Electronic Commerce Management for Business

Applications of Artificial Intelligence in Business and Finance 5.0

Richa Goel | Vikas Garg | Michela Floris
Editors

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Editors-in-Chief:

Dr. Vikas Garg
Christ University, India
E-Mail: vikasgargsir@gmail.com

Dr. Richa Goel
Symbiosis Centre for Management Studies, Noida, India
E-Mail: richasgoel@gmail.com

Electronic trading, typically called e-commerce, involves procurement and distribution of electronic systems and other digital networks of goods or services. E-commerce stands for electronic commerce and concerns the electronic medium trade in goods and services. As the Internet grew, the volume of online trade has increased significantly. B2B, B2C, C2C, and related resources help to build online technology for future customer needs and markets. E-commerce has revolutionized industry, disrupted trade with the Internet, and created an e-commerce market for customers and enterprises through the electronic communications system.

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The series aims to serve as a valuable resource for researchers, academicians, and industry professionals and undergraduate, postgraduate, doctoral students in electronic commerce, Internet marketing, business innovation, digitization, technology in product design, management, and more.

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About the Editors

Richa Goel, PhD
Associate Professor of Economics and International Business, Symbiosis Centre for Management Studies, Noida, India

Richa Goel, PhD, is an Associate Professor of Economics and International Business, Symbiosis Centre for Management Studies, Noida, Symbiosis International Deemed University, Pune, India. She has more than 21 years of experience in academics and consistently strives to create a challenging and engaging learning environment where students become life-long scholars and learners. Imparting lectures using different teaching strategies, she is an avid teacher, researcher, and mentor. She has to her credit a number of books and research papers published in reputed national and international journals and has participated at many professional conferences as well. She is serving as a member of review committees for conferences and journals and also acts as associate editor of the *Journal of Sustainable Finance and Investment.* She is a gold medalist in her Master of Economics with dual specialization at the master level with an MBA in HR and with dual specialization at graduate level with gold medal in Economics along with a Bachelor of Law. She also holds a PhD in Management and has about six years of working in the area of diversity management.

Vikas Garg, PhD
Associate Professor, Christ University, India

Vikas Garg, PhD, is an Associate Professor of Management at Christ University, India. He has more than 20 years of experience with over 10 PhD scholars under his guidance. He has published numerous research papers in various Scopus- and ABDC-indexed international and national journals. He is acting as Associate Editor of the *Journal of Sustainable Finance and Investment* (indexed in the WoS and Scopus). He is also acting as the Book Series Editor with Taylor and Francis for three books series: *Technology Innovations: Strategies for Business Sustainability and*

Growth; Emerging Trends in Technology in Management and Commerce; and *Electronic Commerce Management for Business.* He has been working with new innovative ideas in the field of patents and copyrights. He has been the lead organizer in conducting various international conferences, workshops, and case study competitions, including those affiliated with IEEE. He has been conferred with many national and international awards for being best academician, researcher, and employee.

Michela Floris, PhD
Associate Professor of Management, Department of Economics and Business, University of Cagliari, Italy.

Michela Floris, PhD, is an Associate Professor of Management in the Department of Economics and Business, University of Cagliari, Italy. She has been teaching Family Business Management for several years. She has published articles in leading journals (e.g., *Family Business Review, Journal of Small Business and Enterprise Development, Journal of Management and Governance, Journal of Family Business Strategy, Management Review Quarterly, Journal of Family Business Management, The TQM Journal)* and has received relevant awards and grants for her studies (e.g., Academy of Management Best Paper–2009 and 2015; Carolyn Dexter Award–2015; IFERA & STEP Best Paper on conference theme–2019; selected paper SIMA-Sinergie Conference-2021). Her main interest of research focuses on strategy, organizational goals, and goal-driven behaviors in family firms, including entrepreneurship, marketing, innovation, and growth. She received her PhD in Management and holds a master's degree in Economics from the University of Cagliari, Italy.

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Contributors

Serife Uguz Arsu
Aksaray University, *Aksaray*, Türkiye

Abhimanyu Awasthi
Learning and Development Manager, DoubleTree by Hilton, Gurgaon-New Delhi, India

Auindrila Biswas
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

Priyanka Chadha
Amity Business School, Amity University, Noida, India

Riya Chakraborty
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

Hira Dhar Chudali
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

Saurav Dixit
Division of Research and Innovation, Uttaranchal University, Dehradun, India

Godwin Ehigiamusoe
Founder, LAPO Microfinance Bank, Nigeria

Amit Gautam
Institute of Management Studies, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Rajat Gera
Dean Management, Commerce, Economics, Liberal Studies Cluster, CMR University, Bangalore, India

Anmol Giri
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

Om Prakash Gusai
Department of Commerce, Motilal Nehru College, University of Delhi, B.J. Marg, New Delhi, India

Aditya Keshari
Institute of Management Studies, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Ruchika Kulshrestha
Amity School of Hospitality, Amity University, Gurugram, Haryana, India

Oumaima Lahmar
Department of Business and Economic Sciences, University of Cagliari, Italy

Subir Kumar Malakar
Amity School of Hospitality, Amity University, Gurugram, Haryana, India

Sagnik Maity
Calcutta University, Kolkata, West Bengal, India

Amit Majumder
Bijoy Krishna Girls' College, Howrah, West Bengal, India

Shruti Malik
Shri Ram College of Commerce, University of Delhi, Delhi, India

Marco Mandas
Department of Business and Economic Sciences, University of Cagliari, Italy

Shivi Mittal
IILM Graduate School of Management, Greater Noida, Uttar Pradesh, India

Luca Piras
Department of Business and Economic Sciences, University of Cagliari, Italy

Ankur Rani
Department of Commerce, Shri Ram College of Commerce University of Delhi, North Campus, Maurice Nagar, Delhi, India

Gargi Sharma
TAPMI School of Business, Manipal University, Jaipur, Rajasthan, India

Soni Sharma
Jaipuria Business School, Ghaziabad, India

Yogita Sharma
Manav Rachna University, Faridabad, Haryana, India

Kamakhya Nr. Singh
Director (Finance, Business and Operations), American Embassy School, Delhi, India

Umesh Solanki
TAPMI School of Business, Manipal University Jaipur, Jaipur, Rajasthan, India

Vikas Solanki
Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India

Saurabh Tiwari
O. P. Jindal Global University Sonepat, Haryana, India

Bola Yaya
Center for Women Inclusion and Strategic Development (CWISD), Africa

Foreword

Applications of Artificial Intelligence in Business and Finance 5.0 is a comprehensive reference source that will provide personalized, accessible and well-designed experiences to all readers. The aim of the book is to provide a deeper understanding of the relevant aspects of AI impacting business efficacy for better output; thereby, readers may discover a reliable and accessible one-stop resource that covers topics that include AI-assisted financial education, credit decisions, risk and return management concept, trading and business transactions, insurance industry, and personalized banking reforms, which have the potential to contribute to global sustainability.

I assume that a wide range of readers with a variety of interests will find this book to be extremely valuable. This includes not only academics, postgraduate students, and research associates, but also banking professionals, financial companies, corporate executives, entrepreneurs, and other professionals and masses in all fields who can improve and expand their knowledge by learning the basic trends and activities in this book.

The field of artificial intelligence applications is a young discipline that can revolutionize any industry as and when needed. As a result, in the coming years, it will affect every single individual on the globe. This book provides a helpful manual for intellectual and practical work, calls for rethinking, and assesses the implications for the management of innovation in the future. It gives me great pleasure to write this foreword because the book's editors have worked tirelessly. The chapters in this book were all chosen based on peer reviews by reviewers who are quite knowledgeable in this field.

—Elisabetta Reginato
Full Professor in Business Economics,
Department of Economics and Business Studies,
Università degli studi di Cagliari, Cagliari, Italy

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Preface

AI has evolved as a burgeoning technology that is applicable to many industries in the current competitive and technologically driven society. The financial and banking sectors face more challenging data management, identity theft, and fraud challenges as transactions and other company processes gradually shift online and gain popularity each year. As systems using deep learning technology are able to detect patterns and spot suspicious activity and probable fraud, AI can advance many financial and business activities.

With the main objective of designing standard, dependable product quality control methods and the search for new ways to reach and serve customers while maintaining low cost, AI has been used in the e-commerce and financial industries to accomplish better customer involvement, efficient supply chain management, improved operational efficiency, and reduced mate size. Currently, machine learning models are being created to handle the complexity and diversity of data seen in the financial markets and food business.

Applications of artificial intelligence and machine learning in business, e-commerce, corporate management, and finance are covered in this book. Some of the key uses are portfolio management, fraud detection, inventory management, sales forecasting, profit maximization, and sales growth.

The most recent results of the field's empirical study are presented in this book along with important theoretical frameworks. It reveals novel and cutting-edge parts of AI applications, demonstrates how they may support sustainable business to increase economic efficiency at both the micro- and macrolevels, and offers a deeper comprehension of the pertinent facets of AI that have an impact on efficacy for greater output. It is an ideal resource for researchers, academicians, policymakers, business professionals, companies, and students. Numerous practical aspects of artificial intelligence that enhance industry skills as well as decision-making are gaining momentum.

This book is a significant advancement. The book's theme is quite cross-disciplinary in nature. Despite being primarily concerned with stakeholder strategies, the book will be extremely helpful to those in

corporate, business professionals, financial markets, the e-commerce industry, sociology, political science, public administration, mass media and communication, information systems, development studies, and business studies. The topic is one of the most significant expanding fields worldwide, and the models covered in the book will have a tremendous replication and practice potential. However, for practitioners engaged in the study of stakeholders and their strategies, this book will be a valuable source of reference. Second, the book is organized in a reader-friendly way with key information that has been properly analyzed and underlined, making it simple to understand the content. The reader's access to materials in the book creates the possibility for more in-depth research. The case studies offer a tried-and-true method for resolving typical issues in the subject area.

Chapter 1 discusses enhancing the efficacy of financial information through artificial intelligence. The use of artificial intelligence and machine learning techniques in finance is gaining more and more traction from practitioners as well as from academia. In fact, corporations nowadays are using these techniques to forecast and assess different financial risks, such as liquidity risk, volatility risk, and credit risk by applying ML models. The ML models are trained on historical datasets to make future forecasts on potential financial threats to the financial performance of the company. Practitioners and institutional investors have been introducing artificial intelligence to assist their work and run different types of analysis based on quantitative and qualitative data. The introduction of qualitative (textual) data in financial market analysis is a relatively recent approach adopted by sophisticated investors to measure the tone, and the sentiment and extract information from corporate annual reports, press releases, and even social media posts. Natural language processing and text mining paired with machine learning models are still under trial but have proven to be effective in guiding sophisticated investors and corporate managers.

Chapter 2 discusses AI in a super-intelligent society: its impact on businesses. The industrial revolutions of the last few centuries and the rapid development of information and communication technology bring great changes to society and various sectors. Due to the rapidly growing and changing digital technologies and artificial intelligence-based solutions, the worlds of technology, economy, and social and cultural structures are experiencing a rapid transformation of mass personalization and advanced product. Industry 4.0, also called digitalization in the sector with smart

factories, has provided an autonomous system by using artificial intelligence technology that transfers the decision-making ability specific to people to electronic systems and machines. Industry 5.0, developed as the leading business and creation topics among industry and academia in the world, has started to be examined and discussed as the subject of many academic publications, practical articles, and conferences in many companies, research centers, and universities. As with all past industrial revolutions, Industry 4.0 supports the transition to a different society, namely, collectivism 5.0. This transition will also affect businesses and business processes. Global ventures will benefit from the prospects that arise from this transition and leverage these insights to overcome the main challenges involved and design temporary strategies. In this study, the industrial revolutions experienced before Industry 5.0 with the new concept, the transition from Industry 4.0 to Industry 5.0, artificial intelligence in Industry 5.0, also called "Super Smart Society," and its effects on enterprises are explained with all conceptual aspects.

In Chapter 3, financial services have been shown to be a potent application for artificial intelligence, which has roots in computer science, languages, psychology, mathematics, and philosophy. In order to analyze data gathered over time, businesses are now using analytical technologies like machine learning and ANN. In order to simulate realizable asset returns based on business characteristics, ML enables quasiempirical techniques used for canonical asset pricing study with neural networks. AI improves adaptive pattern recognition by utilizing cutting-edge statistical techniques and vast amounts of data to offer the "best guess" solution to each particular and tightly defined issue set. When used with caution, wisdom, and accuracy, AI has tremendous potential for good influence. Financial solutions and information technology are combined to develop FinTech. The first part of the study focused on the evolution of FinTech and was divided into phases to understand the connection amongst the variables. FinTech 1.0, when transmission cables were utilized as a tool to enhance financial globalization, dates back to the much earlier year of 1866 and endured until 1987. The second stage of evolution, known as FinTech 2.0, spans the years 1987–2008, when businesses began to digitalize their financial operations.

Chapter 4 talks about role of artificial intelligence in making a positive impact on sustainable development. The study's authors regularly come across stories that warn us about how artificial intelligence (AI) will

take over our work and that robots will eventually dominate the globe. However, despite the abundance of material depicting a dystopian future, there is also the possibility of learning about the good effects of AI and how they might assist us in making the world a better place. AI has the potential to become an effective tool for attaining a circular economy and a lifestyle that is less harmful to the environment in the context of global efforts to achieve sustainability, and more specifically, for reaching the UN Sustainable Development Goals (SDGs). The use of AI might have as one of its goals the resolution of problems connected to the SDGs. It has been suggested that the existing capabilities of AI might assist solve instances spanning all 17 of the United Nations Sustainable Development Goals (UN SDGs), which would ultimately be of use to hundreds of millions of people in both developed and developing countries.

Chapter 5 discusses the evolution of FinTech in the age of AI, particularly concerning the Indian FinTech industry. AI is the part of computer science that manages bots that are programmed to exhibit human-like characteristics, such as cognition, learning, and self-reflection. AI has emerged as the most significant driver of change in today's business world. AI works toward a user-friendly ecosystem in every field, financial sector, medical sector, and other fields. "Financial Technology," or "FinTech," refers to the role that has become essential in the financial system. This research paper explores AI, an implementation of FinTech in India.

Chapter 6 looks at the role of artificial intelligence in trading and business transactions. In recent times, AI is an impelling businesses, strategists, pioneers, entrepreneurs, and investigators to come out with different layouts adding more value to ventures. By deploying the right AI technology, a business may gain the ability to save time and cash, achieve increment profitability and operational efficiencies, settle on quicker business choices depending on yields from subjective innovations, keep away from missteps through human activities, use knowledge to foresee client inclinations, and offer better, customized involvement. Sharing a tremendous measure of information will create quality leads and develop a client base, accomplish cost investment funds, increase income by distinguishing and amplifying deal openings, develop skill by empowering investigation, and offer clear guidance and backing.

Chapter 7 explores the dynamics of cryptocurrency in emerging markets, presenting a study on India and Africa. Though cryptocurrency used to be very new and significant financial innovation, it is now known

that almost one person in a family believes it is a good option to invest in cryptocurrency. In India cryptocurrency is gaining popularity for the past few years as people have started to learn more about digital currency and what amendments it will bring with the adoption of cryptocurrency in India. Cryptocurrency transactions have grown exponentially in Africa pre-and post-pandemic, which is a indicator that despite the socioeconomic downturn faced by most African countries, cryptocurrency is seen as a way out for the vast youth populace. The decentralization of blockchain technology has enabled undeterred participation in cryptocurrency transactions, favoring regions like India and Africa. However, issues of legal regulations of cryptocurrency have been the bone of contention across regions. This work navigates ways India and some African countries are finding ways to include this fast-growing system in their economies, and it also assesses the ban on cryptocurrency in countries, such as Nigeria, Morocco, Zimbabwe, and Namibia. This chapter discusses its adoption barriers, legal issues pertaining with investment, and regulatory framework of cryptocurrency in India and Africa. The chapter captures the present state of research on legal challenges related with the applicability of cryptocurrency in India and Africa by providing a critical review of the current frame of data. The author tries to review key systems and concepts, identifies contradictions when compared with the applicability in both countries, and provides explanations toward a common understanding.

Chapter 8 provides an overview of the contributions to banking, investment, financial education, and microfinance made by FinTech and artificial intelligence. AI is also used in financial education and financial inclusion such as in banking, investment, financial management, credit decisions, trading, and business transactions, and hence, financial education, and so on. Automated creditworthiness assessment and robotic financial advice are examples of AI application within the financial system. In this, we try to explore the competencies and competitive advantages for financial institutions that adopt the latest fintech technologies, and their future opportunities in fintech with AI.

Fintech brings technology to the financial services and AI brings a human touch to that technology. The new opportunities opened by fintech, and AI will impact directly or indirectly to the profitability or earnings of the banks and other financial institutions within the financial system by increasing their sales and profit margin, widening the clientele base, area of work and boundaries. It will also reduce the cost, time, and fraud

in services through automation. There will be some positive and negative impacts of the combination of these two in financial services. But positive aspects will be more appreciable.

Chapter 9 discusses FinTech for MSME (micro, small, and medium enterprises) and role of financial education for MSMEs in optimizing their return as investor. In this chapter, the researchers highlight various SIDBI (Small Industries Development Bank of India) schemes for arranging business finances. This structure provides the opportunity for various MSMEs to get in-principal approval of a business loan without even the need to physically visit a bank branch. This platform provides an opportunity for the applicant to avail loan in a hassle-free and timely manner. The study discusses how FinTech-enabled loan disbursal platforms like PSB (public sector bank) loans in 59 minutes could be instrumental to MSMEs to avail business loans especially in the recent COVID-19 pandemic situations and the like, where there is increased emphasis on digitalization of financial services. The authors also mention some of the limitations of this scheme and sought the experience of the industry experts and the loan applicants themselves. Lastly, the authors discuss the way forward and offer suggestions to improve such platforms.

Chapter 10 explores the role of smart technologies' influence on consumer decision-making for selection of tourist destinations. The goal of this study is to close the knowledge gaps between technological solutions and experience customization in order to understand how smart technologies might encourage customized development within the context of tourist spot making decisions. Using a qualitative methodology, this chapter contributes in two main ways: (a) it outlines the requisites of technological solutions for decision-making, such as data synchronization and prevalent smart technology, and (b) it demonstrates how smart technology integration can result in a better decision-making processes for choosing a tourist attraction.

Chapter 11: Business Model Innovation and Digital Transformation: A Way Forward discusses the concept of Industry 4.0, or the smart factory introduced by digital technologies, has fundamentally changed how industries work. The integration of digital technologies into business operations is known as digital transformation or digitalization. As firms adapt to the usage of digitalization, their current business models must also undergo digital transformation. This digital transformation takes advantage of digital technology and provides chances to integrate goods and services

beyond organizational, functional, and geographic boundaries. The aim of this study is to create a framework for businesses to digitally transform their business models as well as the underlying constructions for the ideas of digitization, digitalization, digital transformation, and business model innovation. This study will aid in the creation of future tools that can direct companies in the digital transformation of existing business model components.

Chapter 12 provides a bibliometric analysis of artificial intelligence in cyber security. The purpose of the study is to review and understand the field of AI and cybersecurity research in order to identify areas that need further investigation. The bibliometric methodology was followed that included productivity analysis to evaluate the total article productivity and impact through citation analysis and most impactful authors, sources of publication, and countries. Through scientometric analysis, the intellectual and conceptual structure of this research domain was systematically mapped with WordCloud, trend analysis, co-occurrence network and thematic mapping. For systematic review, the Preferred Reporting Items for Systematic Reviews (PRISMA) plans were followed for article search and selection from Scopus-indexed publications for the period 2000–2022. The niche and emergent nature of this research domain is evident from the productivity of the most prominent authors in this field. The majority of the significant contributions come from Europe and the USA, followed by South Asia, a few African nations, and countries in middle-east Asia. The emerging field of AI in cyber security is mostly confined to the AI tools of learning systems and machine learning (ML) and business domains of IoT, network cyberattacks and security, which shows selective focus of research in this domain on specific AI techniques and applications. Conclusions are drawn and future research areas identified.

Thus, this book intends to present unique insights and methods of application for current scholars and users. This book offers a great overview of how AI applications are transforming global businesses and financial organizations.

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CHAPTER 1

Enhancing the Efficacy of Financial Information Through Artificial Intelligence

LUCA PIRAS, OUMAIMA LAHMAR, and MARCO MANDAS

Department of Business and Economic Sciences, University of Cagliari, Cagliari, Italy

ABSTRACT

The use of artificial intelligence and machine learning techniques in finance is gaining more and more traction from practitioners as well as from academia. In fact, corporations nowadays are using these techniques to forecast and assess different financial risks, such as liquidity risk, volatility risk, and credit risk, by applying ML models. The ML models are trained on historical datasets to make future forecasts on potential financial threats to the financial performance of the company.

Practitioners and institutional investors have been introducing artificial intelligence to assist their work and run different types of analysis based on quantitative and qualitative data. The introduction of qualitative (textual) data in financial market analysis is a relatively recent approach adopted by sophisticated investors to measure the tone and the sentiment and extract information from corporate annual reports, press releases, and even social media posts. Natural language processing and text mining paired with machine learning models are still under trial but have proven to be effective in guiding sophisticated investors and corporate managers.

Meanwhile, finance scholars were reluctant to introduce new methodologies, especially those relying on content and textual analysis, for

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different reasons. Their orthodoxy, not only in the way they write research but also in the topics they debate, could be one of the reasons that probably makes their knowledge less accessible, sometimes less relevant, and probably not read by practitioners.

Finance-related texts, commonly meant to make information available to market participants, tend to be written in formal and technical language that makes them less intelligible than they should be, complicating the possibility to make sense of them and drive action in the financial environment for the great majority of individuals.

This has, for a long time, been a silently accepted limit, though more recently it brought to attention the need for a more effective and transparent spread of financial information, aimed at reducing noise as a source of volatility.

New technology, among them machine learning as a prominent application of artificial intelligence, maybe a handy instrument to underpin latent meanings, isolate prevalent emerging topics, and help nonprofessionals to make sense of financial information. Inaccessible information significantly reduces its real impact on the market's dynamics, considerably limiting the possibility to enhance efficiency.

In this work, we introduce and describe in a very understandable way how machine learning may help improve the comprehension of financial information. We also present the results of our latest research as a prominent example of how the application of machine learning to different fields may be of great utility both for the activity of scholars and researchers and also for practitioners and investors.

1.1 INTRODUCTION

We are coming across artificial intelligence (AI) on a daily basis, sometimes without even perceiving it. Individuals in the common imagination still sometimes relate AI to science fiction movies, a thought that is losing importance as the applications of AI are becoming more common, frequent, and accessible: "Hi Siri!." AI is becoming a technological reality not only in daily life but also it is developing for business management purposes. Before stepping into the functions and applications of AI in the financial environment, it seems crucial to understand what AI is and how it works. As the name indicates, oversimplifying it, AI is the intelligence shown by machines and systems that perceive and analyze a set of inputs

to maximize their "chances" to resolve a problem. The concept of learning and mimicking the human cognitive mechanisms to resolve problems seems to fall under the needs of business management, especially nowadays. In fact, machines at this point prove to be of extreme usefulness given their capacity to treat and analyze an amount of data that cannot be performed otherwise (manually).

With the increase in the number of inputs (volume) and the diversity of data (numerical and textual), it is virtually impossible for businesses to assign the treatment and the data analysis to employees, as it is time-consuming, costly, and sometimes not enough informative. On the other hand, the applications of AI, the most commonly used machine learning, proved to be efficient and reliable in quickly processing an "infinite" amount of data. It consists of the development of algorithms that "learn" and improve models used to resolve a problem or provide relevant information extracted from an unstructured set of inputs. In other words, the more users feed these machines, the better they learn and improve their efficiency in treating the data.

In finance, the applications of AI are gaining more traction since financial transactions are becoming more frequent, voluminous, and complex, which requires a huge computational and "learning" capacity to be able to "partially" automatize the latter. It is noteworthy that the processing capacity is not limited to numerical data; it includes textual data as well. In fact, corporate communications, analysts' views and recommendations, news, social media posts, and an immense amount of text are spread globally. Such a tide makes it extremely difficult to detect, identify, and extract relevant information for financial decision-making. Making sense becomes a daunting task to be performed by individuals; thus, using machines becomes a necessity.

These textual communications contain valuable information that not only guides decisions but also orients action. From the actual topics debated to embed sentiments, investors are constantly trying to detect useful signals to implement proper strategies in a market that, in the past decades, has become extremely volatile, noisy, and turbulent. Traditional theories and models are continuously challenged by short-term market dynamics resulting from the increasing role of robot investing and individuals active in the market without the intermediation of advisors or financial institutions. Furthermore, the contribution of AI should not be interpreted as a tool for reducing the impact of human emotions but

rather for enhancing the capacity to order and manage these emotions, thus passing from "chaos" to feasible strategies.

In this chapter, we will have a closer look at the mechanisms and applications of AI, such as text mining, machine learning, and natural language processing (NLP), to name just a few, in the financial context. The first section consists of a description of textual data and the way they are treated and preprocessed to be useful for textual analysis. The second section is an overview of text mining and NLP applications in the financial environment, going from chat robots to information extraction tools. The third and fourth sections give a deeper idea of AI technologies, specifically machine learning techniques, such as topic modeling and sentiment analysis, and their applications to extract latent word patterns and sentiments. We finish with an example in which we simulate a concrete application of machine learning tools to a set of textual data produced by ESG analysts to assess the ESG performance of 1000 financial institutions to give a realistic idea about which ESG features are discussed and the potentially associated feelings implicitly expressed by analysts.

1.2 TEXTUAL DATA AND PREPROCESSING

Textual analysis can be thought of as a method for describing and interpreting texts. Thus, text is the fuel of textual analysis, and inspecting the meaning and the origin of this field seems to be crucial for our work.

The first written communication dates back thousands of years, and since then, the growth of written communication in terms of tools, content, and amount has been exponential, and human interaction has gotten easier and faster. The reconstruction of human history is based on textual evidence, and it clearly suggests how crucial the role of text content is in influencing our evolution.

Text can be defined as the written application of language, where language refers to a complex system of signs and rules aimed at satisfying the need to interact and communicate. In every text emerges the intention to transmit and/or share a message with whoever will read it—a message that may influence the opinion, way of thinking, and acting of the social group to which it is directed. This communication force is strongly present within each text; thus, a simple combination of words and signs becomes crucial data that, when processed and analyzed, can become useful information for decision-making.

In other words, information is meant as the output of the interpreting process of texts that turns out to be the proper input of the decision-making process. By reducing the ambiguity about a particular situation, information can be considered a stimulus to act.

By combining the meaning of text and information, we have the key elements to understand what is meant by textual information. Textual information is literally the information coming from a text; it is the result of text processing evoking a specific reaction. The power of the texts lies precisely in their ability to enhance action, and the digital revolution, along with technological evolution, has been providing us with the tools to make unprecedented use of this power.

Indeed, the digital revolution has been affecting every economic activity, and the financial sector also appreciates the great value of the several instruments and tools that this revolution keeps providing us. An incredible amount of text data is now available, and a large set of technologies and tools is capable of processing it in a very short time. Particularly, the introduction of artificial intelligence and machine learning models has transformed the decision-making framework by providing the instruments to extract, process, and analyze valuable information.

As mentioned previously, the main challenge in the textual analysis is to extract insightful information from heterogeneous sources of text content. Therefore, to perform an efficient textual analysis, it is crucial to respond to two crucial requirements. Namely, we are expected to identify what kind of information or output we are looking for and what kind of textual content or input we need to analyze to get it. For example, the starting point of a research project aiming at predicting a bank failure by developing an early warning model is identifying what kind of information and data are necessary. In this case, data may be extracted from different sources (financials, financial news, bank ratings, etc.). These data, once analyzed, provide useful ratios and indicators to predict bank failure. By adding textual data such as financial news and internal communications to the empirical indicators, the prediction may become more robust and could increase the predicting power of the model. It is evident that we need word-based data to perform textual analysis, but it is also important to identify which sources and tools are available to get them and how to prepare the unstructured and heterogeneous textual input in order to be effectively examined by content analysis instruments.

Once the objectives of the analysis are clear, the first step is collecting the textual input. News, reports, bulletins, emails, and reviews are potential input data for textual analysis in the financial context, and we can get them by examining different sources and by using different exploratory tools. The sources that are most frequently used are: (1) social media such as Twitter, Facebook, etc., where comments, reviews, and reactions from the users are constantly collected to a highly dynamic data source that is gaining more and more grip from practitioners and academics; (2) news archives such as Reuters, National or Google News where a vast collection of multimedia content covering all the topics and moments of the recent history is available; (3) free available dataset that can easily be downloaded from the web; (4) blogs and forums collecting discussions and opinions shared by groups of individuals; (5) reports and bulletins provided by companies, governments, and national or local authorities. Text data can take either the digital format or be simply paper-based data, as it is possible to make physical documents understandable by machine language.

Searching and storing data is an important process in text mining. If the dataset to be processed is limited in terms of volume, one can manually manage its collection. However, if the volume of the data is significantly large, the process may be automatized by generating an algorithm that permits data storage. In fact, many tools are available to construct the dataset, such as application programming interface (APIs) or web scraping, which are also intensively used by researchers. Technically, an API is a type of software interface that provides access to other computer programs and allows them to communicate. Thus, it is possible to directly gain access from one's computer program to the "addresses" where the textual data of interest are located. On the other hand, web scraping is a task performed by a robot that copies entirely or extracts particular content from a web-based data source and stores it. It can be performed by using different software (e.g., R and Python), which require knowledge of the programming tools and languages used to build web pages (HTML and XHTML).

The second step is to construct a structured and homogenous corpus of documents from the data obtained that are usually unstructured. A structured corpus of documents is an organized repository of texts in which each element can be easily understood by machine language and prepared for textual processing and analysis. Each document needs to have a key identifier (document ID), and it may be very useful to associate it with a timestamp (document's date of emission) and an ID identifying the company, product,

or any other entity or item the text is about. The company ID, for example, is useful to link the document to other databases, including information referring to the company (name, country, sector, etc.).

The unstructured input data may have different formats (CSV, XML, TXT, etc.) and different sizes and lengths. The structured corpus of text data needs to be formatted into precisely defined fields to be easily addressed by the machine. We can visualize the data as rows and columns in a spreadsheet program. Each column refers to a different attribute (text, document ID, date, company ID, etc.), and each row includes the data associated with the attribute for a single document. A lot of software are available to organize the textual data and perform textual analysis techniques, including R and Python, which are open-source programming languages well-suited for data science tasks. Easy to learn and free to download for everyone, their popularity keeps increasing, and a large community of academics and programmers keeps developing libraries of programs for handling several tasks, from data manipulation to data modeling and visualization. R and Python have a rich ecosystem of machine learning and deep learning libraries, state-of-the-art forecasting models, and elegant tools for data reporting and visualization. More than 13,000 R packages are available via the Comprehensive R Archive Network (CRAN) for deep analytics, and over 137,000 Python libraries are present today.

The third step is the cleaning and preprocessing of the text before stepping into textual analysis. The raw form of text data always presents a lot of noise that may have an impact on the quality and informativeness of the resulting output. Indeed, reliable analytical results require the corpus to be cleaned and refined for the analysis. The preparation processes must be performed in such a way that only useful textual features relevant to the analysis are kept, allowing the machine to work on a reduced dimension of input data, which implies the removal of many useless words and characters. The preprocessing is a preparation phase involving several tasks and may depend on the textual analysis that will be adopted. The most common tasks are listed below:

- Switching all the characters to lowercase in order to disregard differences between uppercase and lowercase.
- Removing special characters, symbols, numbers, and punctuation that are not considered useful to include in the analysis.
- Spelling correction.

- Removing stop words such as "is," "the," "and," etc. These words have limited discriminatory power and do not help in selecting the key features to be analyzed.
- Tokenization by breaking the text into smaller parts called tokens. For example, it breaks the document into sentences or the sentence into words. During this step, it may be decided how many words one wishes to capture in each n-gram.
- Lemmatizing or stemming the words. These techniques are used to convert words into their lemma (lemmatization) or stem (stemming) and are generally applied when ignoring the differences between the various forms of a single lemma or stem is better for the quality of the output.

Based on the input data format or the textual analysis, it is possible to perform many other preprocessing tasks that might be necessary. For example, PDF and Word files may include sections of the text that should preferably be removed, such as headers, footers, or titles. Furthermore, in particular types of analysis, such as topic analysis, that will be further explored, it might not be sufficient to remove only stop words. It is usually recommended to set some criteria to remove words that are extremely common or extremely rare. These words have too limited or too high discriminatory power and do not help in classifying topics. The criteria can be based on the number of documents (a word occurring in at least 10 documents to remove extremely rare words or a word that occurs in more than 50% of all the documents to remove common words), on the term frequency (removing the most and least frequent words), or on the tf-idf (term frequency-inverse document frequency).[1]

1.3 APPLICATIONS OF ARTIFICIAL INTELLIGENCE ON TEXTUAL DATA

1.3.1 TEXT MINING AND NATURAL LANGUAGE PROCESSING

Artificial intelligence is seldom pictured by the common imagination as the science that will create machinery and robots that will dominate humans. It is not surprising that some people get "seriously" concerned that evolving technologies and computers will rule humans one day. However,

1 Tf-idf is a statistical measure equal to the term frequency multiplied by the inverse document frequency (Aziz et al., 2021).

if we put away this fictive portrayal of artificial intelligence and focus on its applications, uses, and benefits in the modern world, we can grasp how beneficial such an evolution is. The benefits of the application of AI are not limited to day-to-day activities like smartphones, cars, houses, and even cities, but also to smart businesses. The use of new advanced technologies can be easily observed in virtually every step of establishing a business activity, from the definition of the business model to the last circle in the chain of service and product delivery.

For a business to be successful and survive the competition in the market, information proved to be an essential ingredient in decision-making for different reasons. In this context, we will refer to the information, whether financial, managerial, or statistical, as the narrative that a business or an individual either communicates, receives, or analyzes. Based on the cognitive process of decision-making, individuals build or communicate through narratives in which important information is wrapped. These narratives are powerful instruments that can guide or misguide a decision depending on their level of truth and the way they are communicated or perceived. In fact, with the immense amount of information circulating within and outside a business, it can be sometimes, if not always, challenging for business managers and stakeholders to keep up with. One can observe a yearly growing flow of internal and external emails, daily social media posts, consumer blogs and vlogs, feedback comments on e-commerce and service platforms, and other written communications. The bottom line of the issue is that businesses are becoming more disposed to missing a relevant part of the information available globally and not being aware of "what is going on." Furthermore, businesses receive an immense amount of textual input that, sometimes even knowing it contains valuable information, they cannot extract or maybe can extract at very high costs. This is where AI, through textual analysis, plays an important role.

In this chapter, we focus on text analysis as it has been recently integrated into business and research conducted by academia. If a "robot" can extract and organize information from unstructured, continuously growing textual data, then it can be claimed that text analysis is beneficial. This has increased interest in the tools and instruments used to mine and deepen the understanding of textual inputs, including text mining, machine learning, and deep learning, to name just a few. Text mining aims at processing and treating textual data to derive relevant information. The basic human approach to analyzing a text is to read it, look for important information,

and record it. A more efficient approach to do the same task in an automatized manner reduces cost and time consumed, and increases accuracy. It is important to highlight that business and financial activities have always been related to data such as commercial and financial transactions, prices, and reported statistics. Manually processing these inputs has significantly decreased with technological evolution over time. Scholars and different stakeholders (investors and business managers) deal on a daily basis with digitalized data using automated approaches to analyze them. The evolution of text-mining tools permits nowadays to reach latent information embedded in a large corpus of data.

NLP is a subfield in the AI sphere by which the machine analyzes human language and tries to extract meaningful information (Greenberg, 1998). It is based on a number of disciplines, including linguistics, semantics, mathematics/statistics, neuroscience, and computer science. NLP has grown considerably fast in the last few years, with the evolution of machine learning techniques reaching greater analysis capacity and accuracy (Joshi, 1991). Algorithms are created by linguists and engineers to train models to "learn" associations between words and entities based on a training set (text examples). Thus, when the machine recognizes word patterns or identifies new patterns, its knowledge bank expands, and its performance improves with time. One of the uses of NLP is, for example, the "chatbot" in a bank's smart service (online), where the machine recognizes phrase structure, analyzes the "keywords" or the dictionary used by the clients, and responds to their query by retrieving the most likely answer from the stored information. So instead of going to the frequently asked questions section, clients can have a more personalized experience.

In the context of credit risk, the fundamental issue is the information asymmetry between lenders and borrowers. In order to evaluate the capacity and willingness to repay a loan, lenders need to collect the maximum amount of information about the borrowers. In cases of the absence or lack of empirical historical information required for the assessment, banks apply NLP on personal loan documents (Wang et al., 2016). By extracting relevant data as input for credit rating models, banks can improve their prediction power on the existing or potential risks that can emerge, in addition to speeding up credit assessment time.

Chen et al. (2020) investigated the uses of NLP in Fintech, and their review included three levels of NLP uses: Know your customer, know your product, and satisfy your customer. In knowing the customer, the

application of NLP consists of collecting and digging deeper into the customers' history, whether personal or corporate, past procedures, and publicly available information to extract and generate latent information that may be challenging to collect and analyze manually. Knowing your product is also a key factor in sales, as the financial intermediary/salesperson should be aware of the attributes of the products in hand in terms of opportunities, risks, and prospects. Satisfy your client in terms of personalized products and services based on their specific needs, which are again established based on the information available about the targeted client.

Furthermore, the biggest accounting and auditing companies in the world are more oriented to the application of NLP to examine contract documents and long-term procurement agreements, with particular attention to government documents (KPMG, 2021). Instead of going through an "infinite" number of daily transactions and invoices, auditing companies are aware of the importance of NLP in performing these auditing processes and detecting anomalies, irregularities, and even potential fraud and/or money laundering.

Another use of NLP in information extraction is through named-entity recognition (NER). It is an information extraction tool that aims at locating and classifying named entities in unstructured documents (Gupta and Agrawal, 2020). The users of this technology establish categories such as the name, the fiscal/medical code, the location, and the monetary values or percentages. Then, the machine treats unstructured documents, seeks these data, and categorizes them accordingly. Untemplated documents such as financial transactions (orders) or queries can be received through fax or email, and NER can be a useful tool to detect and extract important and meaningful data in a short amount of time.

One of the text analysis techniques that has gained traction in the last decade is readability analysis. This type of analysis aims at analyzing texts and estimating the degree of accessibility and understandability of the exhibited information. Based on simple formulas, including the number of complex words and the number of syllables in a sentence, these indexes estimate the number of years of education required to be able to grasp its meaning (Crossley et al., 2011). This type of analysis, combined with empirical analysis, was proven to increase fraud prediction based on companies' annual disclosures. It can also give relevant insights into the companies' financial performance, depending on the ambiguity

or clarity exhibited by these documents (Dempsey et al., 2012). Readability analysis is also useful in determining investors' perceptions and their potential behaviors in the market (Tan et al., 2015). In fact, when manually processing more complex corporate disclosures, investors tend to be reluctant to lessen the ambiguity of these documents as it is time-consuming. Thus, trade volumes tend to decrease when facing uncertainty due to a "lack" of clarity.

1.3.2 SENTIMENT ANALYSIS

The focus on textual analysis has recently shifted to a deeper type of "data" extraction, that is, human sentiment embedded in the text. With the advent of the internet, and particularly, with the impetuous coming of social media, a tidal wave of opinions, sentiments, and reviews comes at us every day from every corner, and we are eager to explore them. Information we collect from the subjective feelings of individuals is valuable and may have the power to move our actions. When we have to buy a new product, try a new restaurant, choose a new TV series to watch, and in numerous other decisions we make daily, we are increasingly used to looking for and reading the reviews and opinions expressed by other users who have already purchased the product we want to buy, have already eaten in the restaurant where we intend to go, or have already seen the TV series we want to watch. Every time we need to approach new things, we are interested in being informed about others' previous experiences, and consequently, some choices we make may be to a certain extent dependent on others' opinions and perceptions. This constant desire to be aware of others' views, along with the continuous progress in machine learning techniques and the increasing accessibility to data sources, are key elements for the success of sentiment analysis that offer an easy way to mine, interpret, and visualize others' opinions.

At first, it was widely studied, developed, and implemented in the context of computer science and data mining, but it has rapidly attracted the attention of the management and social science communities, and it is now applied in several sectors, such as marketing, political science, and more recently, financial institutions. It has quickly become an integrated part of the managerial business system because of the increasing accessibility to opinion-mining methods.

Indeed, what is changing and evolving is not the interest in others' opinions, but the set of tools available to scan and analyze them. Businesses, institutions, and individuals have always been interested in the community's judgment before making any kind of choice, from the purchase of a product or service to the implementation of a business strategy. Opinions have always been important factors influencing our behavior. In the past, we collected opinions by asking friends and relatives or by conducting surveys and opinion polls. It was much more expensive and less effective than it is nowadays. Sentiment analysis tools have successfully replaced the obsolete and cumbersome processes that were previously employed, providing a deeper view of individuals' common or particular sentiments and opinions.

Sentiment analysis is defined by Liu (2020) as *a field of study that aims to extract opinions and sentiment from natural language text using computational methods*. This definition highlights in a few words the objectives, the sources, and the methodologies featuring sentiment analysis.

The main task of sentiment analysis is to associate each text with a quantitative measure that estimates the positive, neutral, or negative feelings expressed by the protagonists. It aims at summarizing the information coming from a complex text into a simple number that is much easier to include in a quantitative framework with predictive power or narrative purposes. The transition from complex to simple is a determinant for sentiment analysis to be useful. The more it is accurate in this phase, without dispersing valuable information, the wider will be its application. It is now well recognized that this technology is able to perform this task and provide extremely relevant information for decision-making across all economic activities, contributing to the spread of sentiment analysis applications to a wider range of industries and research fields.

It goes without saying that sentiment analysis requires the use of computational tools to be performed. They are applied to automatically identify and evaluate the language constructs that are commonly used to describe human sentiment. So, it is not sufficient to recognize and know the meaning of each word, it is also necessary to identify the syntax, the logic, and the context of the sentence. Obviously, achieving such an ambitious objective leads researchers and practitioners to deal with a lot of challenging technical problems.

Since the introduction of social media and blogs, research has become lively and productive. On one hand, sentiment analysis provides researchers with motivating issues to be explored. On the other hand, social media and

web platforms provide businesses with a large amount of text data that needs to be tested and exploited.

In order to have a clearer picture of the challenging issues to be explored, it is necessary to go deeper into the details of the technical process lying behind sentiment analysis. Two main approaches can be applied to perform sentiment analysis: (1) a lexicon-based approach and (2) a machine-learning-based approach. Within the lexicon-based approach, the subjectivity lexicon plays a crucial role in driving the sentiment scores and can be defined as a list of words associated with a value measuring the emotional context, such as positive or negative, or specific emotions like "happiness" or "anger." The mechanism is very simple: Words like "beautiful," "happy," or "good" are associated with a positive value, whereas negative values are assigned to words like "bad," "awful," or "horrible." A lot of built-in lexica can be easily downloaded from the web. For example, R and Python provide several packages with different lexica employed in the algorithms and functions assigning a sentiment score. There is not a single and universal lexicon, but a variety of lexica exist to meet the context of the corpus or the intents of the analyst. The vocabulary used to write an article about the transmission of monetary policy is different from the vocabulary used to review the washing machine or to criticize a political candidate. The meaning of a word may change depending on the context, the targeted reader, and the perception that the writer wants to transmit. This implies the necessity of adapting the lexicon to these circumstances to obtain an informative analysis. Each piece of written text is characterized by its distinctive traits and its language, and it would be desirable to adjust the lexicon since it is unlikely to find a built-in lexicon that is accurate for the exact needs of the user. Moreover, a lexicon may have different purposes. For example, Amazon Mechanical Turk Lexicon aims at extracting valuable insights from the feedback and opinions expressed through social media. Emoticons and punctuations are often used to communicate our feelings, and consequently, the users of this methodology would better include them in the lexicon to extract more "feelings" embedded in the data.

Typically, much more words exist than the words listed in a lexicon. However, the list of words in a lexicon does not need to be so long. Zipf's law states that given some text, the frequency of any single word is inversely proportional to its rank in the frequency table (Chen and Leimkuhler, 1987). In other terms, Zipf's law observes a steep decline in word usage. A speaker or writer does not want to make extra linguistic

effort when communicating an idea and the audience does not want to be cognitively challenged to reach an interpretation. They may know tens of thousands of words, but then they use a few of them to express themselves. Generally, a lexicon does not include more than 5000 words.

Once we choose or create a lexicon, a simple database joint technique is used to identify the terms in the text. More specifically, a function scans the text, vectorizes it, and joins the words in the text with the words in the lexicon that are associated with a positive or negative value. Next, it is necessary to investigate the context of the identified subjectivity word, which may change its meaning. The clusters of words around the identified word are called valence shifters. Precisely, valence shifters are words that amplify or negate the emotional intent of the word. For example, "well known" is positive, while "not well known" is negative. Here "not" is a negating term and reverses the emotional intent of "well known." Meanwhile, "very well known" employs an amplifier, increasing the positive intent. Accordingly, a function identifies the valence shifters and adjusts the sentiment score. Eventually, the sentiment score generated by lexicon-based methods is the result of the processing of three inputs: (1) subjectivity terms, (2) valence shifters, and (3) the total number of words in the text.

The second approach to estimating sentiment from textual input is based on machine learning methodologies, whether based on a supervised or unsupervised approach. The choice between these two approaches strongly depends on the dataset in hand. In fact, the supervised approach needs a labeled dataset whereby a training text is already connected to positive or negative sentiment to train the model that will perform the sentiment analysis on the test set of texts. For example, a dataset of product reviews where the comments are linked with feedback on a 1–5 rating scale is a labeled dataset, as the comments are labeled with a sentiment measure. On the other hand, when it is too costly to collect labeled data or the labels are not reliable, an unsupervised approach is preferable. The labeled data are used to educate the classification algorithm. More precisely, the classification algorithm is a set of rules to be followed for modeling the relationship between input features and output labels. During the training process, the classifier keeps learning by gathering information from the labeled data and generates a model that will be used to predict the sentiment score based on the mapping that is estimated to link the textual data features to the labels. Various supervised classification algorithms have been developed to overcome the technical challenges and increase

the accuracy of detecting sentiment. Zhang et al. (2018) and Kearney and Liu (2014) provide a detailed survey of the main methods and models that are now applied to sentiment analysis. The most popular classifiers are: (1) Naïve Bayes, (2) Bayesian network, (3) support vector machine, (4) artificial neural network, (5) decision tree, and (6) rule-based classifier.

Having set out the range of methodologies for sentiment analysis, it is now important to shed light on its possible applications in finance. Financial institutions are increasingly using sentiment analysis to identify the key issues in financial products and services by summarizing customer opinions collected from the content in social media, emails, and news about their products and services. Monitoring customer and public opinion is a task that is now regularly performed to explore valuable information for decision-making in product and service governance strategies.

Moreover, one of the most popular sentiment analysis applications in finance is stock market forecasting. The flourishing literature demonstrates that investors' sentiment turns out to be very helpful in predicting stock market fluctuations. Tetlock et al. (2008) and Das and Chen (2007) are two pioneering works in this research field that prove how qualitative information impacts stock market changes. The former uses a quantitative measure of sentiment to predict firms' accounting earnings and stock returns. The latter develops a methodology to extract investor sentiment from stock message boards. The resulting sentiment indicators have predictive power for tech stock prices. Additionally, Bollen et al. (2011) found an accuracy of 87.6% in predicting the daily up-and-down changes in the closing values of the Dow Jones Industrial Average by using measurements of collective mood states derived from large-scale Twitter feeds.

In addition to the mentioned applications, sentiment analysis tools are employed to predict future firm characteristics or firm acquisition decisions. Ang et al. (2009) prove that small investors' negative postings can predict a potential acquirer's subsequent decision by using textual analysis on internet stock message board postings of 303 value-reducing acquisition attempts.

1.3.2.1 TOPIC MODELING

Sentiment analysis proved to be significantly informative and useful, especially when joined with one of the most innovative textual analysis tools that have been recently developed: topic modeling. It is a text-mining

tool aimed at discovering and detecting latent topics discussed in a corpus. In fact, topic modeling is a machine-learning technique by which the algorithm seeks the most frequent word patterns that have the maximum likelihood to describe a topic embedded in a corpus of documents (Blei et al., 2003). The corpus in this context refers to a collection of texts of any length involving different categories of protagonists and characterized by similar contents. Topics are the dominant themes expressed by clusters of words that are grouped considering the probability of co-occurrence within the corpus. Latent topics are inexplicitly discussed in a text and often remain unnoticed by human readers, whereas the algorithm can detect them by employing its computational capacity after being trained on a set of reference texts. When facing a large amount of unstructured textual data that can't be read by humans, topic modeling helps transform this input into structured data. This task is performed thanks to dimensionality reduction functions that meanwhile allow the machine to extract hidden contents that are not immediately perceivable by human readers but potentially extremely useful to make sense.

There are multiple approaches to performing topic modeling: latent Dirichlet allocation (LDA), structural topic modeling (STM), and latent semantic analysis (LSA), to name just a few. Even though these approaches are based on different assumptions when treating the corpus, the resulting output is a highlight of either pattern of words or patterns of word connections. In other words, the machine extracts a set of keywords that characterizes and defines specific topics that dominate the corpus and the distribution of topics per document.

One of the most commonly used approaches in topic modeling applied to finance-related texts is LDA. It is based on two main assumptions. Each document is a distribution of a number of topics, and each topic is a distribution of a number of words. The corpus, after being preprocessed, is considered a bag of words, where the order and position of the latter are not considered. The machine builds a term document matrix in which words are placed according to their frequency in each document. Thereafter, it detects the topics described by co-occurring words based on their "common" frequencies in the corpus. Topic modeling "looks" for the words that tend to be used in the same semantic context across documents based on their frequency of joined presence.[2]

2 For a more detailed description of LDA approach, see Blei et al. (2003).

Topic modeling is used on unstructured texts for different purposes. One of the main uses is document categorization. Based on the topics extracted and their proportions within each one of them, topic modeling is used to sort the documents into categories according to the dominant topics in each. In fact, when dealing with a collection of texts such as financial analysts' reports on different industries, asset classes, and geographical contexts, one can face a serious challenge in categorizing these texts according to their content, as it requires a lot of time and effort. Using LDA permits the extraction of these characterizing themes based on which the documents are, thus, sorted out. LDA can be used by financial institutions to identify the features and issues discussed by their clients when providing their feedback on a financial product. Feedback and opinions are considered a set of unstructured texts that do not obey a certain template readable by the machine. When the financial institution applies topic modeling to this input, the financial products can be engineered so that they match investors' preferences and expectations more accurately.

Another use of this methodology can be observed when applied to annual reports and corporate disclosures to identify the different types of risks the corporation can potentially face. It is also used on the same set of data to understand the issues as they are discussed and their evolution over time. Topic modeling is usually joined with sentiment analysis to detect latent topics and identify the tone with which these topics are discussed. It proves to be effective in extracting specific features (topics) of financial products, such as risk, revenue, opportunity, and threat, and the tone with which these features have been understood and discussed by investors and other interested parties.

1.3.2.2 APPLICATION

After this overview of the uses of artificial intelligence applied to the deep understanding of finance-related texts, we will present a concrete application that will help us explore how to extract a significant set of information from a large corpus of unstructured data issued by ESG analysts. The objective of this analysis is to determine the most important features highlighted by ESG analysts when assessing the best and the worst ESG-performing financial institutions.

To do so, we will examine the construction of a corpus, the data preprocessing procedure, the selection of the appropriate techniques for textual analysis, and the development of the algorithms that will perform, particularly topic modeling and sentiment analysis, on the input data. We will then describe the visualization methods used to report the output. In our example, we aim at exploring a collection of views written by ESG rating analysts, representing a commentary on financial institutions' performance with respect to the exposure and management of ESG issues.

We collected a large number of such documents from the Sustainalytics' dataset. Documents are formed by short statements of about 200 words each. Our sample includes almost 1000 financial institutions, and the dataset provides three assessments for each. Although several software are available to run this type of analysis, we opted for RStudio as it is an open-source programming language, including a wide variety of effective packages and appropriate functions for the scope of the analysis.

Before performing the topic analysis, it is necessary to clean the data by applying a set of commands that permit the removal of stop words, numbers, symbols, and punctuations that may distort the results. Then we proceeded with the preprocessing by further removing a list of 42 words occurring in more than 25% of all the documents. These words have bounded discriminatory power, preventing the model from estimating the topics properly. Additionally, we exclude all words that do not occur in at least 10 documents. Quite the opposite, these words have too high discriminatory power.

Before applying the LDA approach of topic modeling to our dataset, it is required to set the number of topics a priori. This challenge is present in virtually all approaches to topic modeling, where the choice of the number of topics is a "guided guess" rather than an automated process. The guidance is provided by a variety of numerical indicators that describe how well the model is performing in extracting the dominant topics. Furthermore, users of this tool can also opt for a trial-and-error approach by which they can "judge" how clear the extracted topics are and how representative they are in describing the topics of interest in the input. However, using the trial-and-error approach alone can be a daunting task, as it may be difficult to compare the output of the model when involving a large number of topics. Thus, we apply both approaches to increase the level of objectivity stressed by numerical indicators, by limiting the effect of personal bias.

The outputs of the topic modeling are, first, a set of keywords that describe each topic. These words are extracted based on their frequency of co-occurrence in the documents. The second output is numerical, as it reports the proportion of each topic in each document.

Table 1.1 reports the top five frequent words that represent each extracted topic. We have labeled these themes based on the context implied by their composing words. The labeling step is relatively subjective as it depends on the perception of the user. However, it could be considered not required when applied in an industry context.

TABLE 1.1 Simulation of Topics' Labels and Top Five Frequent Words.

#	ESG	Label and most frequent words
1.	E	Environmental Sustainability *Sustainability, Renewable, Gas, Nature, and Strategy*
2.	E	Pollution Risk *Emission, Waste, Pollution, Risk, and Environmental*
3.	S	Gender Equality *Human Capital, Diversity, Female, and Minority*
4.	S	Human Resource Policies *Skills, Training, Safety, Standard, and Employees*
5.	S	Occupational Healthcare Policy *Safety, Health, Occupational, Insurance, and Medical*
6.	G	Moral Conduct *Ethics, Corruption, Bribery, Morals, and Code*
7.	G	Public Disclosure *Disclose, Integration, Information, Commitment, and Public*
8.	G	Green Finance *Return, Investment, Green, Portfolio, and Climate*
9.	G	Reputational Risk *Governance, Performance, Financial, Reputational, and Poor*

In a second phase, we apply sentiment analysis on the corpus of data to extract the "attitude" of the analysts toward particular topics and ESG features reported by the topic analysis. The preprocessing for this type of analysis is slightly different compared to the one performed for topic modeling. In fact, punctuation points and stop words are kept in the input

data as they are relevant to the sentiment analysis. For example, may or might are indicators of uncertainty, even though they are considered as stop words.

In order to get the sentiment score, we use the polarity function in R software, which has a built-in subjectivity lexicon. The function scans the text to identify words in the lexicon and creates a cluster around an identified subjectivity word. The polarity function then computes the sentiment score based on subjectivity elements, valence shifters, and the total number of words.

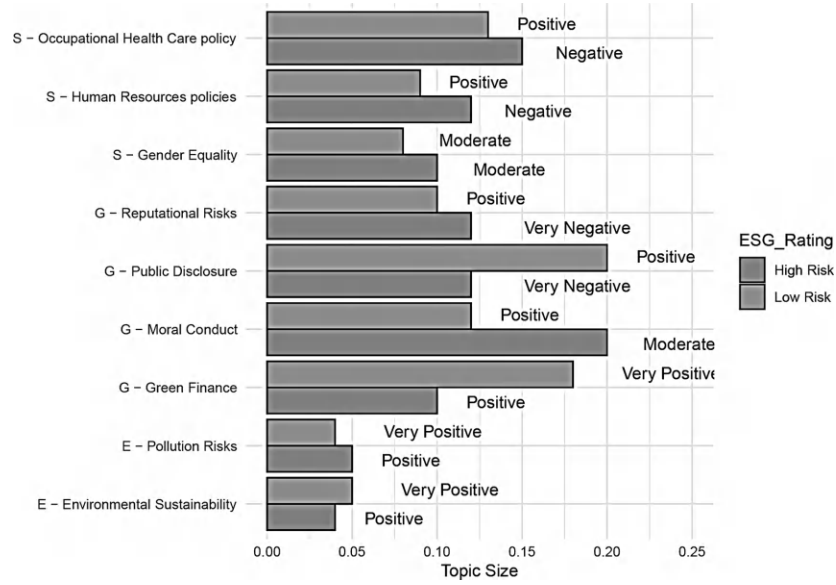

FIGURE 1.1 Simulated distribution of topics by "Best" and "Worst" financial institutions where the labels next to each bar indicate the average sentiment score on a scale from "Very Negative" to "Very Positive."

Finally, after applying topic modeling and sentiment analysis, we end up with a dataset including the ESG scores, the topics, and the sentiment or perception of the analysts embedded in each document associated with each entity. In other words, each financial institution has an ESG score, a distribution of ESG features (topics), and analyst sentiment. The sample was divided into the best (highest score) and the worst (lowest score) ESG-performing financial institutions to provide a more precise view of what

topics are targeted and assessed for both categories and what sentiment it generates for the analysts while discussing them.

Figure 1.1 shows an example of nine ESG features (extracted topics) discussed by the analysts. For each feature, we have extracted the feelings of the analysts from very negative to very positive associated with the best and worst subsamples. For example, for high-risk institutions, an average proportion of 15% of the views are about "Occupational Healthcare Policy," which is associated with an average negative feeling. On the other hand, for low-risk institutions, an average proportion of 20% of the views discuss "Public Disclosure" with an average positive tone.

1.4 CONCLUSIONS

The application of machine learning is still growing and can have an immense impact on the financial market. Having the capacity to study numerical and textual data is of great help to market practitioners. Information, as complex as it may get, with AI, individuals are able to extract the necessary set of information more comprehensively and with much more precision to guide one's decision. Textual analysis is a new piece in the puzzle of AI applications as it permits the identification, extraction, and interpretability of financial textual information. Unsurprisingly, textual information is of great importance for decision-making given that it encompasses valuable insights about the performance of corporations (annual reports), market dynamics (news), and investment strategies (analysts' reports and press releases). However, before applying any type of textual analysis, data preprocessing is required to clean the inputs from "less" informative features and keep relevant ones. The preprocessing phase is crucial, as it can determine how effective the analysis can be and influence the quality of the output. Once the data is ready for analysis, AI users can apply various tools and instruments to extract information depending on their needs and purposes.

Textual analysis can be considered to be the umbrella under which one can use tens of methods such as text mining, NLP, machine learning, and deep learning. These tools can detect, extract, organize, categorize, and quantify textual inputs, transforming the unstructured data into structured and more informative ones. In this chapter, we focused on the application of sentiment analysis and topic modeling, as they are gaining more traction

in the last decade and witnessing considerable developments and technical evolution. Sentiment analysis is a method by which users can mine and quantify the sentiments in textual communication, while topic modeling is a machine-learning technique that extracts frequent word patterns used to discuss dominant topics in a corpus.

The joint application of both techniques has proved to be significantly relevant and effective in the financial context, as it helps users, for example, understand and obtain specific features (topics) of a financial product like the risk profile, revenue, performance, opportunities, and the associated tone (sentiment) with which they are expressed. Machine learning is able to perform a wide variety of tasks that can guide decision-making processes and derive action in the market. It is still a growing field of research, showing some technical and theoretical challenges. Further research can be conducted on the impact of the application of machine learning on investors' behavior and market efficiency. In fact, the fight is quite furious between the believers in market efficiency and the unpredictability of prices and the practitioners that are striving to build models with the help of the most powerful machine learning techniques to predict the future of the market.

KEYWORDS

- **machine learning**
- **topic modeling**
- **textual analysis**
- **financial information**
- **ESG**

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CHAPTER 2

AI in a Superintelligent Society: Its Impact on Businesses

ŞERIFE UĞUZ ARSU

Aksaray University, Aksaray, Central Anatolia, Türkiye

ABSTRACT

The industrial revolutions of the last few centuries and the rapid developments and innovations in information and communication technology have brought great changes to society and organizations. Due to the intensive use of robotic technologies in working life, it is obvious that these changes will also affect businesses. The aim of the study is to draw attention to the transformation that will be experienced in enterprises with the effect of artificial intelligence in Industry 5.0, which is called industrial revolutions, and especially in Industry 5.0, which is called supersmart society, and to draw a general framework on how it will affect the structure of enterprises, ways of doing business, employee profiles, employment policies, business processes, behavior patterns in business life, and competition strategies. In addition, it is aimed to raise awareness on issues such as the opportunities obtained in the transition from Industry 4.0–5.0, the difficulties to be experienced, concerns about the rapid changes brought by technological transformations to business conditions, behavioral and managerial problems between employees and robots, and basic skill gaps in the management and manager roles of enterprises. In this context, starting from the transition from Industry 4.0 to Industry 5.0 with industrial revolutions, the effects of artificial intelligence on enterprises in a superintelligent society are examined in all conceptual aspects.

Applications of Artificial Intelligence in Business and Finance 5.0.
Richa Goel, Vikas Garg, and Michela Floris (Eds.)

2.1 INTRODUCTION

Thanks to rapidly growing and changing digital technologies and artificial intelligence-based solutions, the world of technology, economy, social, and cultural structure is in a phase of rapid transformation of mass personalization and advanced production. In parallel with these developments in technology, industrial revolutions and artificial intelligence, which are constantly transforming the globalizing world, have increased their impact on businesses. However, industrial revolutions and artificial intelligence have become prominent issues on global platforms and in the business world. As the last point of industrial revolutions, businesses that can effectively use Industry 5.0 applications in a supersmart society will be able to gain significant competitive advantages in the field of the global economy from the changes in business processes and behavior in business life. Industry 4.0, also called digitalization in the sector with smart factories, has provided an autonomous system using artificial intelligence technology that transfers the decision-making ability specific to people to electronic systems and machines. Instead of removing people from production, these developments have revealed human–robot interaction and the necessity for people to work in harmony with robots in order to increase productivity and efficiency. This situation has brought up the concept of Industry 5.0, where people work in cooperation with robots. In addition, Industry 5.0, which is focused on eliminating the deficiencies of Industry 4.0, which is technology-oriented and draws less attention to human aspects, and which has been put forward to complete Industry 4.0, is more based on human-centeredness and sustainability. In this sense, Industry 5.0, which is also called Society 5.0 and supersmart society and aims to use systems that work in harmony with each other for the benefit of society thanks to artificial intelligence, is emerging as a new philosophy. Industry 5.0, which has become one of the most trendy business and production topics in sectors and academic platforms in the world, has started to be examined and discussed in a large number of academic publications, practical articles, and conference topics in many companies, research centers, and universities. Industry 5.0 will also affect the structure of enterprises, the way they do business, their employee profiles, employment policies, business processes, and even competition strategies. Businesses will be able to leverage these insights to take advantage of the opportunities that arise from this transition, overcome the main challenges involved, and

design ad hoc strategies. In addition, in Industry 5.0, artificial intelligence, and technological elements, it is necessary to examine the problems to be raised as a result of these examinations within the framework of Society 5.0, which is expressed as the superintelligent societies of the future by considering the administrative, social, psychological, and economic-based phenomena that form the basis of business life, to evaluate the problems to be revealed as a result of these examinations within the framework of enterprises and management science, and to solve them in line with management strategies that can provide a road map to enterprises from theoretical and practical perspectives. In this study, the industrial revolutions that preceded Industry 5.0, which is a new concept, the transition from Industry 4.0 to Industry 5.0, and its effects on artificial intelligence and enterprises in Industry 5.0 are explained with all conceptual aspects.

2.2 INDUSTRIAL REVOLUTIONS

Throughout history, industrial revolutions have been driven primarily by disruptive technological breakthroughs that have changed the paradigms of production and the way they satisfy customer demand (Quin et al., 2016, s. 173). The first revolution in the industrialization adventure that started with steam engines was the first industrial revolution that enabled the increase of production with the invention of machines operating with water and steam power in the 18th century (Endüstri 1.0). The first industrial revolution was followed by the second industrial revolution (Industry 2.0), which accelerated the transition to mass production by using electrical energy and began in the 20th century with the symbol of mass labor production. Later, in the 1970s, the third industrial revolution (Industry 3.0) emerged, which started with the automatic production feature based on electronic and internet technology and the inclusion of digital systems in the industry and expressed a production understanding in which production systems ceased to be analog. Industry 3.0 is focused on the semiconductor industry, digital circuits, telecommunications, wireless communications, the renewable energy sector, and automation. While these are counted among the successes of the third industrial revolution, the fact that the automated system does not work in certain situations is the primary disadvantage of this revolution (Akundi et al., 2022; Yıldız, 2018, s. 547; Sharma and Singh, 2020).

While the revolutions in the industry bring mechanization, electricity, and information technology (IT) to human production on the one hand and provide increase and efficiency in production, on the other hand, global competition, changes in customer requests and expectations, complexation of production processes, environmental, economic, social, and technological changes are the basis for the emergence of a new revolution called "Industry 4.0," in which production tends to control the production processes of the products themselves. Industry 4.0, called cyberphysical systems (CPS), uses the Internet of Things (IoT) and cloud computing to provide a real-time interface between the virtual and physical worlds (Schumacher et al., 2016, s. 161; Akundi et al., 2022, s. 2; Ouin et al., 2016, s. 174; Lu, 2017, s. 3; Nahavandi, 2019, s. 2).

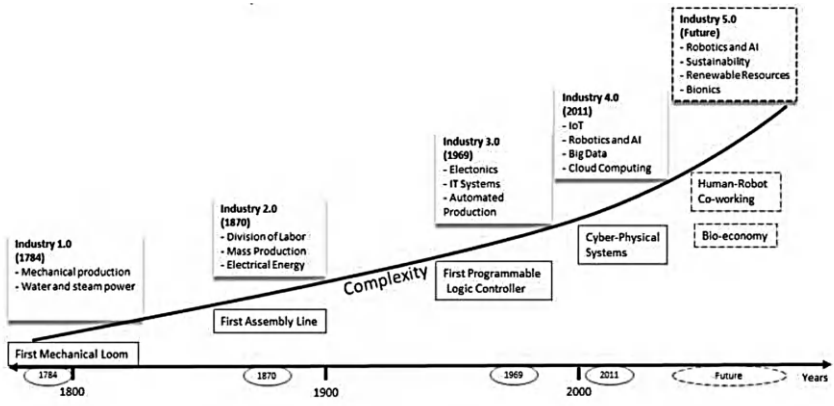

FIGURE 2.1 From Industry 1.0 to Industry 5.0 industrial revolutions.

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As seen in Figure 2.1, the historical development of societies up to Society 5.0 has been seen to have developed, respectively, as groups of people hunting together in nature, as groups based on agricultural production, organization, and nationhood, as a society that enables industrialization and mass production, as an information society, and as a human-oriented information society in prosperity (Saraccel and Aksoy, 2020, s. 30; Keidanren, 2016, s. 8). While the discussions on the use of Industry 4.0 technology continue, Endstri 5.0 has emerged, which brings a new perspective to the sector and requires many changes (Broo et al., 2021, s. 1).

2.3 INDUSTRY 4.0

Industry 4.0, which was first introduced in Germany in 2011 at the Hannover Fair, has been proposed by the German Ministry of Education and Research (BMBF) to continue its sustainable development strategy, increase Germany's competitiveness in the global market, and develop the German economy (Lu, 2017, s. 3; Ouin et al., 2016, s. 173; Bahrin et al., 2016, s. 137; Madsen and Berg, 2021, s. 2; Yüceol and Karaboğa, 2021, s. 33; Herman et al., 2015, s. 5). Industry 4.0 as a concept combines information and communication technologies (ICT) with production and production processes (de Sousa Jabbour et al., 2018, s. 277).

Industry 4.0 encompasses big data, industrial automation (robots), simulations, integration systems, IoT, cybersecurity, cloud computing, cognitive computing, additive manufacturing, augmented reality, and artificial intelligence as comprehensive factors of technological work aimed at continuous improvement (Madsen and Berge, 2021, s. 2; de Sousa Jabbour et al., 2018, s. 277; Nahavandi, 2019, s. 2; Saniuk et al., 2022, s. 3; Yücebalkan, 2020, s. 243; Wang et al., 2017, s. 321). Technologies and concepts related to Industry 4.0, also called components of Industry 4.0, are:

- Internet of Things (IoT): The integration of the IoT and the Internet of Services (IoS) into the manufacturing process has ushered in the fourth industrial revolution. IoT allows "objects" such as sensors and mobile phones to reach common points that interact with each other through unique addressing schemes and collaborate with neighboring "smart" components. The objects in question can be understood as CPS. Smart factories, smart homes, and smart grids are examples of IoT (Hermann et al., 2015, s. 9; Perales et al., 2018, s. 347).
- Cyberphysical Systems (CPS): CPS, which are the fusion of the physical and virtual worlds, are the integration of computing with physical processes (Kagermann, 2014, s. 603; Lee, 2008, s. 363). By fulfilling the dynamic requirements of production, CPS increases the efficiency of the entire industry and ensures transparency, control, surveillance, and efficiency in the production process. Examples such as autonomous automobile systems, robotic systems, industrial control systems, and smart trash cans are examples of CPS.

- Internet of Services (IoS): IoS consists of participants, service infrastructure, business models, and services (Perales et al., 2018, s. 347). IoS is the embodiment, creation, and delivery of new types of value-added services by companies and private users, making services easily accessible through web technologies. From a purely technological perspective, it is defined more broadly as "a commercial transaction in which one party grants temporary access to the resources (such as manpower and skills, technical systems, knowledge, consumables, land, etc.) of the other party in order to perform a predetermined function and a related benefit (Hoffman and Rüsch, 2017, s. 25).
- Smart Factories: A smart factory is defined as a factory that helps context-sensitive people and machines perform their tasks. The close connection and communication between smart factories' products, machines, transportation systems, and people are expected to change the current production logic. For this reason, smart factories are recognized as another important feature of Industry 4.0 (Hermann et al., 2015, s. 10; Hoffman and Rüsch, 2017, s. 25).
- Augmented Reality: It is the adaptation of virtual objects (3D) to the real environment. Augmented reality technology, with the high level of interaction of three-dimensional models and the ability to represent image, video, and reality, gives users a sense of reality by making them feel touched by 3D virtual objects. Augmented reality covers all the ways and processes of doing business of companies, universities, public institutions, and many other organizations. Managers' coordination between employees and departments, the processes of serving customers, employee training, product design, supply chain and value chain management styles, marketing services and financial transactions, etc., affect the changes. Among the companies that implement augmented reality, which is spreading rapidly in the world day by day, companies such as Boeing, Amazon, Facebook, General Electric, and Mayo Clinic are involved (Tekin, 2019, s. 882–883).
- Big Data: In the century we live in, data are now defined as raw material. With each passing year, more and more data are being offered to businesses. A facility of the future must be able to

generate large amounts of data and record, process, and intelligently analyze it (Perales et al., 2018, s. 347).

- Cloud Computing: Cloud computing is a computer environment that ensures that various documents and files required in business, work, and social life are accessible at any time. Cloud computing, which is one of the important components of the internet system, is defined as "receiving services related to information systems from third parties." It enables users to access data from anywhere and eliminates the material requirements of personal data and documents such as hard disk and external memory together with businesses (Tekin, 2019, s. 876).

As the debate on Industry 4.0 continues and businesses begin to adopt Industry 4.0, Industry 5.0 has emerged that goes beyond for-profit and technology-driven manufacturing. Industry 5.0 is understood as ensuring that production respects the boundaries of the planet and places the well-being of the industrial worker at the center of the production process, recognizing the power of industry to be a flexible provider of well-being, and achieving societal goals beyond employment and growth. The introduction of Industry 5.0 is based on the assumption that Industry 4.0 focuses less on the principles of social justice and sustainability and more on digitalization and AI-driven technologies to increase the efficiency and flexibility of production (Xu et al., 2021, s. 530; Saniuk et al., 2022, s. 4–5; European Commission, 2021; Breque et al., 2021). In summary, Society 5.0 again follows Industry 4.0. However, the most important point here is that Industry 4.0 focuses on production in technology, while Society 5.0 focuses on increasing the welfare level of people by benefiting more from technology, improving the quality of life, social responsibility, and sustainability (Saracel and Aksoy, 2020, s. 29).

2.4 TRANSITION FROM INDUSTRY 4.0 TO INDUSTRY 5.0

Industry 4.0, which aims to reach a higher level of automation and intelligence thanks to advanced production technologies and digitalization, is more technology-oriented and pays less attention to the human aspects of technology. Industry 4.0 focuses on increasing the efficiency and improvement of the process, which unwittingly ignores the human cost resulting from this improvement. This situation is discussed by both industrial

practitioners and academics as a threat to the sustainable development of people and society. Concerns about this threat give rise to the necessity of having a systematic conceptual development to complete the missing points of Industry 4.0 (Saniuk et al., 2022; Madsen and Berg, 2021, s. 2; Xu et al., 2021).

Another factor is that environmental pollution has increased considerably in recent years. In addition, there is now a greater focus on reducing the negative impact on the environment caused by waste generation and management. However, Industry 4.0 is not focused on the world's technologies that protect the environment and improve environmental sustainability. This leads to the need to find better solutions to protect the environment (Nahavandi, 2019, s. 3; Chen et al., 2008; Yetilmezsoy et al., 2011).

Therefore, considering the importance of anthropocentricity, flexibility, and environmental awareness, the concept of Industry 5.0, which attaches more importance to socioeconomic conditions and environmental performance in meeting industrial and technological targets and is considered to complement Industry 4.0, is proposed. With the concept of Industry 5.0, the research limits of technology-oriented Industry 4.0 have changed. Research has now begun to address the need for a smart and harmonious socioeconomic transition driven by both people and technologies. In this technological transformation, the emphasis is mainly on human beings (Callaghan, 2019, s. 448–449; Ghobakhloo, 2020; Jafari et al., 2022, s. 1–2; Saniuk et al., 2022; Madsen and Berg, 2021, s. 2; Xu et al., 2021; Nahavandi, 2019, s. 3).

Industry 5.0 was defined as a people-oriented society in a paper published by Keidanren in 2016. In January 2016, the "Fifth Science and Technology Basic Plan," which was developed by the Japanese government, which had experienced social and economic problems as a result of the analyses made to solve these problems and foresees the transition to Society 5.0, was adopted. Meanwhile, Japan, which is experiencing problems with energy scarcity and imports, insufficient natural resources, and an aging population, began supporting Society 5.0 (T5.0), the vision of creating a human-centered sustainable society, in April 2016 to solve long-term social and economic problems with artificial intelligence and to increase people's productivity and quality of life through CPS. T5.0, which has been identified as a growth strategy for the Japanese, is also a fundamental part of investment for the Future Strategy 2017 and reform to

achieve T5.0. In addition, in 2017, Japanese Prime Minister Shinzo Abe's emphasis on the T5.0 philosophy during his speech at the technology fair CeBIT in Hannover, Germany had a significant impact on the hearing and awareness of the issue (Saniuk et al., 2020, s. 5; Çalış Duman, 2021, s. 5). According to Keidanren (2016, p. 10), to increase the power of individuals by carrying out individual reform, including elderly people and women, to provide new values such as productivity, innovation, and globalization through the digitalization and reform of business models of companies, and to create a better future by solving social problems such as declining populations, rapidly aging societies, and natural disasters: (1) Trying to realize a rich and strong future to solve many problems is among the goals of Society 5.0.

2.5 SUPERSMART SOCIETY: INDUSTRY 5.0/SOCIETY 5.0

The main ideas of the Industry 5.0 concept were discussed in two virtual workshops organized by the European Commission, Directorate-General for Research and Innovation, on July 2–9, 2020, with discussions between participants of research and technology institutions as well as funding institutions in Europe (European Commission, 2021). Thus, the basic principles of Industry 5.0 have been developed by proposing the necessary changes for a sustainable and people-oriented industry (Breque et al., 2021). On January 4, 2021, the European Commission formally called for the Fifth Industrial Revolution (Industry 5.0) (Xu et al., 2021, s. 532; Saniuk et al., 2022, s. 3).

Promoting social goals in the workplace, Industry 5.0 emphasizes goals such as technology, human and machine interaction, social and environmental responsibility, and workplace safety (Saniuk et al., 2022, s. 4). In Industry 5.0, digitalization and artificial intelligence elements that regulate business and supply chain processes are penetrating people's daily lives. In other words, adopting the Industry 5.0 perspective means blending the needs of employees with digitalized production and reorganizing classical methods and tools to achieve better performance. This leads employees to work in harmony with technology and adopt a sustainability approach. Therefore, Industry 5.0 is believed to have given rise to the idea of Society 5.0, which solves social problems and expresses a society in which advanced technologies are actively used to benefit people in all areas of

their lives and to improve the quality of life (Fonda and Meneghetti, 2022, s. 2; Elim and Zhai, 2020; Saniuk et al., 2022, s. 4; Arı, 2021, s. 464; Fidanboy, 2022, s. 110). In a nutshell, this new perspective on social and global well-being is called Society 5.0 (Aquilani et al., 2020).

Society 5.0 refers to the transition from the information societies that emerged with Industry 4.0 to superintelligent societies, which are a more sustainable model. In other words, Society 5.0, which emerged as a result of the inadequacy of Industry 4.0, which focuses on efficiency in production and industry, on issues such as climate changes, diseases, and ecological balance, which are at the beginning of today's problems, is a revolution that tries to integrate society and the problems of society with Industry 4.0 (Çalış Duman, 2022, s. 1). With Society 5.0, which expresses change in areas such as production, health, and education, solutions are sought to problems such as environmental pollution, an aging population, disasters, and terrorism (Avşar, 2018). Therefore, Industry 5.0 is not a technology-oriented revolution but a value-oriented initiative that directs technological transformation with a specific purpose.

2.6 ARTIFICIAL INTELLIGENCE IN A SUPERSMART SOCIETY

While the essence of Industry 4.0, which is defined as a structure based on digital production, integrated communication networks, cyberphysical systems, smart factories, and the production of meaningful information from data, is the developments in the field of "unmanned production" and artificial intelligence (AI), Industry 5.0 focuses on creating interaction in the human–machine system (Yücebalkan and Aksu, 2018, s. 473; Saniuk et al., 2022, s. 4). This interaction means that in the future, robots will have a powerful combination with the human brain and will be used as collaborators and executors of commands instead of competitors (Madsen and Berg, 2021, s. 6; Nahavandi, 2019, s. 1).

In Society 5.0, artificial intelligence accumulates information obtained from the physical space in cyberspace, enabling future analysis of process data through the use of Human-Cyberspace-Physical Systems (HCPS) that take human–machine interaction into account. The goal of Society 5.0 is to balance economic progress by solving social problems. In other words, while upgrading products, services, and processes with intelligent systems, also adapting these processes to human and environmental needs. Society 5.0, along with artificial intelligence, refers to an intelligent society that

can use standardized processes to assess human needs (Foresti et al., 2020, s. 836). In this respect, the interaction of human and artificial intelligence is very important in Industry 5.0. In Industry 5.0, which focuses on the return of human beings to the production system, it finds ways to work in human and robot cooperation to improve the quality and efficiency of production (Demir et al., 2019, s. 688).

2.7 INDUSTRY 5.0 AND THE EFFECTS OF ARTIFICIAL INTELLIGENCE ON BUSINESSES

Since the industrial age, in which humanity entered a long time ago with steam series, robotic systems, and artificial intelligence have entered our lives with the development of digital technologies, changing business conditions and ways of doing business have serious effects on the economy and businesses. In addition, the economic and social effects of information technologies and technological revolutions are felt on business strategies and affect human resource management practices and processes intensively (Dirican, 2015; Garg et al., 2018, s. 113; Yüceol and Karaboğa, 2021, s. 32).

With the increasing change in the nature of jobs, muscle work is being replaced by brain work, and labor-based industries are being replaced by knowledge-based industries. In a world that has become a global village where people interact through technology and innovation, artificial intelligence is helping businesses perform any function more effectively and efficiently. Artificial intelligence also supports all functions of human resource management applications of enterprises, from recruitment, selection, training, development, remuneration, and performance management. Artificial intelligence reduces work pressure on employees with issues such as softening the procedure, analysis of data, etc., as well as issues for worker commitment, recommitment, career development, and so on (Garg et al., 2018, s. 113).

In addition, according to Nahavandi (2019, p. 4), in Industry 5.0, artificial intelligence will have positive effects on businesses in terms of workplace friendship, people working with robots, and job satisfaction. Thanks to the fifth industrial revolution, which paired the human brain and the machine, humans will work collaboratively with their robot colleagues who they believe understand them adequately. This will lead to the production process being effective and efficient, while at the same

time reducing waste-related costs. Industry 5.0 will show that robots can not only be programmable machines but also ideal companions. With the next industrial revolution, collaborative robots called cobots, also called next-generation robots, who know what to do and learn fast, will be introduced. These robots will be able to recognize and understand the purpose, expectations, and feelings of human operators and humans. They will also monitor them to learn how they perform their tasks and perform the desired tasks. This will allow people who work with cobots to experience a different sense of satisfaction in business life.

In addition to workplace companionship and job satisfaction, it is also expected to create new jobs in many areas, such as intelligent systems, artificial intelligence and robotics, machine programming, machine learning, intelligent health and care, and intelligent education. With Industry 5.0 aiming for a higher standard of living and creativity, artificial intelligence plays an important role in all sectors of society, especially in human resource management. Other issues where artificial intelligence contributes to businesses are (Maddikunta et al., 2022, s. 4–7; Saniuk et al., 2022, s. 4; Martynov et al., 2019, s. 539–540; Garg et al., 2018, s. 113–115):

- Recruitment: Artificial intelligence saves time with functions such as resume scanning, job description creation, and resume matching. In addition, artificial intelligence software is also used to find candidates to fill the vacant positions in enterprises. Thanks to this software, resumes are automatically scanned, candidates with the right qualifications are found, and thousands of phone calls can be made at the same time.
- Performance evaluation: Artificial intelligence also allows a person to perform performance evaluation operations on a daily basis, which are carried out in 3 or 6 months.
- Operations: Almost all parts of HR operations also benefit from artificial intelligence. Thanks to artificial intelligence, chat rooms, chat boards, and various applications are available to solve employee queries.
- Workforce: In recruitment processes, AI also reduces 55–60% of the traditional recruiter's work, making work more efficient and time-saving.

In addition to these, it is believed that productivity and efficiency will increase thanks to Industry 5.0 and artificial intelligence, production times

will be shortened, and enterprises will be ensured to be environmentally friendly. Again, with industry 5.0 and artificial intelligence, it is thought that a large number of jobs will be created in many areas, such as intelligent systems, maintenance, training, programming, reuse, and the invention of a new type of production robot (Nahavandi, 2019, p. 11).

On the other hand, there are concerns that technological developments with artificial intelligence, digitalization of processes, and integration into production will reduce the need for human resources. However, this integration is actually in direct relationship with human resources management. It is not possible to think and design technology, digitalization, and human resources independently of each other. Moreover, cloud computing, which is an information processing service provided on demand, points to the technology element because it provides instant data. On the other hand, it is actually humans who will carry out the data mining process, which has the capacity to discover, analyze, and create information from big data, which is a huge dataset that includes customers, sales, operations, and all other interests of the enterprises, rules, and models. Therefore, although this process is unmanned, a qualified labor force is required in the background with very meticulous planning ability, advanced programming knowledge, and the ability to perform maintenance and repair (Aksoy, 2017, s. 38; Filizöz and Orhan, 2018).

In addition to the effects of Industry 5.0 on businesses and the benefits it will bring to society, there are also some concerns about enterprises and production in the future. According to Doyle-Kent and Kopacak (2020), in addition to the opportunities of the fifth industrial revolution, there are also many threats to humanity, such as the destruction of the environment and income inequality. Since technology and automation will also change the dynamics of the workforce, the new type of work created in the technological environment will also require a range of skills. Current online security techniques will become outdated. International laws, regulations, and governance will need to be reinvented to be agile and relevant to emerging challenges.

In another study by Rada (2018) and Nahavandi (2019, p. 12), the challenges related to Industry 5.0 are: "the difference between the development of technology and society, as well as legal issues arising from change in the community and the labor market/environment; disproportion in the number of elderly and young people due to innovations in society and the working environment; the need to control the system to prevent

overproduction, fast, and highly efficient production; the fact that it can lead to the phenomenon of overproduction, consideration of application transparency; reducing the clarity of implantation technology in processes and industries due to the new implantation method; dependence on IT and electricity; the difficulty of adapting to the new industrial revolution, especially for senior members and stakeholders of a society; the need for autonomous systems to be subject to ethical behavior, verification, and validity" is laid out.

In this respect, there are also ethical concerns about Industry 5.0. As ethics-related organizations witness an increasing level of human–machine collaboration, more and more ethical questions and concerns may arise in the future about the impact of technology on humans, such as collaborative issues, psychological issues, lack of social interaction, skepticism toward learning robots, declining labor, and human–robot competition (Longo et al., 2020, s. 4).

Given these challenges and concerns about Industry 5.0, the fact that fast and highly efficient production can lead to the phenomenon of overproduction, application transparency, how autonomous systems can combine ethical principles, behavioral solutions in autonomous systems, the need for ethical behaviors to be subject to verification and validity, and key skill gaps in future management and manager roles should be addressed (Nahavandi, 2019, p. 12). In addition, the issue of integrating employees into newly developed processes, equipping them with new skills and competencies, how to gain these competencies, how new occupational groups will be shaped, and which features will be required is on the agenda. In addition to the findings that support the views that the employment concern and the need for human resources will decrease, there are also opposing views. It is argued that the need for human resources will continue in the new process, but there are new competencies to be gained. For example, in line with the predictions in the World Economic Forum's "The Future of Jobs" report, it is obvious that it will threaten some occupational groups. It is debatable whether the replacement of labor and machines will cause a decrease in employment opportunities, but on the other hand, it turns out that the most important factor for people to find a place in business life and to operate in production is "talent." Accordingly, the importance of the human factor is increasing day by day, and the keys to the success of the highly innovative organizations of the future are the skills and qualities they have (Yüceol and Karaboğa, 2021, s. 36).

For example, five important barriers that need to be broken down in order to develop Society 5.0 are mentioned, and among them is the phrase "lack of qualified personnel." From this point of view, in terms of human resources management, it is extremely important to create a "qualified workforce" that can use technology correctly, manage technology, create creativity, and cooperate in the light of the technology brought by Industry 4.0 and the philosophy of Society 5.0 (Güner, 2019; Filizöz and Orhan, 2018, s. 113–115; Yüceol and Karaboğa, 2021, s. 36). In this respect, it is necessary to invest in employee retraining and lifelong learning. In order to adapt to the needs of society and the economy and to increase productivity, employees need to focus on issues such as talent development and talent management (Saniuk et al., 2022, s. 4).

Again, the necessity of an innovation management framework that can balance business and customer needs for Industry 5.0, openness, and confidentiality is emphasized. In addition, because rapid changes in business conditions require rapid response, businesses must invest resources in R&D to compete in the market and bring some new advances.

As a result, Industry 5.0 leads to radical changes in organizations and societies. Modern organizations, therefore, face a variety of challenges that bring with them new opportunities. In order to perceive Industry 5.0 from a broader perspective and to overcome these difficulties, it is necessary to recognize or foresee all the problems that the human factor encounters or will encounter as an employee in this process. In addition, these challenges faced by modern organizations can be solved with the help of artificial intelligence. Artificial intelligence increases the competitiveness of businesses in the global market **(**Garg et al., 2018, s. 113).

KEYWORDS

- **artificial intelligence**
- **Industry 4.0**
- **Industry 5.0**
- **supersmart society enterprises**
- **workforce transformation**

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CHAPTER 3

FinTech Evolution and Artificial Intelligence: Opportunities and Development

ADITYA KESHARI and AMIT GAUTAM

Institute of Management Studies, BHU, Varanasi, Uttar Pradesh, India

ABSTRACT

Financial services are a potent application for artificial intelligence, which has roots in computer science, languages, psychology, mathematics, and philosophy. Businesses are now using analytical technologies like machine learning and ANN to analyze data gathered over time. ML enables quasiempirical techniques used for canonical asset pricing studies with neural networks to simulate realizable asset returns based on business characteristics. Financial solutions and information technology are combined to develop FinTech. The first part of the study focused on the evolution of FinTech and was divided into phases. The next part focuses on the research into blockchain security and governance, which will also be a new development in this field. This era is not just confined to financial products and services but extends to how these services are delivered. The second section of the study concentrates on the various aspects of AI that paved the way for the rapid growth of FinTech. Blockchain and cryptocurrencies, digital advisory systems, equity crowdfunding through peer-to-peer lending, and digitalized mobile payment services are some popular topics. Artificial intelligence is also an essential part of these topics, which

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will help create new ways to solve financial problems. The introduction of recent innovations such as Roboadvisors, which can provide significant investment advice and portfolio management without human intervention, will transform trading and investment completely.

3.1 INTRODUCTION

The development of FinTech with the incorporation of AI is phenomenal. Although the financial system is primarily digitized, innovations in these modern technologies and their implementation in the contemporary financial world can take businesses to the next level (Alt et al., 2018). The FinTech industry is expanding rapidly, and marketers predict that it will continue to grow in the near future. Before considering the most recent trends as future prospects, it is always required to assess the series of events that have transpired in the past, which provide direction for future development (Hendershott et al., 2021). So, the study focuses on the evolution of FinTech from early 1886 to the present day and how technology has helped the FinTech firms in expanding their operations and incorporating the latest innovations. Also, the study incorporates the latest technologies of artificial intelligence in business and its application in improved decision-making. The result improves the prospects for companies and emerging economies to collaborate with developed nations on technical exchanges (Alt et al., 2018).

3.1.1 EVOLUTION OF FINTECH

3.1.1.1 FINTECH 1.0 (CHANGING FROM ANALOG TO DIGITAL MODE)

Although the term "FinTech" was coined recently, its history dates back to when analog systems were converted to digital, utilizing transmission cables to further the globalization of financial services and the introduction of investment and share trading (Hau et al., 2021). In light of this, the oldest evidence of a connection between technology and finance may be seen in the evolution of money into fiat currency, a form of transferable value that has become one of the most significant aspects of Fintech in recent years (Puschmann, 2017). Abacus was used for mathematical

calculations in the early days of technology. A similar process can be seen in the early development of trade, including businesses, banking, insurance, and international trade.

The link between technology and finance deepened until the invention of the telegraph, which made it possible for countries to communicate clearly (Chakraborty, 2018). Additionally, the growth of transportation connectivity brought about by the canals and railroads facilitates trade between nations and increases the crossborder migration of people. The earliest breakthrough in this financial technology happened in February 1950s when Frank X. McNamara, founder of Diner' Club, introduced the Americans to their first "general purpose" credit card, the earliest breakthrough in this financial technology (Lukonga, 2018). In the context of information technology, the most significant contribution was given by IBM business, which introduced the early financial computers produced by Texas Instruments in 1967 (Lee et al., 2018). In continuation, the first ATM was deployed in the UK by Barclays in 1967.

So, with the introduction of the fax machine, the installation of ATMs, and the invention of the first calculator, the modern phase of FinTech 1.0 began, where the change was visible as the industry was moving from the analog mode to the digital mode.

Figure 3.1 depicts the stages of evolution and divides the phase into three stages, namely, FinTech 1.0 (1886–1987), followed by FinTech 2.0 (1987–2008), and FinTech 3.0 (2009–present). These phases have seen various developments in FinTech from the analog to the current period when people are talking about Artificial Intelligence, Deep Learning, Big Data Analytics, and Blockchain technology, which take the businesses to another level by smoothening the process.

3.1.1.2 FINTECH 2.0 (TRANSFORMING TRADITIONAL FINANCE SERVICES)

The most iconic incident in the early years of FinTech 2.0 happened with the introduction of mobile phones in 1983 in the US, which the investment bankers held mainly at that time on "Wall Street." In contrast, the most significant development happened after the introduction of the Internet in 1995, when online account checking started and expanded to eight banks in the US (Chisthi and Barberis, 2016). By the end of 2005, HSBC

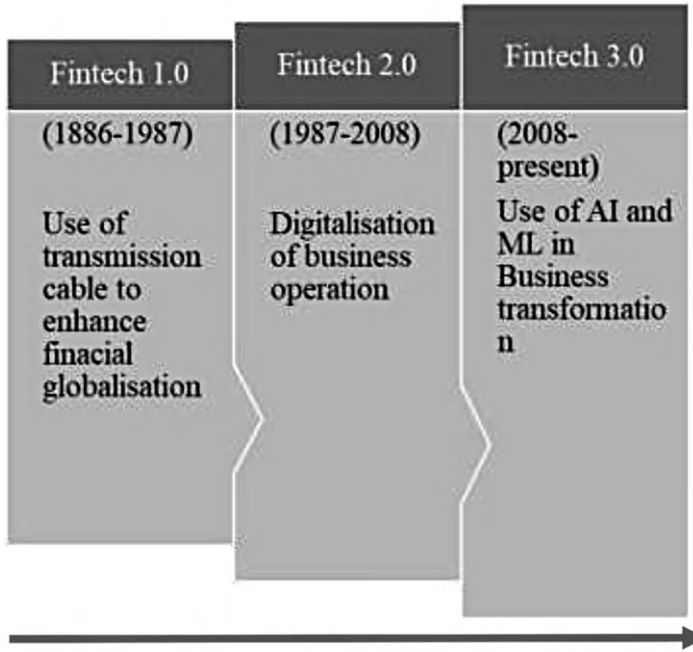

FIGURE 3.1 Different stages of Fintech evolution.

Source: Author's own.

and ING Direct had established their first digital bank without a physical branch in the UK. In the context of the UK and US security markets, the use of computers for trading and recording information became famous in 1987 (Arslanian and Fischer, 2019). The early introduction of cryptocurrencies was also introduced in the year 1996 when Dr. Douglas Johnson and Barry Downey raised electronic money and tied it with the possession of gold. Still, the credit for modern cryptocurrency goes to Nick Szabo, who developed the concept of Bit Gold by using blockchain technologies such as peep-to-peer networks, registry, cryptography, and mining.

The major concentration of the biggest FinTech firms is in the USA and China, which is shown in Figure 3.2 and reflects the technological dominance of these two countries. During this period, the expansion of FinTech firms started expanding worldwide, as depicted in Figure 3.3, showing the number of FinTech firms worldwide, where America is leading with the most significant number of FinTech startups.

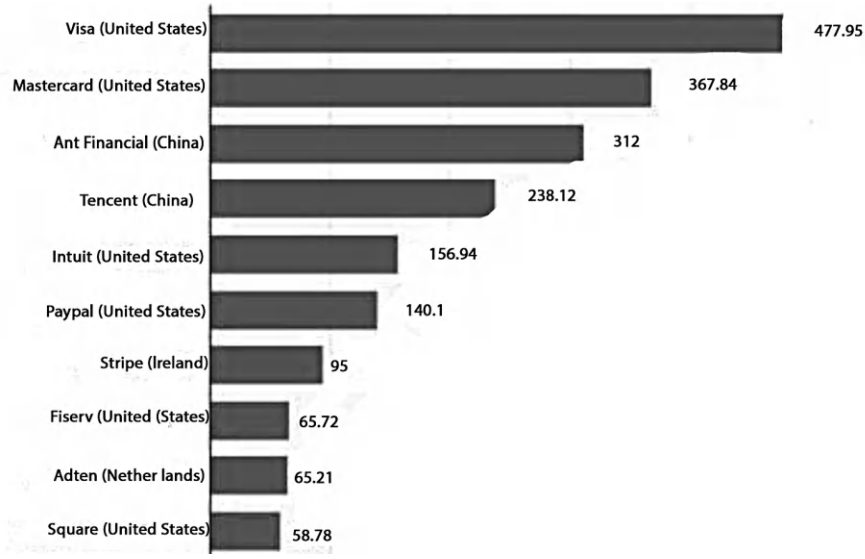

FIGURE 3.2 Market capitalization of the largest FinTech companies worldwide (billion USD).

Source: Adapted from Statista. https://www.statista.com/statistics/893954/number-fintech-startups-by-region/#:~:text=Number%20of%20fintech%20startups%20worldwide%202018-2021%2C%20by%20region,the%20region%20with%20the%20most%20fintech%20startups%20globally.

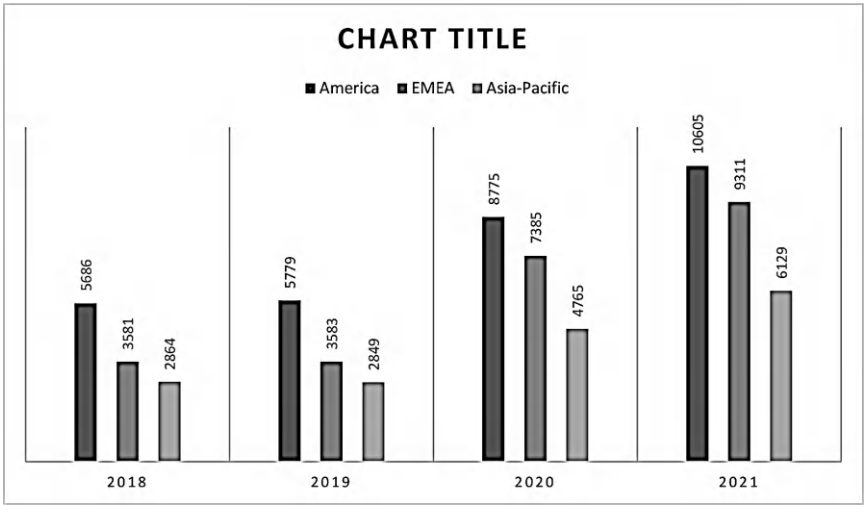

FIGURE 3.3 Number of Fintech startups by region between 2018 and 2021.

Source: Author's own.

3.1.1.3 FINTECH 3.0 (MODERNIZING DIGITAL FINANCIAL SERVICES)

The Global Financial Crisis of 2008 made a huge impact on the growth of FinTech as various regulatory bodies started monitoring and regulating the process. The innovativeness of public scrutiny, economic events, and political situations led to the rapid growth of FinTech Era 3.0. In January 2009, Satoshi Nakamoto launched bitcoin with the help of software programmer Hal Finney. From then on, bitcoin became very popular, and the first bitcoin transaction also happened between Nakamoto and Finney for ten bitcoins (Liu and Tsyvinski, 2021). The first transaction in the real world occurred for the purchase of two pizzas for 10,000 bitcoins. Since then, FinTech adoption has become a significant concern for companies and startups (Zheng et al., 2019). According to the report published by the EY group in 2019, Table 3.1 shows that the FinTech adoption rate among the users is outstanding worldwide. India shares the top position, with China having an 87% adoption rate, followed by Russia and South Africa, which have an 82% adoption rate. The overall adoption rate worldwide is 64%, which shows that there will be growth in financial services in the upcoming years.

TABLE 3.1 Consumer FinTech Adoption Rates Worldwide.

Country	Adoption rate (%)
China	87
India	87
Russia	82
South Africa	82
Columbia	76
Peru	75
Netherlands	73
Mexico	72
Ireland	71
UK	71
Average	64

Source: EY.

3.2 THEORETICAL BACKGROUND

3.2.1 ARTIFICIAL INTELLIGENCE (AI)

AI is the area that integrates computer science skills to address the challenge of extensive dataset analysis. It allows the computer to mimic and function like the human mind while solving problems. Many definitions have been given over time for AI (Pallathadka et al., 2021). Still, John McCarthy provides the most relevant explanation in the field, focusing on combining different domains to create a space for robust problem-solving. "It is the science and engineering of making intelligent machines, especially intelligent computer programs (Veloso et al., 2021). It is related to the task of using computers to understand human intelligence, but AI does not have to confine itself to biologically observable methods." Additionally, it incorporates the machine learning algorithm subfields that are usually referenced when discussing AI. These fields use artificial intelligence techniques to build specialized systems that provide forecasts or categorize data depending on the input.

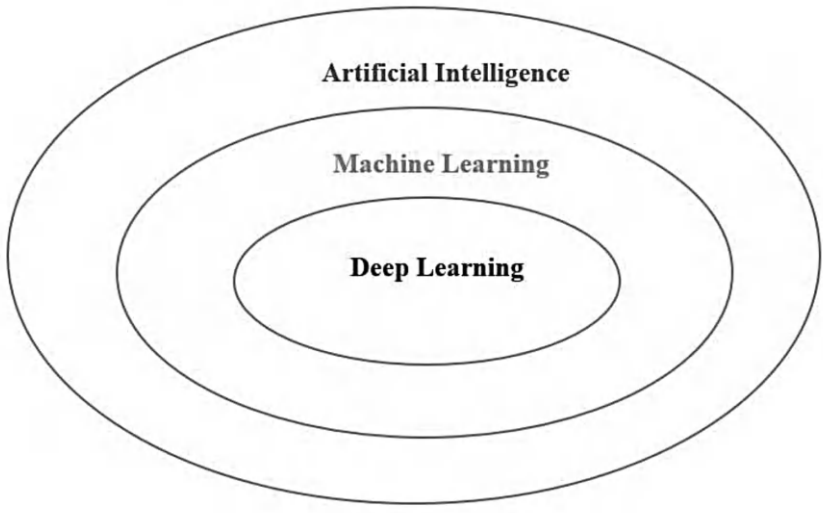

FIGURE 3.4 Relationship among the dimensions of AI.

***Source*:** Author's own.

ML and deep learning are the subfields in AI shown in Figure 3.4, and they are used interchangeably, but this is not the case while machine learning is the subfield of AI, which focuses primarily on the data algorithms to enable machines to imitate exact human ways to learn and improve gradually for better accuracy (Callier and Sandel, 2021). Hence, deep learning is a subfield of machine learning, which develops a network structure that goes deep into the layers of information and gives an inclusive output level. The deep neural network is generally represented as:

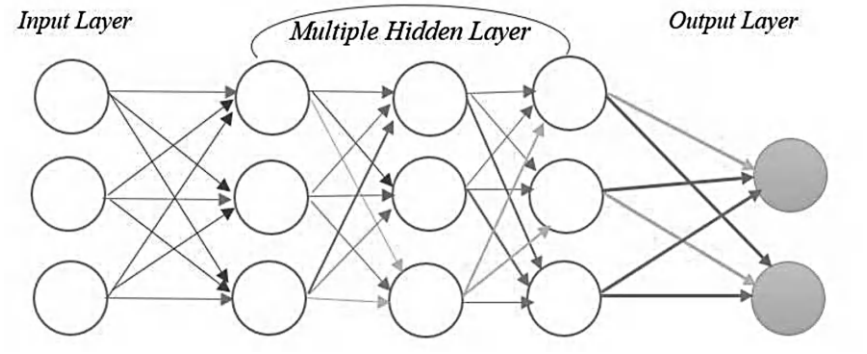

FIGURE 3.5 Deep neural network.

Source: Author's own.

Here in Figure 3.5, deep neural networks have mainly three layers: an input layer in which the information is given to the system, a second hidden layer which is performed by the system and is unknown to users, and the third is the output layer, which is provided by the system after performing the function.

3.2.2 COMPONENTS OF AI

Creating an effective AI mechanism requires addressing specific qualities while making algorithms. These functions act as a group rather than just a separate system, and they comprise the following items:

3.2.2.1 LEARNING

In Artificial Intelligence, learning combines inputs for training networks. Learning is categorized into various forms; the hit-and-trial method is one

of the most used forms of learning in the system; there are multiple forms of learning.

- Self-Learning
- Feature Learning
- Sparse Dictionary Learning
- Anomaly Detection
- Association Rules

3.2.2.2 PROBLEM SOLVING

Artificial intelligence helps in solving advanced problems, which are divided into two parts: the first is solving the problem for general uses, and the second is solving special-case problems. Advance-specific issues are related to the application of AI in genetic coding. On the other hand, general problems which cater to large audiences like problems related to controlling robots.

3.2.2.3 LOGIC AND REASONING

Reasoning is the process of drawing a conclusion based on judgment and inferences drawn from the data, facts, and figures and interpreting them in a sensible manner. Reasoning is divided into two types based on approach: inductive and deductive reasoning.

Drawing the general conclusion from the specific information like "Coffee is addictive," it is also called bottom-up reasoning, which starts from specific observations and ends with deriving the general conclusion shown in Figure 3.6. The process of inductive reasoning is as follows:

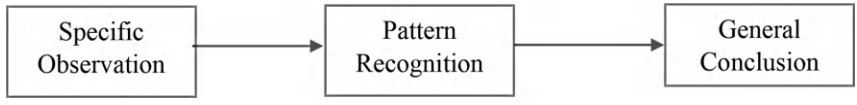

FIGURE 3.6 Flowchart of inductive reasoning.

Source: Author's own.

On the other hand, deductive reasoning takes general information assumed to be accurate and draws a specific conclusion.

A system that seeks to reach reasonable conclusions based on available information is called logic. This indicates that logic aims to draw conclusions from evidence. Logic in AI is used for the presentation of information and problem-solving. Several logics used in the AI algorithms are as follows:

- Formal logic is a set of phenomena that derive logical conclusions from the known truth.
- Informal logic presents the arguments in their natural form and does not follow any systematic pattern to reveal the results.
- Fuzzy logic works on partial truth, which revolves between true and false. Under uncertainty, fuzzy logic is being used in quantum applications.
- Propositional logic is a sub-branch of mathematics that forms a logical platform in situations where there is uncertainty about whether something is true or false. Here, simple statements called propositions are being developed to examine the problem.

3.2.2.4 MACHINE LEARNING (ML)

Machine learning focuses on computer learning algorithms to train the machines in problem-solving. Algorithms are trained in a way that helps the machines find the patterns, structures, and correlations among the big datasets to forecast and make the best decisions based on the analysis done (Pabreja et al., 2020). The increased applications of machine learning are being improved to provide optimum results and solve advanced problems. The learning process starts from observations and experiences, set patterns, and better decisions for the situation provided. Machine learning can be categorized based on algorithms in the form of supervised and unsupervised learning.

Supervised ML labels the data for predicting future events based on the past incidents that have been learned. At the same time, unsupervised ML uses the trained information which is not labeled and describes the hidden structure of the unlabeled data.

3.2.2.5 NEURAL NETWORK

Neural networks are the core of deep learning algorithms and a subset of ML. ANN structures are inspired by the human brain, which comprises

node, hidden, and output layers (Sharma et al., 2021; Zupan, 1994). In Figure 3.7, it is clearly stated that ANN is developed in the same way as the real neurons of the brain in which the neurons consist of the cell body, extensions as the synapses, and dendrites forming branch-like structures. The extended network of axons transfers the information from one neuron to another. In the same way, ANN works like the X_0, W_0, and Y structures, where X_0 works as dendrites, W_0 as the main cell body, and Y as the axon. In ANN, each node is connected to the other node of the layers, and the relative weight is associated with the threshold. When the information reaches the output layer, it gets activated and transferred to the following neural network. In other cases, it will not get activated, and no information or data will be transferred to the next network structure (Agatonovic-Kustrin and Beresford, 2000; Alamsyah et al., 2018). Figure 3.8 shows the training process of an artificial neuron, starting with initializing to assign weight to the training set of neurons and then determining the signals and modifying the consequences accordingly. If the criteria are fulfilled, then the training is complete; run the training set to neuron once again and run the process.

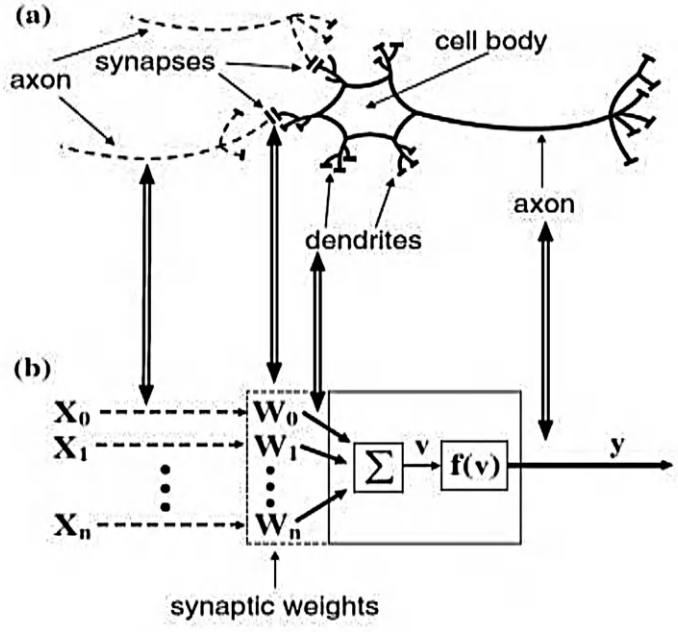

FIGURE 3.7 Comparison of real neurons with artificial neurons.

Source: Adapted from Agatonovic-Kustrin and Beresford, 2000.

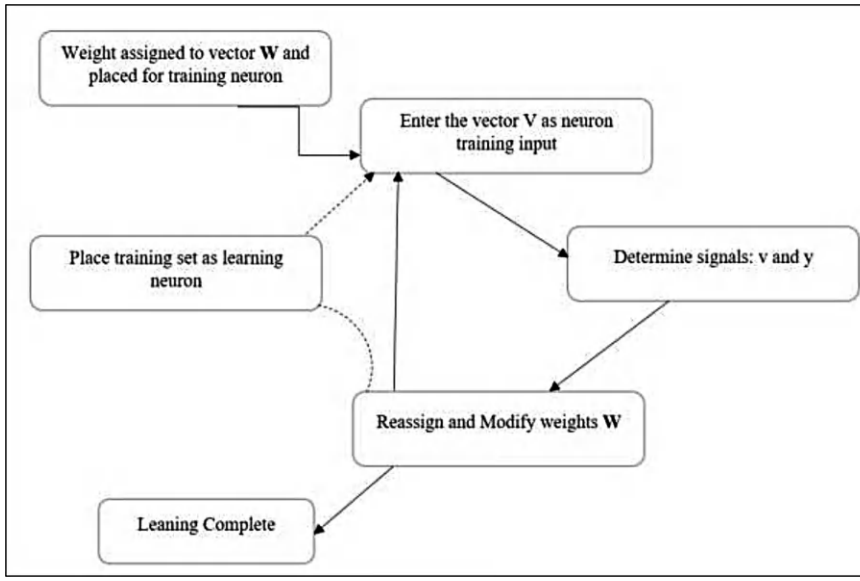

FIGURE 3.8 The training process for artificial neural networks.

Source: Adapted from Abiodun et al., 2019.

3.3 APPLICATION OF ARTIFICIAL INTELLIGENCE IN FINTECH

Over time, the usage of AI in FinTech has increased, and in several industries, its implementation has changed how business is conducted. Modern technologies are deployed in place of the conventional strategy, which unquestionably helps businesses resolve challenging problems (Kitao, 2018). Along with business expansion and competitive advantage, it also aids organizations in lowering operational expenses and improving the effectiveness and efficiency of their operations. In the fintech sector, artificial intelligence has the potential to complement human intelligence for better internal organizational processes and financial decision-making (Farell, 2015). This has had a substantial positive impact on service quality. According to a survey released by Allied Market Research, the market for AI in FinTech is expected to grow from $8.3 billion in 2021 to $61.30 billion by the end of 2031. This demonstrates the potential of AI in FinTech, with a CAGR of 22.5% from 2022 to 2031.

Figure 3.9 shows the areas where attention has been concentrated more heavily since FinTech and AI work best together to provide businesses with the best possible solutions. The three key areas where the most

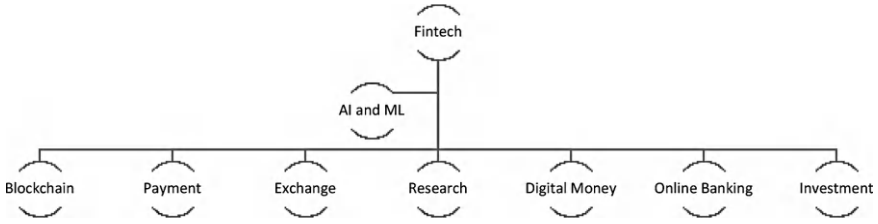

FIGURE 3.9 Areas focusing on the application of Fintech.

***Source*:** Author's own.

significant impact has been observed, as determined by the seven verticals above, are as follows:

- Blockchain Technology
- A payment system incorporates digital money, mobile banking, and online banking.
- Stock Exchange System, which also contains advancements that increase investments.

3.3.1 BLOCKCHAIN TECHNOLOGY (BT)

Blockchain technology emerged as a substitute for traditional ledger distribution systems, gaining popularity after the introduction of bitcoin in 2008. The technology became famous for its most effective distributive ledger technology for open peer-to-peer transfer (Marwala et al., 2018; Seebacher and Schüritz, 2017; Zheng et al., 2019). Human involvement in traditional systems is prone to errors, poses additional costs, and shows the system's inefficiencies. The introduction of BT is not only restricted to the transactions of cryptocurrencies; its application is far beyond and potentially affects corporate governance, capital markets, and social institutions.

- Blockchain is a decentralized, transactional database that enables validated, tamper-resistant transactions across many participants in a network (Glaser, 2017).
- But the use of blockchain is not limited to transactions; only its use in business makes the definition broader. Mougayar (2016) defines blockchain as a peer-to-peer exchange network for transferring value, while from a legal perspective, it can be defined as a technology for valid transactions.

- Based on the above definition, blockchain has two essential characteristics: trust and decentralization, as shown in Figure 3.10. Seebacher and Schruitz (2017) categorize it as follows:

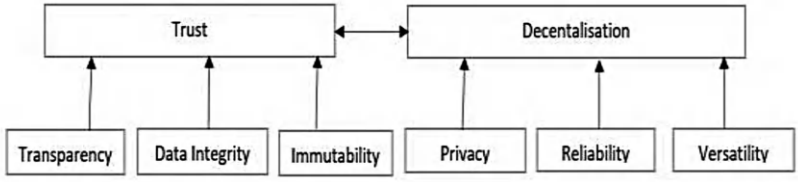

FIGURE 3.10 Blockchain technology features.

Source: Adapted from Seebacher and Schruitz, 2017.

However, blockchain technology is mainly known for monetary and financial transactions, but the transactions also comply with the rules and help form smart business contracts. Although the application of blockchain solves significant issues, it is still in the nascent stage. More focus is needed on the technical part of blockchain technology related to efficiencies, adaptability, security, and system integration issues.

3.3.2 PAYMENT SYSTEM

The development of traditional and digital payment systems facilitated better operations and improved techniques for businesses. Due to their disruptive presence, the innovations in payment systems are mainly categorized in three ways. The first innovation is being seen in the retail category at the point of sale, payment through digital payment apps, and mobile payments. The second is the introduction of digital money and its adoption by many participants (Chiu, 2017). Digital money is far different from the traditional fiat-based system and is a nontangible currency. In terms of the payment system, it is just like any other payment system. Digital money is categorized into four types based on its nature:

3.3.2.1 CURRENCIES HAVING INTRINSIC VALUE

The government does not regulate these types of currencies, but they have their value and derive their value from valuable assets like gold, silver, bronze, etc.

3.3.2.2 TOKENS

Tokens are digital currencies with less intrinsic value but are used as specialized local currencies in a particular location. BerkSahres and Storj tokens are a few examples of digitalized token money.

3.3.2.3 CENTRALIZED DIGITAL MONEY

Centralized digital money is recognized by the government and complied with by the marketplace. The governance structure usually defines them. The most common forms of centralized digital money are digital wallets, loyalty points, and central bank digital money.

3.3.2.4 DECENTRALIZED DIGITAL MONEY

Decentralized digital money is the prime form of peer-to-peer blockchain digitalized money based on trust and decentralization. Cryptocurrencies are the primary form of decentralized digital money.

Third, which is relatively new among all, is distributive ledger technology or autonomous organization technology, which can pass out the existing payment, clearance, and settlement systems. Figure 3.11 shows the mobile fintech payment system related to requirements, FinTech use, and security challenges.

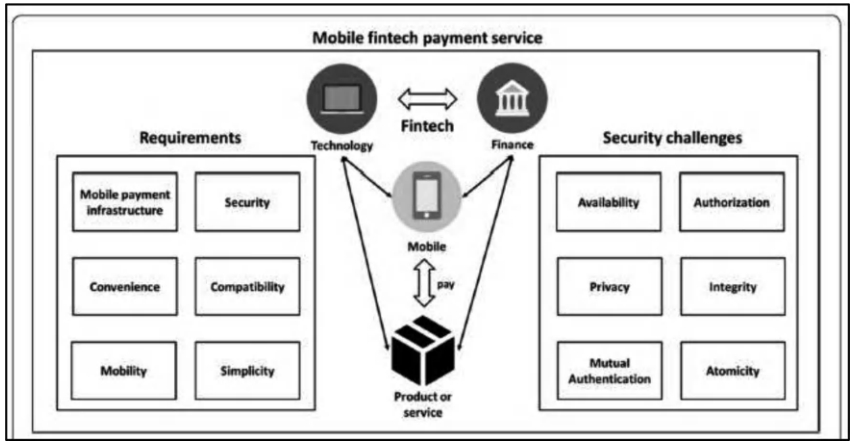

FIGURE 3.11 Mobile fintech payment service.

Source: Kang, 2018.

Mobile money is the most widely adopted form of Fintech worldwide (Hinson et al., 2019). The Indian financial landscape has changed drastically over the past decades due to frequent innovations in retail payment. Rapid innovations and changes have lowered transaction costs and increased people's social welfare (RBI, 2019). In rural areas, cash is still the dominant mode of payment, accounting for 90% of all payments (RBI, 2019). However, digital penetration is increasing rapidly in rural areas, including the agriculture sector. UPI apps like PAYTM, PhonePe, and GooglePay play a significant role in digital payment among the Indian rural population. UPI growth has been accelerated by the pandemic and compared to credit cards, it processes eight times more transaction value (RBI, 2021).

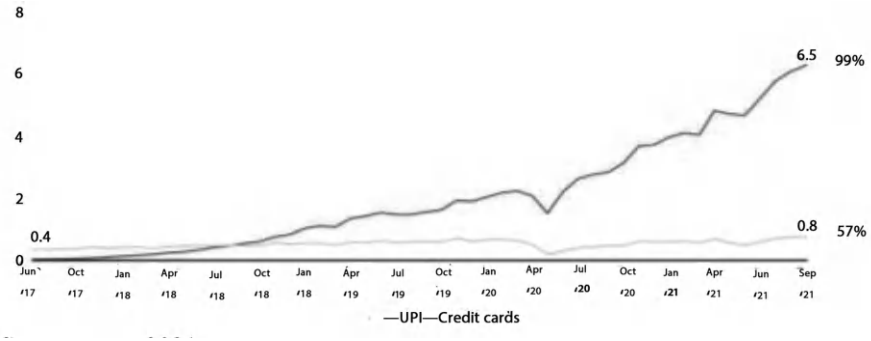

FIGURE 3.12 Monthly transcation values (INR lakh Cr)CAGR (September 2020–2021).
***Source*:** RBI (2021).

As per Figure 3.12, monthly transactional value through UPI reached ~INR 6.5 lakh crore in September 2021, whereas through credit cards, it was ~INR 0.8 lakh crore. The monthly transaction value of PhonePe also increased from ~INR 0.6 lakh crore to ~INR 3 lakh crore between April 2020 and September 2021. Similarly, another UPI app, Google Pay, is top-rated among rural people. This app experienced a growth of 7% in 18 months, with the monthly transaction value rising from ~INR 0.7 lakh crore in April 2020 to ~INR 2.5 lakh crore in September 2021.

A survey by Statista shows the FinTech user base on the Asian continent, and the projection for the year 2023 segment-wise is given in Table 3.2, in which the major portion of FinTech is being covered by Digital Payment, followed by Digital Investment and Alternative Lending. At the same time, neobanking is also becoming popular and being adopted by users in the Asian region.

TABLE 3.2 Number of FinTech Users in Aisa from 2017 to 2023, Segment-Wise (millions).

Year	Digital payment	Digital investment	Alternative lending	Neobanking	Alternative finance
2017	1451.15	36.31	53.15	3.1	0.05
2018	1653.54	71.77	56.87	5.34	0.05
2019	1952	125.33	62.37	9.12	0.05
2020	2146.79	186.36	69.5	15.18	0.05
2021	2375.83	240.25	76.55	23.97	0.06
2022	2591.94	281.99	81.31	34.69	0.06
2023	2785.09	315.19	83.6	45.06	0.06

Source: Adapted from Statista. https://www.statista.com/forecasts/1236037/number-fintech-users-asia-by-segment

3.3.3 STOCK EXCHANGE SYSTEM

The advancements in the foreign exchange rate system due to technological innovations led to better communication; this led to improved dynamics of the exchange rate system, where real data analysis has a significant impact on exchange rates.

Here are some changes that the introduction of AI and technology brings to the foreign exchange rate system:

3.3.3.1 TECHNOLOGICAL ADVANCEMENT

The advancement in technology leads to better storage of data and its execution. Various algorithms in ML enable computers to have a quicker processing speed and make it easier to process a vast amount of data in a significant amount of time. Techniques like LSTM (long-short-term memory) enable us to make decisions. Modern technologies also helped demolish the geographical boundaries and made it easier for investors to do transactions from anywhere. For example, a person can be in India but make investments in the US exchange rate system and manage their portfolio.

3.3.3.2 MODERNIZED TRADING TOOLS

The introduction of various trading platforms also enables the investors to track their portfolios with ease; the earlier majority of investors used to do

speculative buying without having the proper knowledge about the fundamentals and risks involved in the particular stocks. But these platforms also provided appropriate information about the stock, market movement, and suggestions for buying, selling, or holding the stocks. Also, these trading platforms assist investors in other forms of trading instruments like futures, options, commodities, and cryptocurrencies, which give investors a wide variety of options to diversify their portfolios effectively with prior knowledge regarding the risk involved.

3.3.3.3 TRANSACTION SPEED

The involvement of technology makes computers process information quickly, improving the transaction speed. Modern technology helped handle quotes for equity, price chart development, interest rates, and other options quicker.

3.3.3.4 REAL-TIME EXECUTION

In the stock exchange system, the order execution happens when it is filed, not when it is placed. The traditional system involves the medium of the broker as well; when an investor makes the order, it goes to the broker and from the broker to the exchange rate system. But with the latest technologies, order execution happens in real time; this process becomes more efficient and effective, and there are reduced execution fees.

3.4 OPPORTUNITIES IN FINTECH

A combination of AI and FinTech opens up various opportunities for businesses and the country. India has seen the historic event of the demonetization of currency notes, which creates a sudden urge for everyone to use cashless technology, including digital wallets, online banking, and mobile point of sale by the government. The Aadhaar card, eKYC, UPI, and BHIM have reorganized the Indian banking system. According to reports, digital transactions grew by 22% in India after the demonetization, while Fintech firms like PayTM had a 435% increase in users on the app. Due to the huge growth potential, this resulted in the expansion of several FinTech startups

in India. Banking structures and financial firms evolved due to different economic shifts, and e-wallets were made a requirement for payment transfers. The traditional banking and financial industry were modernized, resulting in more consumers, shorter wait times, and the ability to provide rapid and efficient services. AI helps financial firms by increasing the value of virtual currencies like Bitcoin. The use of cryptocurrency and blockchain architecture speeds up the processing of cashless transactions. The increased adoption rate of virtual currencies is also one of the positive indicators for the economy to look beyond the traditional investment and payment system pattern. The introduction of cryptocurrencies is one such example of growth in virtual currencies.

Also, FinTech services and the use of these modern technologies improve service efficiency and reduce costs. So, the adoption will also enhance the firm's profit-making abilities. The application of AI and ML in FinTech firms is still nascent in emerging countries like India, Sri Lanka, and Bangladesh. In comparison, the Fintech adoption rate is relatively high, which acts as an opportunity for the firms to expand their operations and tap the markets. Firms from emerging economies should treat it as an opportunity to collaborate with firms from developed nations regarding a technological exchange, which will equip them to be ready for future opportunities. The biggest FinTech firms are mainly concentrated in countries like the USA and China, demonstrating these countries' dominance in terms of technology. Hence, it acts as an opportunity for firms from emerging markets to expand their global presence. Awareness regarding the latest technologies related to Deep Learning, Artificial Neural Networks, and blockchain technology can quickly solve cumbersome business problems. Adopting these technologies will enable firms to compete with worldwide global networks.

3.5 CHALLENGES

Great opportunities also come with challenges, as in AI's application in revolutionizing FinTech. Modern technologies like blockchain and cryptocurrency are still nascent due to the integration of several other approaches and their slow adoption rate. Moreover, cyber fraud and technophobes are other obstacles to the smooth adoption of innovative technologies among users. For the low-income classes, innovation has been

relatively constrained. In emerging economies, widespread knowledge and limited internet access continue to be significant obstacles, and the recruitment of tech talent and regulatory transparency are two of the major concerns faced by the FinTech industry. Apart from having a number of successful FinTech startups, many FinTech firms find it challenging to reach the growth stage of the business cycle, which also hinders the global acceptance of the application of AI and ML in FinTech. The adoption of digital payments is significant in emerging counties as well. Still, other forms of digital money, like cryptocurrencies and tokens, are primarily limited to developed nations. At the same time, emerging economies face the problem regarding proper regulations and wider public acceptance, resulting in a low pace of collaboration and implementation.

3.6 CONCLUSIONS

Technology has emerged as a key driver of FinTech since the premodern era. Still, in the last decade, its role has accelerated with the development of modern artificial intelligence methods involving deep learning, ANN, and blockchain technology, which have fundamentally altered the way problems are solved. According to the report, it is evident that the United States of America and China have had significant growth in the financial technology sector since these two countries have a concentration of the most prominent fintech companies due to their smooth adoption of technology. The first section of the study concentrated on the development of Fintech and the many stages in depth by emphasizing the role of technology in fintech 1.0, fintech 2.0, and the role of AI in fintech 3.0. Along with this, there is also a focus on the growth of FinTech businesses worldwide and consumers' readiness for digital transactions. Worldwide, America is leading with the most significant number of FinTech startups.

In contrast, India shares the top position, with China in digital adoption rate, having an 87% adoption rate, followed by Russia and South Africa at 82%. The overall adoption rate worldwide is 64%, which shows that there will be growth in financial services in the upcoming years. The following section focuses on the technical aspects of artificial intelligence, its most recent advancements, and its applications in enterprises. Considerable focus has been given to the use of AI in FinTech businesses, how those businesses can adopt the newest approaches, and how those techniques

can help them address their challenges. Artificial neural networks, which behave like a human brain and effectively perform decision-making, can handle major business problems when machine learning and deep learning algorithms are considered. The third aspect of the study, which is also its crucial component, focuses on using AI in business while taking into account real-world scenarios. It is divided into three sections: Blockchain, Payment System, and Exchange Rate System. The application of AI in these segments provides insights regarding the use of digital money, a modernized stock exchange system, and increased use of digital payment in comparison to traditional currency, all of which will contribute to the economy's overall growth as these three segments make up the majority of the FinTech industry. Based on the discussion above, it provides opportunities for emerging economies in digital transactions, higher investment rates, global technology collaboration, and increased competitiveness. With these opportunities, challenges also come into the picture regarding fraud, technological incompetence, cyber threats, and the collapse of significant FinTech businesses.

KEYWORDS

- **artificial Intelligence**
- **FinTech**
- **neural network machine learning**
- **deep learning**
- **blockchain technology**

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CHAPTER 4

Role of Artificial Intelligence in Making a Positive Impact on Sustainable Development

OM PRAKASH GUSAI[1] and ANKUR RANI[2]

[1]*Department of Commerce, Motilal Nehru College, University of Delhi, B. J. Marg, New Delhi, India*

[2]*Department of Commerce, Shri Ram College of Commerce, University of Delhi, North Campus, Maurice Nagar, Delhi, India*

ABSTRACT

Over the course of the past several years, we have consistently come across stories that warn us about how Artificial Intelligence (AI) will take over our work and that robots will eventually dominate the globe. However, despite the abundance of material depicting a dystopian future, there is also the possibility of learning about the good effects of AI and how it might assist us in making the world a better place. AI has the potential to become an effective tool for attaining a circular economy and a lifestyle that is less harmful to the environment in the context of global efforts to achieve sustainability and, more specifically, for reaching the UN Sustainable Development Goals (SDGs). The use of AI might have as one of its goals the resolution of problems connected to the SDGs. It has been suggested that the existing capabilities of AI might assist in solving instances spanning all 17 of the United Nations Sustainable Development Goals (UN SDGs), which would ultimately be of use to hundreds of millions of people in both developed and developing countries. AI will revolutionize

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corporate methods and industries, and it can address fundamental societal issues such as sustainability. Natural environmental degradation and the climate problem are extremely complicated phenomena that necessitate the most modern and imaginative solutions. We suggest that AI can help the development of culturally appropriate organizational and individual practices to minimize the natural energy and resource intensity of human activities and inspire revolutionary research and real solutions for environmental sustainability. The main value of AI would not be in how it allows society to decrease its energy, water, or land usage intensities, but rather in how it facilitates and fosters environmental governance at a higher level. AI and ML, two of the most cutting-edge technologies, will have a significant influence on the decisions we make in the years to come. The global market for artificial intelligence was predicted to be $39.9 billion in 2019, and Grand View Research projects that it will increase at a compound annual growth rate (CAGR) of 42.2% from 2020 to 2027. Because of this rapid expansion, AI and the Sustainable Development Goals (SDGs) will benefit from increased acceptance of the technology, which will allow it to further penetrate a broad variety of businesses and sectors. That is to say, AI will more and more become a component of the solution regarding these objectives. This study indicates that we do need to learn a lot more about carbon impact and all kinds of AI. Today's problem is that humans do not know this. We may be creating a small amount or a large amount, and we need to understand. We must ensure that we comprehend what is going on. We must request information that our AI teams are not already collecting. Without statistics on our AI carbon emissions, we may be exposing the organization to an unexpected reputational risk if information regarding our carbon emissions becomes public.

4.1 INTRODUCTION

Artificial intelligence-based systems demand a significant amount of processing resources. They are required to manage massive amounts of data, which drives up the need for servers and the dependence on electricity to maintain a comfortable temperature in data centers. The adoption of AI throughout a company will lead to an increase in the amount of energy that is consumed. One study conducted at the University of Massachusetts found that training artificial intelligence models for computational

linguistics (NLP) can result in the emission of the same amount of carbon dioxide as the lifetime emissions of five American automobiles or even the equivalent of three hundred round trips between San Francisco and New York (van Wynsberghe, 2021). This particular example of AI-related CO_2 emissions is surprising and concerning at the same time. This is a wake-up call for all of us to remember something important. However, before we place an excessive amount of weight on these accomplishments, we need to take a step back and look at the bigger picture. This is simply one study for one particular type of AI, which is not utilized very frequently at all. To a small degree, carbon emissions are produced by more representative training positions. On the other hand, the fact that the most popular AI technologies of today do not produce a considerable amount of carbon dioxide does not mean that they will not become important contributors in the future. There are currently very few studies that can aid a business in determining the influence that artificial intelligence will have on carbon dioxide emissions. You will not be able to give your investments in any project an accurate assessment until you have data on the potential effects that your future AI advancements may have on the surrounding environment. It is more important than ever before for the impact that artificial intelligence has on carbon dioxide emissions to be taken into account during the decision-making process (Bartmann, 2022).

4.2 OBJECTIVES OF THE CHAPTER

The following are some of the goals that this chapter attempted to accomplish:

- To provide an explanation of artificial intelligence
- To do research on the potential for AI to cut down on carbon footprints
- What components of artificial intelligence for sustainable development should be added
- To investigate the manner in which AI can affect environmentally responsible development
- To study AI in environmental sustainability
- To investigate the potential dangers involved in achieving sustainability through the applicationof artificial intelligence

- Finally, we will investigate many facets of sustainable development that can benefit from theapplication of artificial intelligence.

Surprisingly, the Montreal Institute for Deep Learning in Canada has recently developed a tool that can estimate the total amount of carbon that is emitted throughout the process of training machine learning models. This piece of software represents a baby step in the right direction. At this time, there are not many other tools available. Your artificial intelligence teams will need to either leverage new technologies or create their own in order to satisfy the board's concerns about the effects on the environment. We will need a great deal more knowledge regarding the effects that sustainable development will have on our business as its importance continues to rise. In order to keep up with what is going on within our organization in terms of environmental sustainability, we need to monitor and keep track of what is happening. The application of intelligence has the potential to counteract massive and far-reaching carbon emissions. The application of AI can also result in emissions.

4.3 ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) can advise people (using data-driven insights) on how to make the most efficient use of resources as we approach a future with net-zero carbon emissions by the year 2050. This could perhaps avert a climate change catastrophe. However, despite the complexity of the environment, we frequently search for easy answers to difficult problems. Thispresents a problem. It is time for us to begin discussing the long-term viability of artificial intelligence (AI) at the same time that we discuss AI's potential to benefit the environment (Visvizi, 2022). The topic of discussion has abruptly shifted over the course of the past year, moving on quickly from intelligent robots accomplishing flamboyant things through AI explanation abilities to the current topic, which is the environmental ramifications of applying these training models.

Every debate can be seen from two distinct perspectives. Achieving sustainable development, which is one of the Sustainable Development Goals (SDGs) outlined by the United Nations, is a wonderful target to shoot for. In spite of this, the advancement of science and technology is doomed from the beginning because of the imbalance in worldwide access to electrical power, which leaves 600 million people without power.

According to findings from recent studies, the training of a single deep learning model on a graphics processing unit (GPU) can result in around 600,000 lb of carbon dioxide emissions (Halsband, 2022). This is common knowledge. If those 600 million people had any bargaining power—which they do not have—and there would have been a massive outcry if they did, then that energy could have been utilized to power one million houses. However, that would not have been possible.

4.4 ARTIFICIAL INTELLIGENCE HAS THE ABILITY TO REDUCE CARBON FOOTPRINTS

Any cloud provider that is also committed to reducing their carbon footprint, and consequently the company's own, should be considered a potential business partner for companies. A firm may decide to outsource its artificial intelligence research and processing to a cloud provider rather than concentrating on largescale internal initiatives aimed at mitigating the consequences of the company's operations on the environment. As an illustration, the DeepMind division of Google has developed an artificial intelligence system that can teach itself to minimize the amount of electricity required to cool Google's data centers. As a direct consequence of this change, Googlewas able to reduce the amount of electricity that its data centers used by 35%. The public cloud service offered by Google is known by its brand name, Google Cloud Platform.

Microsoft has committed to eliminating all of its carbon emissions by the year 2030. Microsoft isalso in the business of operating massive public data centers under the brand name of Microsoft Azure (cloud offerings) (Tanveer et al., 2020). The long-term goal of Amazon is to provide its entire infrastructure across the world with energy derived from renewable sources. This includes the company's cloudplatform known as AWS.

In order to define what it means for artificial intelligence to be sustainable, three tensions need tobe taken into consideration: the tension between the development of AI and the equitable distribution of resources; the tension between different generations; and the tension between the environment, the community, and the economy. All of these conflicts are connected in some wayto the idea of AI that is sustainable. However, despite the fact that there are three pillars of sustainable AI (namely, social, economic, and environmental), on the other hand, the purpose of this work is to remind

the user, the policy expert, the AI ethicist, and the AI programmer that AI has an impact on the environment (Wu and Shang, 2020).

4.5 WHAT SHOULD BE INCLUDED FOR AI FOR SUSTAINABLE DEVELOPMENT?

The use of AI in sustainable practices is hampered by

1. An over-reliance on previously collected data in machine learning techniques
2. The lack of certainty surrounding human behavioral responses to AI-based interventiontactics.
3. Rising dangers to the integrity of information systems,
4. The unintended consequences of the applications of AI, as well as
5. Challenges associated with accurately assessing the results of intervention programs (Genovesi and Mönig, 2022). According to the review, the following should be included in the scope of future research on AI for sustainable development:

    - multiple viewpoints,
    - the procedures for installing the system,
    - design cognitions,
    - sociological and psychological aspects that are pertinent, as well as
    - economic benefit factors to highlight how artificial intelligence can provide quick remedies while simultaneously posing long-term threats to environmental conservation (Ligozat et al., 2022).

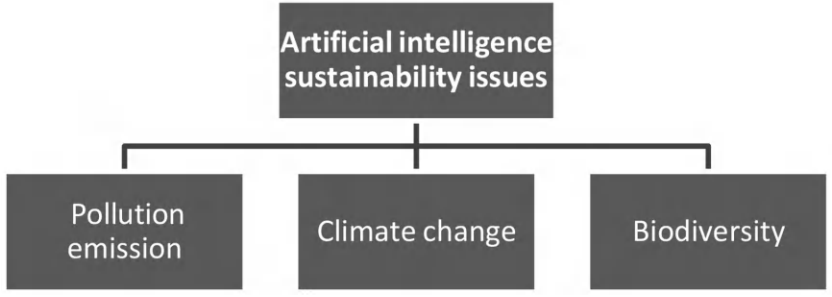

FIGURE 4.1 Artificial intelligence sustainability issues.

Source: Authors' creations.

4.6 WAYS IN WHICH ARTIFICIAL INTELLIGENCE AFFECTS SUSTAINABLE DEVELOPMENT

As you research your business, consider the following three ways in which artificial intelligence is expected to affect sustainable development:

- Error elimination – When humans are involved in the performance of manual tasks, there is a higher likelihood of errors occurring, which results in the job needing to be examinedand repeated more frequently. Attempting to solve these avoidable problems will result inan increase in energy use. Artificial intelligence has the potential to help humans become more accurate in a range of tasks (Gherheș and Obrad, 2018).
- Improved effectiveness in operation – Combining different kinds of artificial intelligence, such as machine learning, natural language processing, and computer vision, can help a firm generate more efficient operations and conserve energy at the same time. In addition, AI can be used to contribute to the re-engineering of processes, which will result in fewer unnecessary stages being included in the existing approach.
- The primary components – When artificial intelligence is used to monitor the usage of raw materials, it can suggest ways to consume less. You can also use AI to help you build low-carbon components for your products, which is another application of this technology.

Even though AI uses a lot of energy, the vast majority of companies have no understanding of how to quantify the impact they have on the environment. We have an obligation to take the initiative in starting a conversation about the understanding and evaluation of the impact that AI will have on the environment.

4.7 AI IN ENVIRONMENTAL SUSTAINABILITY

In many different types of enterprises, artificial intelligence has the potential to be a substantial net contributor to environmental sustainability. Several examples of this type include the following:

The application of AI in agriculture has the ability to change production by enhancing the monitoring and management of environmental variables

as well as crop yields (Lannon et al., 2021). Artificial intelligence has the potential to help reduce the amount of fertilizer and water used while also enhancing crop yields. There are a variety of companies operating in this sector, some of which include Blue River Technology, Harvesting CROO Robotics, and Trace Genomics.

In the energy industry, AI can be used to manage renewable energy supply and demand by leveraging its deep predictive abilities and intelligent grid management capabilities. Artificial intelligence has the potential to boost productivity by enabling more accurate forecasting of weather patterns, as well as by cutting costs and unnecessary production of carbon dioxide. These are some examples of companies that operate in this market: Stem, Cloacal, and Foghorn Systems.

In the field of transportation, artificial intelligence (AI) can help reduce congestion, improve freight transport (supply chain logistics), and provide more and more capabilities for automated driving. In the future, artificial intelligence will help with "last mile" delivery, which will reduce the need for delivery cars. Artificial intelligence has the potential to assist businesses in their demand forecasting, thereby minimizing the amount of transportation that is required. There are a

few notable businesses operating in this sector, including Antimony, Naoto, and Sea Machine Robotics.

Artificial intelligence can help reduce or even eliminate waste in the management of water resources, thereby cutting costs and minimizing adverse effects on the environment. The ability to provide localized weather forecasts using AI will be helpful in the effort to conserve water. Companies such as Innovis, Kurita Water Industries, and Pluto Shift are all examples of businesses that operate within this area (Sou et al., 2021).

The application of AI in manufacturing has the potential to help cut down on the amount of energy used and the amount of waste produced by manufacturing processes. The use of robotics can result in greater precision. The use of AI can result in the creation of more effective systems. There are a few different businesses operating in this sector, including Drishti, Cognex Corp., and Spark Cognition.

In the field of property management, AI makes it possible to recycle heat within structures and improves the effectiveness of heating and cooling systems. Artificial intelligence can assist in the optimization of energy use in buildings by monitoring the number of people present or estimating the availability of alternative energy sources. Among the businesses operating in this sector are names like Aegis AI and IC Realtime, as well as IBM's Tricia.

In the field of material science, artificial intelligence can provide assistance to researchers in the process of detecting absorbent compounds for use in CO_2 filtering systems, transforming waste heat into usable power, and discovering new materials for solar panels (taking CO_2 out of the atmosphere). There are a few different businesses operating in this sector, including Citrine, Mastic AI, and Ansys.

4.8 THE DANGERS ASSOCIATED WITH RELYING ON ARTIFICIAL INTELLIGENCE TO ACCOMPLISH SUSTAINABILITY

Do you think that this is too good to be true? There is always going to be a drawback to using artificial intelligence, despite its numerous potential advantages. Although it has many practical applications, artificial intelligence comes with a hefty price tag. It is of the utmost importance to factor it into our plans for saving the globe, but we cannot do so without first determining who will foot the bill. In an ideal scenario, all wastewater treatment facilities and cities would have smart grids, which is less difficult to execute than it may sound. It is necessary to have a solid plan, a high level of experience, and, of course, the appropriate equipment (Huang et al., 2022). The costs continue to escalate as a direct result of the equipment's requirement for ongoing maintenance to remove potential vulnerabilities.

The accessibility of sources of energy also presents a challenge. The use of such technology can result in a significant increase in energy consumption, which might cause more problems than it solves in the end. According to the MIT Technology Review, the production of carbon dioxide during the training of a single artificial intelligence model can equal the lifetime emissions of five automobiles. Artificial intelligence, on its own, calls for a different tactic to be taken. Before information can actually be of use, however, it must first be disseminated in a way that does not harm the environment. Of course, if a company had the resources necessary to support such technology, there would be no reason for us to not develop it.

4.9 ASPECTS OF BENEFITS TO SUSTAINABLE DEVELOPMENT OBTAINED THROUGH THE USE OF ARTIFICIAL INTELLIGENCE

4.9.1 ENERGY

When it comes to issues of sustainability, energy is a factor that cannot be ignored. The year before that was a challenging one for all of us, and the

majority of the time we were required to work from home. We did things that required more natural effort. Brand new AI technologies may be able to lend a hand in enhancing the grid infrastructure that makes renewable energy possible. In this day and age of digitization and decentralization, it is becoming an increasingly challenging task to manage all of the participants in the grid and to keep it in a state of balanced operation. The transfer of data as well as power is a possibility with smart grids. This information assists in developing a response to the increased consumption of energy. Using artificial intelligence, the behavior may be analyzed, and the system can react appropriately.

On the other hand, if a person generates their own electricity, it is possible for that electricity to be transported to other grid junctions. The smart grid's primary function is to facilitate the coordination of power generation and consumption. Are you familiar with the term "prosumer"? It is a single term that describes both the producer and the consumer of the good or service. The electrical grid is another area where this holds true. Nevertheless, smart grids are not the final

word in this matter. In addition to that, AI can help with capacity forecasts. Using sensors, renewable energy sources like solar and wind may provide a significant amount of data. It is ableto display both the speed of the wind and the global horizontal irradiance (Camaréna, 2021).

4.9.2 RECYCLING

Recycling is another essential activity toward a future that is environment-friendly. The amount of waste generated each year is now 2.01 billion tonnes of municipal solid rubbish, and this number is only going to continue to rise. Recycling such a large quantity of waste is a challenging endeavor, and for human beings, it may perhaps be impossible to complete. The answer lies in either robotic sorting or using artificial intelligence to solve the problem. The proper sorting of waste is accomplished with the help of advanced cameras and technology. Additionally, the use of this way of sorting can help protect the health of the workers. It is helpful in professions that involve repeated motion and lowers the risk of workers being injured (Arogyaswamy, 2020).

These robots are able to identify a taste based on its appearance, such as its color or shape, and place it in the correct container. During the sorting process, the robots will be able to collect data and gain a better

understanding of which goods arrive on which days. This technology not only contributes to the preservation of our natural resources but also offers advantages to commercial enterprises. It does so while simultaneously reducing the amount of energy that is consumed.

4.9.3 WASTEWATER

In the world that we live in, water is an immensely valuable resource. It stands to reason that they require it in order for us to keep on living. We have wastewater treatment technologies in place so that we can conserve as much of this valuable liquid as possible. If wastewater were to be released into the environment mistakenly, it would cause severe disruption to the ecosystem, having negative effects on fish populations, habitats for wildlife, and our own health. Indeed, the application of artificial intelligence is a viable option for preventing the occurrence of such an event.

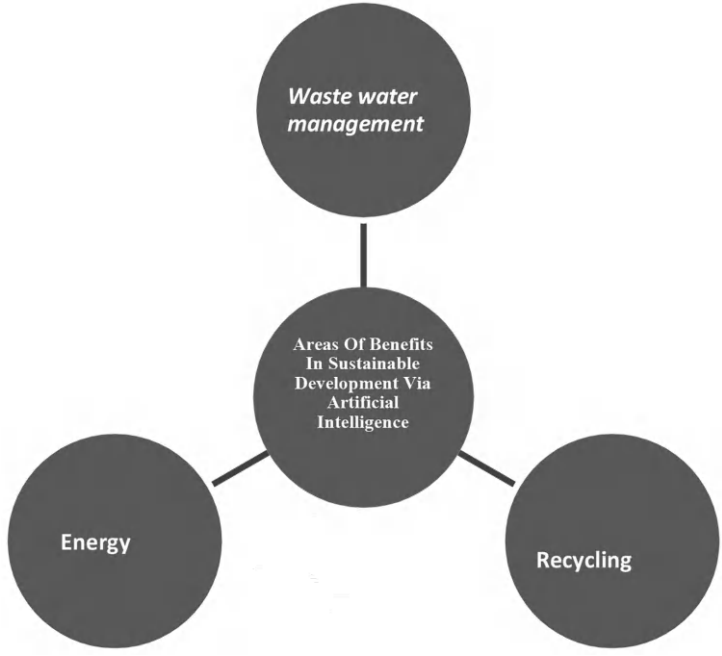

FIGURE 4.2 Areas of benefits in sustainable development obtained through the use of artificial intelligence.

***Source*:** Authors' creations.

Through the regulation of a daily flow and the collection of data, artificial intelligence is able to uncover anomalies.

It has the ability to identify abnormal sensor behavior and notify operators. They are, nevertheless, able to monitor the amount of energy consumed and take the necessary steps. The quality of the effluent might also be evaluated with the use of artificial intelligence. This helps to optimize the process and ensures real-time compliance with the rules governing effluent. In essence, the AI is able to inform the operators about what is happening and assist them in detecting patterns and trends (Ai et al., 2020).

4.10 CONCLUSION

Sustainable AI seeks to develop artificial intelligence (AI) products over their entire lifecycles, from conception to implementation and governance, with the objectives of promoting ecological and social justice (i.e., training and retuning). Therefore, sustainable AI is not merely concerned with the applications of AI; rather, it focuses on the sociotechnical system that underpins AI as a whole. Sustainable AI is not about how to sustain the development of artificial intelligence; rather, it is about how to construct AI that is sustainable in terms of sustaining environmental resources, economic models, and societal values that are vital to society.

Both the use of AI for sustainability and the sustainability of AI itself are essential components of a system that uses AI. However, the latter seems to be more of a backend consideration in product creation, despite the fact that there has been a lot of discussion about the former in recent years.

KEYWORDS

- **artificial intelligence**
- **sustainability**
- **implementation**
- **computers**
- **environmental**
- **organization**

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CHAPTER 5

Evolution of Fintech in the Age of AI: A Study Concerning Indian Fintech Industry

SAGNIK MAITY[1] and AMIT MAJUMDER[2]

[1]*Calcutta University, West Bengal, India*

[2]*Bijoy Krishna Girls' College, West Bengal, India*

ABSTRACT

Purpose – Artificial intelligence (AI) is the part of computer science that manages bots that are programed to exhibit human-like characteristics such as cognition, learning, and self-reflection. Artificial intelligence (AI) has emerged as the most significant driver of change in today's business world. Artificial intelligence (AI) works toward a user-friendly ecosystem in every field, including the financial sector, the medical sector, and other fields. "Financial Technology," or "FinTech," refers to the role that has become essential in the financial system. The research paper aims to explore artificial intelligence (AI) as an implementation in fintech in India. The research effectively uses multiple case studies to understand how AI became a game-changer for the fintech industry.

Methodology – The paper will use secondary sources to identify areas where AI has already been implemented in fintech firms. It will also cover the challenges that come with AI. This area will help us to understand how AI uses users' data like payment patterns, lending patterns, and income

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patterns to build an ecosystem that helps to engage and identify the creditworthiness of the users. These secondary sources act as an alternate evidence for data analysis to create a theoretical representation of the evolution of fintech in the age of AI.

Findings – The findings have been presented as one-of-a-kind results that were accomplished while considering the context of those sources. The paper also envisaged both the benefits and the difficulties that artificial intelligence (AI) is currently experiencing in India. Findings show that day by day, AI uses have experienced exponential growth in fintech.

Practical implication – The research broadens one's perspective on the many ways in which the practice can be improved. This paper will show how the use of AI will redefine the fintech market's future. It would tell them to prioritize the efficiency and safety of financial processes and implement new technology-driven business models to provide better service to their clients.

Social implications – Artificial intelligence is reshaping the conventional techniques in every sector like the medical, education, and financial sectors. In the financial sector, fintech companies are the major players using AI to understand the user's usability and income and spending patterns, find new worthy customers, and reduce human errors.

Value – This work fills a research gap by shedding light on the previously uncharted territory in Indian contexts, where comparatively little has been done to examine the available literature or organize the abundant data that exists there. Thus, our research was necessary to address that void. Artificial intelligence (AI), a disruptive invention that delivers predictive intelligence to the Indian financial system and equips it with process efficiency, cost optimization, and client engagement, is without a doubt driving exponential growth in the Indian fintech sector.

Paper type – This is a desk-based conceptual research paper.

Research limitations – It is possible to conduct further research and analysis in other areas of finance, and this is something that should be

done. Therefore, prospective researchers might consider conducting a comprehensive study that considers all previously done research.

5.1 INTRODUCTION

Throughout the world, artificial intelligence (AI) is developing enhanced technologies and demonstrating signs of adoption by integrating with various businesses and allowing them to adopt AI for various applications. Since it is interdisciplinary by nature, artificial intelligence has essentially shifted the way businesses use technology, and its uses have become extensive every day. With access to advanced data science and AI methods, the financial sector has become more engaging in recent years. With artificial techniques at its core, as a hub of coordination, innovation, and change, fintech is becoming an essential area in the financial services sector, economic system, new tech, information providers, interaction, and society. Smart communications and interactions, intelligent access control, enhanced privacy-protecting processing and pattern recognition, advanced analytics and learning, information retrieval, machine learning, event and activity recognition, and social media network analysis are among the advanced artificial intelligence domains, although FinTech is made possible in large part by other essential fields like statistical modeling and mathematical modeling.

The financial system has been profoundly affected by AI and machine learning. In response, the fintech companies have expanded their offerings in algorithmic trading, virtual currencies, blockchain technologies, lending, online and mobile payments, digital assets, and crowdfunding. The conceptions of money and investing are being fundamentally disrupted by artificial intelligence (AI) and data science, which also serve as the driving force behind new funding breakthroughs, products, services, and next-generation financial ecosystems. Modern finance companies are driven by artificial intelligence (AI) and data analytics to comprehend user behavior and build models of complex behavioral patterns.

Since the 1850s, technology has been an integral part of the financial system; it is only in the last two decades that FinTech has become

a term commonly used to describe technological innovations, which have the capacity to transform financial intermediation, drive the development of business practices, implementations, financial processes, and products, and result in consumer gains (Arner et al., 2015). The term "FinTech" refers to the development and widespread adoption of innovative financial technology solutions tailored to meet individual consumers' specific requirements; AI follows a logical opportunity to drive the modernization of the financial industry by offering benefits to users and boosting company profits (Park et al., 2016). For example, the State Bank of India uses the SBI Intelligent Assistant (SIA) to help the customer; another illustration is the case of HDFC Bank using EVA (Top 8 Banking Chatbots and Virtual Assistants in India, 2022). New-generation AI, data science, and machine learning further enhance this long history of AI in finance by evolving the vision, missions, goals, frameworks, theories, methodologies, and societal factors of economics and finance. Smart FinTech is a direct result of this transformation. As a result of AIDS, existing economic and financial systems and services are more effective, cost-effective, and pleasant for customers. Furthermore, AIDS encourages the development of a wide range of new economic–financial processes, innovations, models, products, and services.

AI and machine learning have a plethora of "use cases" already. Because of data and infrastructure availability in the financial sector, technical advancements, demand considerations like profitability requirements, competitiveness with other organizations, and regulatory mandates, these use cases have become increasingly popular (Artificial Intelligence and Machine Learning in Financial Services Market Developments and Financial Stability Implications, 2017).

5.2 EVOLUTION OF ARTIFICIAL INTELLIGENCE (AI)

5.2.1 ADOPTION OF ARTIFICIAL INTELLIGENCE (AI)

AI is a digital innovation that attempts to simulate human intelligence capability processes with technology, primarily using machine language and robotic advisors (Patel et al., 2021). According to Jordan and Mitchell, previous information on the input and output variables is used

to construct a predictive model. Decision trees, Bayesian networks, and regression analysis are just a few of the algorithms utilized in supervised learning techniques. An unsupervised learning algorithm uses unstructured datasets without prior input and output variable knowledge. This includes ANNs, clustering, genetic algorithms, and deep learning (Jordan and Mitchell, 2015). Artificial intelligence is based on three cognitive domains: (1) learning (acquiring data and then creating algorithms to convert the data to meaningful information), (2) reasoning (choosing the best algorithm to interpret an ideal result), and (3) self-correction (constantly adjusting crafted algorithms and making sure that they provide the most precise results every time) (Gharaei et al., 2019). A wide range of industries, including manufacturing, retail, and service, are already being transformed by robots and artificial intelligence (AI). Even though advanced technology penetration has grown at a rate of 20% per year, the current technological revolution has changed long-established principles in economics and the workforce (Johnson, 2017). Addressing complicated real-world problems with artificial intelligence is now a standard practice across a wide range of scientific areas (Basheer and Hajmeer, 2000).

In the modern corporate world, artificial intelligence (AI) has quickly become a game-changer. An article in Analytics India cites a study titled "The State of Enterprise AI in India 2019" which estimates that AI will add $3.9 trillion to the global economy. Also, the study says that the Indian market for AI applications will reach $100 million by 2025, growing at a CAGR of 200–250% (Cao, 2020). The goal of Digital India is to make the internet more approachable and to encourage e-governance and e-banking in the country. In 2020, the Indian government increased Digital India's budget to $477 million in order to promote artificial intelligence, big data, cybersecurity, machine learning, IoT products, and robotics. Also, it will generate 10 million job opportunities (State of Enterprise AI in India 2019, 2022). According to NITI Aayog (2018), India must devise a comprehensive AI strategy. As per Accenture (2017), artificial intelligence (AI) has the potential to boost India's GDP by $957 billion, or 15%, by the year 2035 (Accenture, 2022; What Are the Key AI Initiatives of the Indian Government, 2022).

5.2.2 CHALLENGES TOWARD IMPLEMENTING ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) is a major driver of innovation, which will eventually overtake human work. Experts believe that in the future, robots will be able to develop tactile intelligence, followed by analytical prowess, and finally, intuitive and empathetic intelligence. This is because automatons will be able to do the work of humans, which requires specialized knowledge, much more efficiently and effectively (Huang and Rust, 2018). AI presents a number of security and privacy threats in addition to automation, which can increase an organization's cyber risk and geopolitical risk exposure (Five Challenges for AI Adoption in India – and What Are We Doing About Them?, 2022). With the introduction of AI goods and algorithms, ethics and morality have risen as significant obstacles. An AI algorithm functions based on the training it receives, predicting occurrences based on the data presented. It is also feasible for the results to be affected by manipulating the dataset (Five Challenges for AI Adoption in India – and What Are We Doing About Them?, 2022a; Kalyanakrishnan et al., 2018).

When using artificial intelligence in India, major issues could arise. The following issues need to be addressed (Chatterjee, 2020) (Fig. 5.1):

1. *Data Challenges* - A big part of the business always belongs to the few major players in the industry. There are several causes for this. As a result, the leading Indian businesses now have most of the crucial industry-specific data required for solution development and customized platforms. The major players with some privilege pose a hurdle in front of the startup firms to discourage them from getting into the business.
2. *Knowledge Challenges* - There are adoption concerns in India since there is a lack of understanding of AI applications for solving business problems. This applies to both private and public entities. Due to a lack of AI experts, awareness is not being achieved.
3. *Infrastructural Challenges* - The rapid growth of cloud infrastructure in India is a proven reality. Because of the scarcity of adequate infrastructure and necessary expertise, the cloud infrastructure has only limited capacity. AI implementation by startups is hampered by the absence of suitable infrastructure. In this circumstance, the startups are acquiring knowledge from abroad. This makes

it difficult for Indian scholars in this discipline to update their knowledge in the practical realm. Due to the limited availability of adequate infrastructure, the use of adequate infrastructure (which is infrequently available) becomes costly. This is one of the obstacles to the adoption of AI.

4. *Skill Challenges* - Only a small minority of India's AI professionals are capable of working in the field of artificial intelligence. Because of a scarcity of qualified AI professionals, the adoption rate has indeed been slowed. There are not enough research scholars in this field.

FIGURE 5.1 Challenges with AI implementation in India.

5.2.3 INDIAN GOVT. INITIATIVES ON AI

Using India's vast digital resources for AI-driven development is a "bottom-up and inclusive" approach. The Indian government uses AI in areas such as biometric identity, facial recognition, and criminal investigation.

Recently, the Ministry of Corporate Affairs (MCA) unveiled MCA 21, its updated online edition. It will use the newest technology, such as data analytics, AI, and machine learning, to make regulatory filings easier for businesses. This was done in order to facilitate the simplicity with which businesses might be monitored for compliance (AI in India: Initiatives from the Indian Government in 2021, 2022).

Despite AI's potential to boost national progress and prosperity, several obstacles are hindering its adoption in India. With the "Personal Data Protection Bill 2019" and "National Cyber Security Strategy 2020," India will address data security and privacy issues. Also, the Data Security Council of India (DSCI) works with it to protect data. For example, NASSCOM's Future Skills Prime initiative tries to bridge the gaps in skilling, and there are concerted initiatives. In addition, the expensive cost of using AI technologies deters a large number of businesses. Investment in the Internet of Things (IIoT) and other elements of industry would be required to transition a facility from manual to automated operation. "AIRAWAT," a cloud infrastructure for Big Data analytics with sophisticated AI processing capabilities, is a start with India's own AI-first compute infrastructure (Data Poisoning: The Rising Threat to AI Ecosystem, 2022; NTLF: Convergence of AI and Cloud for Data-Driven Innovation, 2022; How the Government is Driving AI Skilling in India?, 2022; The Interplay of AI, Data and Privacy, 2022; Five Challenges for AI Adoption in India – and What Are We Doing About Them?, 2022b). It is important to remember that AI presents both opportunities and threats, some of which are immediately apparent and others that may take longer to manifest themselves. The occurrence of AI in India necessitates a thorough academic investigation due to the high stakes involved (Kalyanakrishnan, 2018).

5.3 UNDERSTANDING FINTECH

5.3.1 FINTECH BUSINESS

Smart FinTech encompasses a wide range of industries and applications from banking to lending to cryptocurrency to portfolio management. An FE is a service and application that is linked and constantly evolving in order to improve the performance of products, processes, and management (Clemons and Weber, 2015). As new technological advancements are introduced into the environment, obsolete or ineffective technological

combinations are obliterated (Adomavicius et al., 2008; Making Sense of Technology Trends in the Information Technology Landscape: A Design Science Approach on JSTOR, 2022). Artificial intelligence involvement changes all aspects of the financial system and environment largely. Smart fintech includes the business area that is involved with regards to both products and services like banking, insurance, borrowing, financing, and crowdfunding (Cao, 2022). The participants in the financial and economic markets include ordinary investors, institutions, and authorities; there is a correlation between investor behavior and the disclosure of financial information by companies or the market forces (the accounting and finance of a business). Also, economic events, such as firm mergers and economic turmoil, affect their behavior and the whole financial infrastructure. To stabilize the system, authorities' implementation of operational instructions and corporate standards is necessary to mitigate economic–financial crises, systematic and unsystematic risk, and improve security (Arslanian and Fischer, 2019; Cao, 2020).

5.3.2 FINTECH IN INDIA

As stated in the KPMG report, 2016, Indian financial startups have access to a dynamic ecosystem that could allow them to become billion-dollar unicorns. Fintech, beginning in India, is seeking various goals, from expanding into new market categories to venturing outside of the country (International, 2017). By 2020, NASSCOM predicts that the Indian fintech market will have grown to a value of USD 1.2 billion from its present value of USD 2.4 billion (Tech Startups: Quarterly Investment Factbook – Deal Analysis (Q2 CY22), 2022). The cash-based Indian economy has responded well to the fintech possibility, most notably through a rise in online shopping and smartphone usage. The value of transactions in the Indian fintech sector is expected to grow from $ 33 billion in 2016 to $ 73 billion in 2020, a compound annual growth rate (CAGR) of 22% (Financial Services Sector in India, 2022). The Commerce and Industry Ministry of India said that India is on the verge of becoming one of the world's largest digital markets, with the highest fintech adoption rate of 87% and an above-average adoption rate of 64% (Fig. 5.2) (Fintech: India has a FinTech Adoption Rate of 87%, against the Global Average of 64%, says Piyush Goyal, BFSI News, ET BFSI, 2022; Hwa). According to Amitabh

Kant (CEO, NITI Aayog), Indian fintech startups are only a few years old, but they have shown tremendous growth and improvement over the last few years. By 2025, the Indian fintech market is anticipated to be valued at USD 150 billion; in the financial year FY22, the fintech industry in India received a capital of $8.53 billion (divided among 278 deals) (Financial Services Sector in India, 2022).

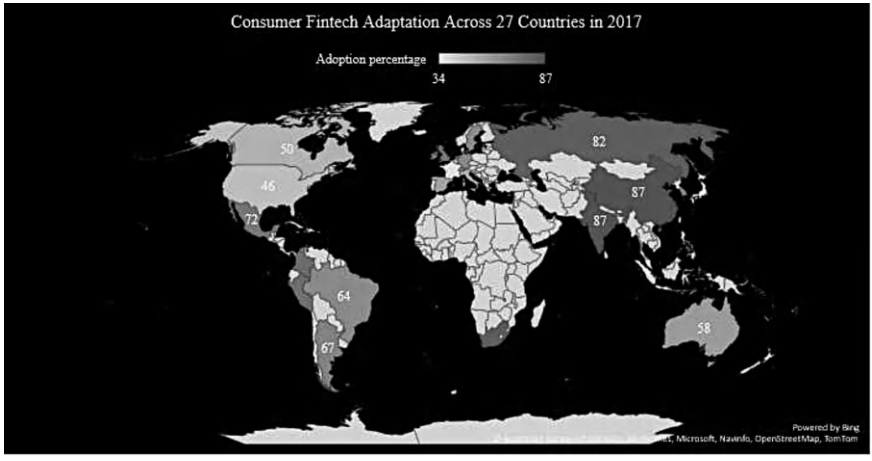

FIGURE 5.2 Consumer fintech adaptation across 27 countries in 2017.

Source: Authors' depiction based on data published by ey.com (Fintech: India has a FinTech Adoption Rate of 87%, compared to the Global Average of 64%, says Piyush Goyal, BFSI News, ET BFSI, 2022).

5.3.3 CHALLENGES TOWARD FINTECH

The digitalization of the financial system, by diverting the flow of information away from established conventional infrastructures and organizations, threatens the long-term stability of the financial ecosystem as a whole (Gozman et al., 2018). Financial market structures are being shaken by the emergence of fintech-enabled delivery mechanisms. For example, payment banks, online banks, mobile banks, and P2P lending are replacing local bank branch offices, allowing customers to bypass payment infrastructures constructed and supported by traditional banks by transferring funds between themselves (Hedman and Henningsson, 2012). Research by PwC (2017) found that 82% of incumbents want to form relationships alongside fintech throughout the next 3–5 years, and 81% of those same

incumbents are worried about losing revenue to fintech (Global FinTech Report 2017: India Insights, 2017).

Despite the enormous potential, the road ahead for fintech is still difficult in India. Challenges regarding the fintech in India are given below (Kanagala et al., 2019):

- Due to the strong regulations in place to avoid fraud, it is difficult to enter and perform in the Indian market. It is a significant roadblock for newcomers. Before the commencement of its operations, it must complete a large amount of paperwork.
- Other obstacles include an unbanked population, a lack of Internet connectivity, and a low financial literacy rate. Even today, over half of all Indians (48%) lack the bank accounts necessary to make internet purchases. Although people have bank accounts, they still experience problems with poor internet connectivity, which delays the transaction process. As a result, cash transactions are preferred over online transactions. Most Indians still lack the financial literacy to open a bank account or use the internet.
- It is extremely difficult for businesses and consumers who do their daily business using cash to adopt a more progressive attitude. If you are a senior citizen, you have likely been using cash for these transactions for a long time, so it is difficult to get them to switch to a new payment method.
- Customers who lose money in online transactions due to various frauds have a hard time swallowing it.
- People's money is stolen by fraudsters exploiting technology, which is a big problem for financial technology companies. As a result, businesses must exert considerable effort in order to improve infrastructure and increase customer satisfaction.
- As in any other industry, obtaining investors' trust has become increasingly challenging in recent years for the fintech sector. It is becoming increasingly difficult to secure the necessary seed capital and additional investment on time, which will have a detrimental impact on the company's operations and functioning.

FinTech in India faces some obstacles, but these can be turned into possibilities if the government provides more assistance and backing, much like every coin has two sides (FinTech Ecosystem in India: Trends, Top Startups, Jobs and Challenges, 2022).

5.4 ARTIFICIAL INTELLIGENCE IN FINTECH

Globally, artificial intelligence (AI) is evolving alongside new technology. It shows signs of acceptability by integrating with many businesses and allowing them to adopt AI for various purposes. An expanding topic of study is looking into how to introduce service improvements that utilize robots, droids, or AI in a similar manner (Singh et al., 2016; Han and Yang, 2018). A focus will be placed on frontline operational technologies that connect with customers directly (e.g., physically, online) (van Doorn et al., 2016). Intelligent interfaces have drastically impacted customer-organization contact according to Singh et al. (2017). For example, AI systems such as Alexa, Siri, and Cortana are projected to directly impact consumer shopping habits by Grewal et al. (2017). As a complementary finding, Van Doorn et al. (2017) found that the level of human and automated social presence in customer service encounters depended on frontline robots' ability to engage customers in a social class (van Doorn et al., 2016).

There are many subgroups within the fintech family, including banking technology, trade technology, lending technology, insurance technology, wealth technology, pay technology, and risk technology. In these technologies, AI uses different methodologies and techniques to accomplish the business' goal (Buchanan, 2005; Optimization Methods in Finance second edition, 2022; Dunis et al., 2016; Hilpisch, 2020). These techniques are as follows: (1) Quantitative Approach (Gilli et al., 2019), (2) Multilayer Approach (Hamill and Gilbert, 2015), (3)Analysis and Instruction Approach (Heaton et al., 2017; Kearney and Liu, 2014; Mitra and Mitra, 2011), (4) Computer-Aided Reasoning Approach (Gentle et al., 2012), (5) Deep Financial Forecasting Approach (Heaton et al., 2017; Gentle et al., 2012; Agent-Based Modeling, 2008; Goodfellow et al., 2016), (6) Augmentation and Optimization Approach (Iwana and Uchida, 2021), (7) System Intelligence and Privacy Preservation Approach (Fung et al., 2010; OECD Blockchain Primer; Karim and Hasson, 2019).

1. *Quantitative Approach* – Fintech enterprises heavily rely on quantitative approaches, such as mathematical and statistical modeling. There are many common quantitative approaches that can be used in statistics, such as numerical methods, time-series

analysis, signal analysis, economics, utility theories, and econometrics (Cao et al., 2021). Financial forecasting also makes use of more sophisticated analytics and learning methodologies, such as deep learning. AI uses these methods to quantify the financial factors that describe firms, construct quality and performance evaluation matrices, assess and stabilize supply and demand linkages, which are all part of creating pricing models, testing of hypotheses and methods, examining concerns like business uncertainty and chaos, etc.

2. *Multilayer Approach* – Brain and cognitive computing, multilayer scientific approaches, game theory, behavioral science, behavioral economics, networks, agent-based simulation models, etc. are all used to build fintech companies and smart fintech. Fintech design, development, and decision support can benefit from such theories and techniques. This approach can be used in modeling product design rules and governance and evaluating mechanisms for fintech firms. It also helps in resolving the issue and organizational structuring.
3. *Analysis and Instruction Approach* – FinTech is becoming more innovative, personalized, efficient, adaptive, or changing due to the use of both traditional and modern analytics and learning approaches. Among the most commonly used classical approaches are pattern analytical procedures, kernel methods, tree models, factor models, connection models, pattern recognition, language models, image analysis methods, and signal processing techniques (Cao et al., 2021). For the most part, today's advancements in finance are driven by more powerful analytics and learning. Among these methods are those used to represent knowledge; those for processing and translating short, long, and informal–formal texts; and those for image analysis, visual analysis, and social media and network analysis. There are also methods for advanced optimization and machine learning, as well as methods for analyzing data from multiple business units.
4. *Computer-Aided Reasoning Approach* – Automation of interactions and communications and answer generation for autonomous, accessible, situational, crosslevel, multilevel,

multilingual, and knowledge-based discussion, interactions, and communications are other companies and jobs built on the interactions mentioned above (Cao et al., 2021). Businesses in the fintech sector are deeply entrenched in personal and societal activities, making human-to-human, human-to-machine, and machine-to-machine interactions (including conversation and communications) increasingly important and overwhelming. Interactions may be verbal (speech-based), textual (e.g., OCR, handwritten, or email), visual (video-based), visual engagements (e.g., images, QR codes), or sensor-based (e.g., IoT device-based) in FinTech.

5. *Deep Financial Forecasting Approach* – Financial modeling that incorporates advanced techniques such as Bayesian learning, reinforced transfer, reinforcement learning, and other advanced techniques is known as deep financial modeling. When it comes to deep financial modeling, there are three main types based on a deep financial report: (1) representation and prediction; (2) modeling based on crossmarket and crossmarket and sectional data; and (3) wide distributed financial model (Cao, 2022). This approach is used to forecast the multivariate time series data and predict the price index trend using financial variable sequencing modeling with the help of deep reinforcement learning to create stock forecasting, optimal portfolio management, and high-frequency trading strategies for algorithmic trading based on deep Q-network reinforcement learning. Also, deep learning is used to understand and mitigate illegal activities like insider trading, market manipulation, and financial reporting fraud in the financial service market.
6. *Augmentation and Optimization Approach* – Augmentation and optimization techniques can help FinTech organizations confront business and data challenges; boost FinTech design objectives; processes, capacity, and strategies; and improve FinTech capability, quality, and performance. By adding distributional noises, biases, or drifts to data or objectives, for instance, augmentation can increase technical capabilities or analytical outcomes while enhancing the capacity and generalizability of FinTech. Pricing and valuation, investment value at risk, transaction costs, portfolio management, and crossmarket

investment and risk management are areas where optimization is becoming increasingly important for developing strong and actionable FinTech (Optimization Methods in Finance, 2022; Gilli et al., 2019).

7. *System Intelligence and Privacy Preservation Approach* – In today's interconnected and interdependent world of global e-commerce, crossborder and multinational supply chains, customer service, and financial services, economic activities through development to technical research, manufacturing, sales, and trade are increasingly linked and chained. For example, a considerable number of enterprises generally have multiple, scattered, and sensitive products or services, as well as a wide range of markets, application domains, or customer communities. Businesses with several facets require FinTech geared toward smart cities and homes in order to meet their needs for dispersed and privacy-preserving business operations and infrastructures, intelligent infrastructures, functionalities, activities, services, and stakeholder management across the entire business enterprise. System intelligence engages in different services like automated analysis and learning, intelligent recommendation, innovative blockchain, tailored interactions, and assistance with privacy features like identification, authentication, and ethical parameters. System intelligence and privacy preservation approaches work in two parts: system intelligence understands customers' wants and needs, the purpose of consumption, and the evolving situation and feedback. All this data is collected and analyzed by an automated system to create intelligent interactions and services for every specific client. This automated, context-aware, and customized visual establishes a dynamic context where customers' intentions and interests are matched. All this needs a simple and easy-to-understand optimized network while ensuring privacy through microservice architectures. Orient modules and microservices for fast computing and services have been designed to ensure privacy from an ethical point of view. Fintech firms not only offer products and services but also ensure customer privacy while still being held accountable, free from bias, and maintaining transparency with customers and stakeholders.

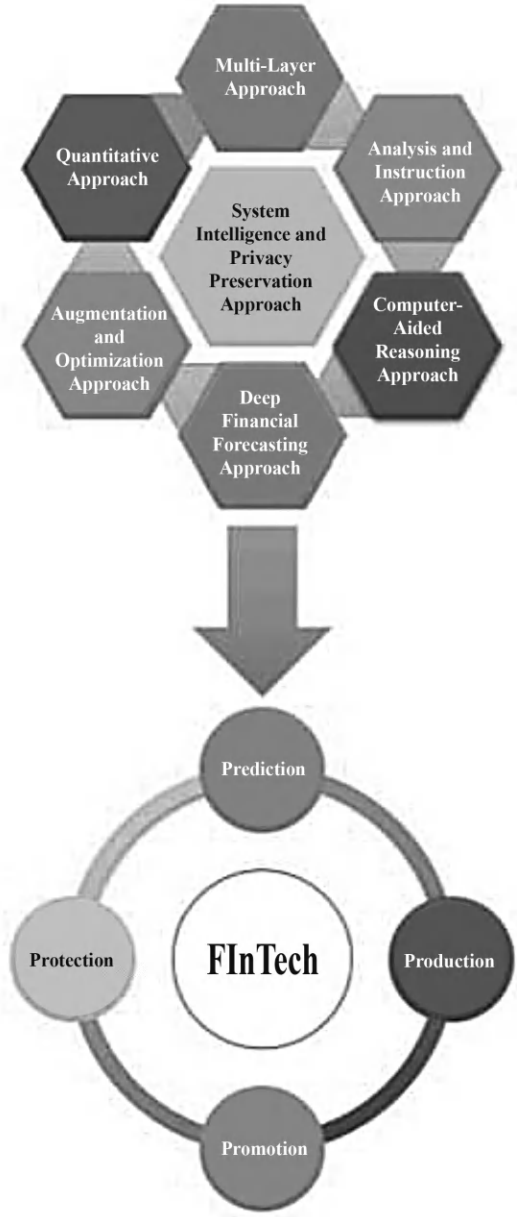

FIGURE 5.3 The seven approaches of AI toward achieving fintech businesses' "4P" goals.

***Source*:** Authors' depiction.

An overview of the seven AI methods for advancing the "4 Ps" of fintech businesses. The 4 Ps included (1) Prediction, (2) Production, (3) Promotion, and (4) Protection (Fig. 5.3).

1. *Prediction* – For an AI, prediction is an essential element. Predicting or forecasting can significantly impact overall corporate strategy, sales nurturing, revenue creation, and resource optimization in financial services, improve business operations and internal procedures, and beat the competition. Artificial intelligence uses the analysis and instruction approach, the augmentation and optimization approach, and the deep financial approach in the prediction process. Analytics collaborates with clients in a variety of industries to capture and organize data, analyze it using cutting-edge algorithms and advanced technologies, and rapidly implement tailored, prescriptive solutions. In the process of calculating credit ratings and preventing bad loans, predictive analysis can be of great use. Predicting analysis makes it possible to predict the future based on these findings and insights, such as what customers will buy, how long an employee will last, and more. Data mining, advanced statistics, and predictive analytics all fall under the umbrella of predictive analytics.

    - *Algorithmic trading* – Trading algorithms utilize a preprogramed sequence of commands to assess data and speed up decision-making. Machine learning, among the most adaptable AI technologies, is used to do this (5 Ways in which Artificial Intelligence Will Change FinTech, 2022).

    - *Client risk profiling* – An essential component of a manager's day is classifying clients according to their risk score. It is possible that that is not the case. This task can now be delegated to artificial intelligence (AI) programs. Users' previous data is fed into ANNs, which subsequently classify their profile as low, medium, or high risk based on that information. In addition, technology can recommend services based on a customer's risk score (How Machine Learning Can Boost Your Predictive Analytics, 2022a).

2. *Production* – To introduce any product in the market, many things need to be considered, like the market mechanism, participants,

and the supply and demand of the market. For the financial product, the fintech firm's artificial intelligence uses a multilayer approach to understand the behavior of the participants and the customers and quantitative approaches to use statistical data for pricing and valuation, among other things, to produce innovative financial products or services.

- *Customer service* – Artificial intelligence has significantly impacted customer service in FinTech. Customer-facing chatbots and virtual assistants have been developed due to advancements in artificial intelligence technology. Front-toffice and helpline expenses can be reduced by answering simple questions (5 Ways Artificial Intelligence Will Change FinTech, 2022).

- *Customized financial products* – Several banking applications offer tailored financial guidance to assist customers in reaching financial goals. AI-powered FinTech advances have made it feasible to personalize this service. When planning your finances, ICICI, HDFC, and SBI have an app that uses AI and a customized strategy for each customer (How Machine Learning Can Boost Your Predictive Analytics, 2022a).

3. *Promotion* – Numerous examples of machine learning and artificial intelligence, which work toward identifying and recruiting new consumers with comparable characteristics, are frequent use cases. Predictive analytics based on machine learning can prioritize existing evidence, prospects, and accounts based on their propensity to take action. Several businesses have seen significant increases in the number of proofs they convert using complex data sets and predictive lead-scoring algorithms. A whole perspective of the potential consumer is created by merging previous data points of customer behavior with market trends via MLAI predictive analytics. Instead of relying on a purely speculative approach to sales and marketing, companies have found success through the implementation of predictive algorithms.

   - *Wealth management for the masses* – Artificial intelligence (AI) will play a significant role in the financial industry's

increased use of automation. Artificially intelligent wallets keep track of and learn from their owners' every move. Advisory services on wealth management with lower net wealth result in lower fee-based commissions for the advisors (How Can Artificial Intelligence Help FinTech Companies?, 2022).

- *Insurance management* – The underwriting procedure in insurance will be automated with the help of AI technology. When it comes to determining insurance needs, automated agents can help. After a loss has happened, insurance typically comes into play. In many cases, expensive and time-consuming testing is unneeded (How Machine Learning Can Boost Your Predictive Analytics, 2022b).

4. *Protection* – A significant reason why AI has been a massive success in financial technology is that it gives a big leap in security. Chatbots, which replicate human conversations by answering frequently asked questions, are the most used form of AI in cyber security today. If a user's password is lost or forgotten, they can easily restore it. ML-AI, ANN, and other AI-related technologies can dramatically improve financial technology. Even in finance, AI is increasingly a must. All fields of FinTech are benefiting from this new technology.

   - *Fraud and claims management* – A conviction can be made with the help of analytics technologies, which gather evidence and analyze data. Fraud detection software then studies and monitors the habits of the users they are tracking to discover an unusual or suspicious activity that could indicate an impending scam. ML approaches can be used at various phases of claim problem management to develop a claims management system. Insurers can automate handling mechanisms by leveraging AI and managing large amounts of data in a short period of time. Customers will have a better experience because of this technology's reduced processing time and handling costs. As a result of these algorithms, fraudulent claims can be spotted earlier in the process. Because of their ability to learn on their

own, artificial intelligence (AI) algorithms can expand their detection capabilities over time by adapting to previously unknown scenarios (How Can Artificial Intelligence Help FinTech Companies?, 2022).

- *Detection and Evaluation* – Cutting through the daily commotion, AI technologies give speedy insights that create considerable diagnostic skills that can analyze vast amounts of data and identify underlying patterns and anomalies (How AI is affecting Fintech - Fintech News, 2022).

5.5 ARTIFICIAL INTELLIGENCE IN INDIAN FINTECH

- **Vymo**

Founded year-	2013
Location-	San Francisco (United States), Bangalore (India)
Funding-	$45 Million
Specialties-	Sales productivity, Field force productivity, Personal sales assistant, Mobile-first CRM, and Field sales CRM
Estimated Annual Revenue (2022)-	$50.5M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$177,800 (Welcome to Growjo, 2022)
Clients	SBI Life, HDFC, Bajaj Allianz, Yes Bank, Varthana, Treebo, and Swiggy.

For sales representatives, Vymo offers a virtual assistant. It also provides software for managing customer resources for sales teams on the road. Among its features are modules for collecting leads, relationships, service requests, and other aspects of a field sales team. Artificial intelligence, geotracking, activity detection, sales data, and more are all included in the product's features (AI in Financial Services Startups in India, 2022) (Source: Vymo).

- **Razorpay**

Founded year-	2014
Location-	Bangalore (India)
Funding-	$747 Million
Specialties-	Financial products and services
Estimated Annual Revenue (2022)-	$80.7M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$185,900 (Welcome to Growjo, 2022)
Clients	Clients involve telecom giants like Airtel, e-commerce sites like Flipkart, food delivery services like Swiggy and Zomato, Oyo, etc.
Estimated valuation	Over $16 Billion

Unlike other payment solutions in India, Razorpay's product portfolio allows businesses to accept, process, and distribute payments. Offering a wide range of products, they include Razorpay for link-based payments, Razorpay X for accelerated banking operations, Razorpay Capital for short-term loans, and other options. Its capabilities include UPI-based recurring payments and payment buttons for receiving payments on websites. In 2019, it raised $1 billion from T Rowe Price, at which point its market worth was above $16 billion. "Thirdwatch" is an AI-powered technology that helps reduce e-commerce losses due to Return-to-Origin (RTO) fraud. Fraud occurs when customers return an item and either switch it for a defective item or deny that they received it in the first place, known as RTO fraud. By having an AI engine that handles orders straight from a user's account on the e-commerce platform, AI helps reduce RTO scams. Those with little risk are given the green light, whereas orders with high risk are given a red light. Orders that have been designated as high-risk can either be rejected or granted based on the circumstances (AI in Financial Services Startups in India, 2022; How Indian FinTech Is Using AI, 2022) (Source: Razorpay).

- **INDMoney**

Founded year-	2019
Location-	Gurgaon (India)
Funding-	USD 142 Million
Specialties-	Stocks investing, Neo Banking and Deposits, Financial life tracking, and Robo Advisory
Estimated Annual Revenue (2022)-	$50.5M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$131,250 (Welcome to Growjo, 2022)
Clients	End consumer
Estimated valuation	$650 Million

FinZoom Investment Advisors has launched an AI-powered financial consulting service called IND Money. Currently, with $650 Million, Ashish Kashyap, the man behind Goibibo and PayU India, is the brain behind this new venture. Its IND SuperMoneyApp organizes user money automatically and gives advice on how to increase savings and earnings through investments, loans, taxes, and costs. The wealth management platform INDMoney is the company's product (AI in Financial Services Startups in India, 2022) (Source: INDMoney).

- **CogNext.Ai**

Founded year-	2019
Location-	Mumbai (India)
Funding-	
Specialties-	AI, analytics, risk management, machine learning, financial services, balance sheet analytics, advanced analytics, big data, cloud computing, managing systematic risks, regulations, startups, and automation
Estimated Annual Revenue (2022)-	$5M per year
Estimated Revenue Per Employee (2022)-	$100,000
Clients	Azure, SAP, AWS, Tech Mahindra, ZenSar, TCS Bank, Infosys Finacle

With the use of AI and ML algorithms, CogNext, a Regtech firm, helps financial institutions automate and digitize analytical procedures in order to tackle largescale problems. CogNext improves and automates compliance with regulatory requirements through the use of these algorithms. Platform X, a CogNext automated technology platform, provides "nimble, flexible, active, expandable, and cost-efficient" regulatory compliance solutions. By using such solutions, financial institutions are able to manage the risks they take on better while also increasing the consistency and openness of their operations. In order to handle client data and perform computations, Project X uses a technological foundation. In addition to its automated machine learning solution, CogNext has another feature that helps experts in the financial industry to leverage ML and AI to produce commercial value. Using this, teams may create advanced AI projects without coding or understanding the underlying ML algorithms. It was, therefore, possible to increase the volume and minimize the turnaround time of the bank or financial institution model workflow without having specific technical skills (How the Indian FinTech is Using AI, 2022) (Source: CogNext).

- **SMEcorner**

Founded year-	2014
Location-	Mumbai (India)
Funding-	$45 Million
Specialties-	Business Loans, Fintech, SME Lending, SME Loans, Small Medium Business Financing, Working Capital Loans, Business Capital, Business Financing, Unsecured Business Loans, LAP Business Loan, Loan against Property, Business Loan against Property, Loans, and SME.
Estimated Annual Revenue (2022)-	$52.5M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$165,100 (Welcome to Growjo, 2022)
Associates	Creditenable, Ftcash, Mswipe, Paisabazar, Paytm, Retailio, Mi Credit, and Swiggy.

SMEcorner is a marketplace for small- and medium-sized businesses (SMEs). Investment banks Karur Vysya Bank, RBL Bank,

Northern Arc, Credit Saison, Poonawalla Finance, Muthoot Finance, and IndusInd Bank have all joined Capital Float's lending operation as partners. It allows small and medium-sized businesses (SMEs) to get bank loans from nonbanking financial companies (NBFCs). Machine intelligence has been used to construct an MSME-focused loan model for a faster disbursement time. The platform allows users to keep tabs on the progress of their applications. A variety of loans are available, including unsecured loans, property-based loans, and loans to women entrepreneurs (AI in Financial Services Startups in India, 2022) (Source: SMEcorner).

- **Credgenics**

Founded year-	2018
Location-	Delhi (India)
Funding-	$29 Million
Specialties-	SaaS, NPA Resolution, Fintech, Loan Collections, Debt Recoveries, Banking Technology, Digital Collections, Technology Solutions, Credit Recoveries, Mobile Collections, Loan Repayments, and Digital Banking
Estimated Annual Revenue (2022)-	$18.2M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$115,500 (Welcome to Growjo, 2022)
Clients	Over 50 of India's largest banks, NBFCs, and Fintechs. Major clients, including HDFC Bank, ICICI Bank, Axis Bank, DMI Finance, and Zest Money, have agreed to lend to a startup company.
Estimated valuation	$100 Million

In addition to providing banks and lenders with AI and cloud-based debt collection solutions, it has a collection strategy and statistical analysis for profiling and collecting. Insolvency, bankruptcy, and fintech laws are among the areas covered by this service. Credgenics is aiding more than 60 financial institutions to increase their collection rates by 15–90% by recovering bad loans (AI in Financial Services Startups in India, 2022) (Source: Credgenics).

- **CASHe**

Founded year-	2016
Location-	Mumbai (India)
Funding-	$23 Million
Specialties-	A full-fledged financial services platform that offers its customers everything, namely, financial, covering credit, EMI shopping, and payments and insurance services.
Estimated Annual Revenue (2022)-	$18.3M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$71,500 (Welcome to Growjo, 2022)
Clients	End consumer
Associates	Bhanix Finance & Investment Ltd., MAS Financial Services Ltd., and Vivriti Capital Private Limited.
Estimated valuation	$76.4 Million

The internet-based market for individual loans: Individuals with regular income or those who operate their businesses can apply for personal loans with flexible terms, high loan amounts, and convenient repayment plans. Underbanked people's credit scores are calculated using an AI-based social loan quotient algorithm. The app is compatible with Android and Apple's iOS operating systems (AI in Financial Services Startups in India, 2022) (Source: CASHe).

- **Capital Float**

Founded year-	2013
Location-	Karnataka (India)
Funding-	$50 Million
Specialties-	Digital Finance, FinTech, and Consumer Finance.
Estimated Annual Revenue (2022)-	$67.7M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$91,000 (Welcome to Growjo, 2022)
Clients	End consumer
Associates	Amazon India, online learning service Unacademy, airline Spicejet, direct-to-consumer lifestyle, electronics brand Boat, and travel booking firm MakeMyTrip.
Estimated valuation	$5.5 Billion

Risk assessment and marketing are made easier with the use of AI and human intelligence. AI and ML algorithms help the organization understand the creditworthiness of clients, allowing them to select the best sort of loan for the application. Capital Float also used AI algorithms to more precisely target potential clients for their promotional efforts (How the Indian FinTech is Using AI, 2022) (Source: Capital Float).

- **CreditMate**

Founded year-	2019
Location-	Mumbai (India)
Funding-	$5.5 Million (Currently acquired by Paytm)
Specialties-	Debt recovery, software as a service, collections, artificial intelligence, technology, and financial services.
Estimated Annual Revenue (2022)-	$1.9M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$52,000 (Welcome to Growjo, 2022)
Clients	Onecard, Tala, Kreditbee, Branch, Herofincrop, and Moneytap
Estimated valuation	$8 Million

CreditMate is a software that supports lenders in collecting overdue payments from borrowers. The application uses AI and ML to make its procedures more efficient. In 2019, the company developed the Sherlock product, which uses a machine learning algorithm to evaluate default debtors and handle debt settlement processes cost-effectively. Paytm has acquired a 100% stake in CreditMate for an undisclosed amount (How the Indian FinTech is Using AI, 2022) (Source: Paytm, ET).

- **Lendingkart**

Founded year-	2014
Location-	Ahmedabad (India)
Funding-	$273 Million
Specialties-	Instant lending system, Financing, Data analytics, Credit decisions, and working capital-related solutions.
Estimated Annual Revenue (2022)-	$182M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$185,900 (Welcome to Growjo, 2022)
Estimated valuation	$138 Million

Lendingkart was founded in 2014 and used AI to help businesses find simple solutions for obtaining working capital credit. The company offers loans to small and medium-sized businesses in India and is a nondeposit-taking NBFC. Therefore, it employs this technology to improve quality lead scoring, product interaction, and credit evaluation. The AI program examines over 10,000 data points to determine a person's creditworthiness. The success of India's small enterprises is crucial to the country's digital goals, which are facilitated by this technology integration (How the Indian FinTech is Using AI, 2022) (Source: Lendingkart).

- **Mswipe**

Founded year-	2011
Location-	Mumbai (India)
Funding-	$97.5 Million
Specialties-	Various payment facilities like QR, Card Payments, Cashless Payments, Digital India, Digital Payments, Card Swiping Machines, NFC Payments, Cashless India, Online Stores, Money Back Cards, Pay by Link, and Contactless Payments.
Estimated Annual Revenue (2022)-	$782.6M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$294,000 (Welcome to Growjo, 2022)
Clients	Insurance premiums are accepted at clients' houses using Mswipe POS by HDFC Life Insurance and Max Bupa. Jabong, Myntra, Orchid Hotel, Inox, and Satyam Cinemas are just a few of the other well-known companies that use Mswipe.
Estimated valuation	$450 Million

Mswipe, launched in 2011, is a significant player in India's mobile POS market as both a merchant acquirer and a network provider. Mswipe began its growth into UPI QR codes and intelligent POS terminals in 2019. Artificial intelligence is used in the company's Field Force Automation Application (F2A2), a merchant onboarding platform developed by another Bangalore-based firm called Signzy. Using AI, the onboarding period for new merchants has been cut from around 3 days to 30 min (How the Indian FinTech is Using AI, 2022) (Source: Mswipe).

- **IDfy**

Founded year-	2011
Location-	Mumbai (India)
Funding-	$21 Million
Specialties-	Prevent fraud and engage with the genuine with the least amount of friction
Estimated Annual Revenue (2022)-	$35M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$81,250 (Welcome to Growjo, 2022)
Clients	Banks and other financial services, online marketplaces, telecommunications, the gaming industry, and the ondemand economy are just some of the places where IDfy's solutions have been put to use. Customers and business associates of IDfy can be found all over India, Southeast Asia, and the Middle East. Companies like Amazon, Airbnb, HDFC Bank, Dream11, and VISA can be seen on the list
Estimated valuation	$67.7 Million

This service provider verifies the identities of clients and employees in various industries. Solutions include know-your-customer (KYC), antimoney-laundering (AML), general data protection regulation (GDPR) conformity (GDPR compliance), and identity authentication (IDA); they provide fraud detection options based on data science and AI. Financial institutions, employment agencies, insurance companies, and others can find the help they need there (AI in Financial Services Startups in India, 2022) (Source: IDfy).

- **Kaleidofin**

Founded year-	2018
Location-	Chennai (India)
Funding-	$21 Million
Specialties-	Portfolio management, credit, product design, risk management, fintech, technology, and product distribution.
Estimated Annual Revenue (2022)-	$13.4M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$105,000 (Welcome to Growjo, 2022)
Clients	End consumer
Estimated valuation	$138 Million

The power of AI to motivate you to save for your goals, "Udaan," "Lakshya," and "Ummeed" are three features that allow you to save money for both short-term and long-term goals in the form of stock, debt, and mixed assets. It provides ML-based goal-setting and profile-building assistance to end users (AI in Financial Services Startups in India, 2022) (Source: Kaleidofin).

- **Tookitaki**

Founded year-	2014
Location-	Singapore (Singapore), Bangalore (India)
Funding-	$20 Million
Specialties-	Reconcilliation, Distributed Computing, Machine Learning, Predictive Analytics, Artificial Intelligence, Antimoney Laundering, and Regulatory Compliance.
Estimated Annual Revenue (2022)-	$14.2M per year (Welcome to Growjo, 2022)
Estimated Revenue Per Employee (2022)-	$145,000 (Welcome to Growjo, 2022)
Associate	Tata Consultancy Services Ltd., CMC India, Senzing, WNS

Tookitaki's antimoney-laundering and compliance management services are powered by artificial intelligence. To combat money laundering, it provides an Antimoney Laundering Suite and a Reconciliation Suite that use artificial intelligence to provide a matching and substantiation solution for reconciliation. As a bonus, screening and monitoring software helps reduce the occurrence of false alarms (AI in Financial Services Startups in India, 2022). (Source: Tookitaki.)

- **Signzy**

Founded year-	2015
Location-	Bangalore (India)
Funding-	$13 Million
Specialties-	SaaS, Digital Contracts, Biometric Identification, ID Verification, Digital background verification, Bank-grade Digital Onboarding, KYC, AML/CFT, Digital Identity, Artificial Intelligence - Biometrics, Computer Vision, Customer Onboarding, nocode AI, Banking Technology, and Video KYC.
Estimated Annual Revenue (2022)-	$17.9M per year (Welcome to Growjo, 2022)

Estimated Revenue Per Employee (2022)-	$71,500 (Welcome to Growjo, 2022)
Clients	Over 100 financial institutions in India, including Aditya Birla Sunlife AMC, BoB Financial, and more, use Signzy's digital KYC solutions. Four of India's five largest banks are customers, including the State Bank of India (SBI) and ICICI Bank.
Estimated valuation	$40.5 Million

Digital onboarding and backoffice process automation are two of the areas in which Signzy specializes. Digital onboarding solutions that incorporate reading documents, facial recognition, and various financial datasets provide a core regulatory engine powered by AI and machine learning for onpremises application growth (AI in Financial Services Startups in India, 2022) (Source: Signzy).

This is a simple comparison of the estimated revenue of these firms (Fig. 5.4). We constructed a comparative chart based on the aforementioned data. The data is collected from Growjos' database and other sources. In Figure 5.5, we showcase the estimated revenue per employee. This indicates how much these companies charge depending on the industry. From the comparison, we find that Mswipe is better on annual revenue but lowest on the estimated revenue per employee. Razorpay and LendingKart both have the same estimated revenue of $185,900 per employee.

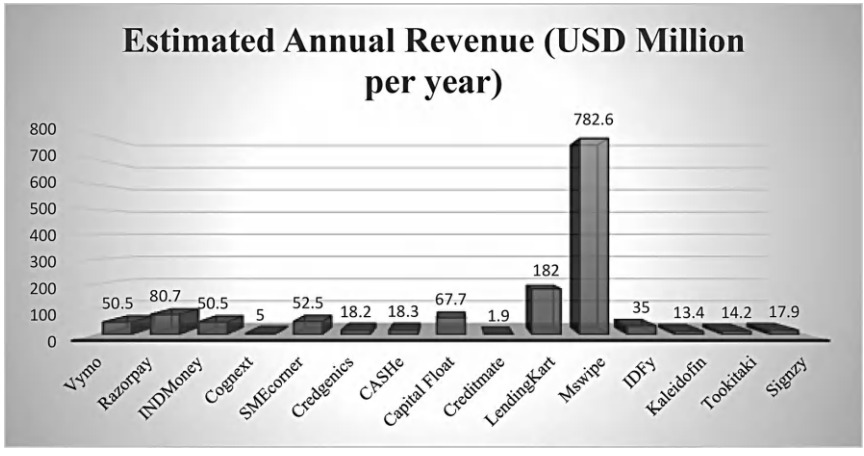

FIGURE 5.4 Comparative chart of fintech firms' estimated annual revenue.

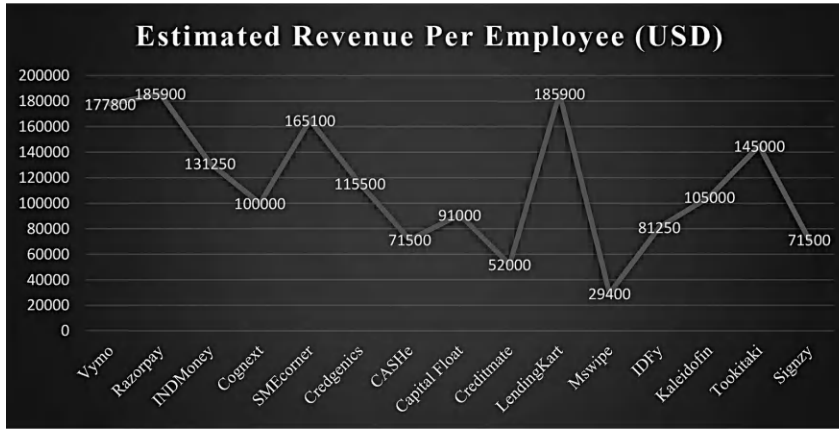

FIGURE 5.5 Comparative estimated revenue per employee.

5.6 CONCLUSIONS

The study focuses on how fintech firms use AI in India. Artificial intelligence is the most significant technology on the planet, and fintech firms use artificial intelligence extensively. Currently, in India, 2100 fintech firms are operating with a market value of over USD 27.5 billion, and it is projected that in 2025, the market value will be between 150 and 160 billion. Of 2100 fintech firms, 67% stepped into the market last year. Prime Minister Narendra Modi of India, speaking at the opening of the "InFinity" forum, a thought leadership gathering on fintech, called for a "Fintech revolution" in India with a "security shield." This revolution will be fueled primarily by income, investments, insurance, and institutional credit. Because of this, artificial intelligence is extremely significant. To understand customers' behavior, predict the future, and ensure regulatory compliance while minimizing risk, fintech firms are spending more than ever before on artificial intelligence. AI is used as a tool for enhancing the client experience and providing a taste of simplicity and convenience. Since the use of AI is expanding, it has impeded the operations of several institutions. It has also produced automation in the financial sector, which may not be intended to replace humans but to provide a more luxurious 24/7 engagement experience for customers. FinTech refers to technology innovation that could encompass everything from monitoring financial transactions to identifying fraud in the financial services industry. Artificial intelligence and financial technology are increasingly merging.

Technological advancements in artificial intelligence, such as better cognitive abilities and social simulation, have moved the field from the margins to the center of discussion.

Even though these methods and other characteristics of AI have been used in entrepreneurial efforts to create value, we cannot yet know how valuable this information is for predicting the future success of fintech companies. As it stands, it is too early to tell how fintech firms will use this AI in the future. Research in the future may examine the long-term viability and effectiveness of fintechs that have adopted artificial intelligence.

5.7 LIMITATIONS OF THE STUDY

- The study is a theoretical representation based on secondary data sources.
- The study is limited to the Indian context.
- The study is done in 2022. Further technology enhancement can change the situation in fintech.

KEYWORDS

- **artificial intelligence**
- **fintech**
- **payment**
- **spending**
- **lending**
- **chatbot**

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CHAPTER 6

Exploring the Influence of Artificial Intelligence in Trading and Business Transactions

RIYA CHAKRABORTY, ANMOL GIRI, AUINDRILA BISWAS, and HIRA DHAR CHUDALI

Department of Agricultural Economics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India

ABSTRACT

In a well-expressed definition of the term artificial intelligence (AI), it is said that "Artificial Intelligence can also be expressed as the development of smart machines with the aid of science as well as engineering, particularly intelligent computer programs" (Minsky and McCarthy, 1950s). If compared to the human cognitive ability involving thinking, reasoning, learning, and problem-solving behavior to accrue knowledge, AI as a term can be explained as machines that imitated and depicted almost similar or found to have some link with the same cognitive abilities. AI was introduced in the academic field in the year 1956. In the present technological era, the impact of AI as an integral part of our daily lives is undeniable. Today, it is impacting human, society, business, and trading activities simultaneously. AI made the key stakeholders take notice in 1982 as the quantitative hedge fund Renaissance Technologies found its way into mathematical and statistical analysis by James Simons, an award-winning mathematician who formerly worked as a code breaker during the Cold War. AI made its way into the business world in the year 2006. *MIT Sloan*

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Management Review has reported in a study that AI has been viewed as a strategic opportunity by more than 80% of organizations and as a way to realize competitive advantage by 85% of organizations (Ransbotham et al., 2018). In recent times, AI has been impelling businesses, strategists, pioneers, entrepreneurs, and investigators to explore new strategies as well as start new sources of generating income or other sources of business value. Andrew Ng—the co-founder of Google Brain, also held other responsible positions from vice-president to chief scientist at Baidu. He also co-founded Coursera for which he also served as the co-chairman, and an Adjunct Professor at Stanford University, had once viewed that AI has the potential to transform the industry just as electricity had revolutionized mankind some 100 years ago. By employing the appropriate AI technology, a company may be able to save both time and money; increase their profitability as well as operational efficiencies and make faster business decisions based on the results of subjective advances; keep away from missteps through human activities; develop a client base by foreseeing the client inclinations, better offerings, providing massive information of quality leads, skill development, and income increment as well as clear guidance and back up; use knowledge to foresee client inclinations and offer them better, customized involvement, sharing a tremendous measure of information to create quality leads and develop a client base; accomplish cost investment funds; increment income by distinguishing and amplifying deal openings; and develop skill by empowering investigation and offering clear guidance and backing.

AI applications in the management of businesses include:

- Intelligent email categorization
- Text-to-voice capabilities
- Intelligent personal assistants, viz., Siri and Google Now
- Online customer service and automated response systems
- Automation of various processes
- Forecasting of business and sales
- Aids in security surveillance
- Behavior-detecting smart devices
- Automated insights, particularly for businesses driven by data (e.g., Financial services or e-commerce)

Since AI is significantly influencing the future of stock trading, it will undoubtedly continue to increase trading profitability in the years to

come. Due to its capacity to execute numerous deals in the stock market every second, it performs trades at the most advantageous time. Hence, for precise analysis, projection, fast trade execution, and risk mitigation, AI plays an important role, some of which are listed below:

- Different algorithms in trade
- Data pattern recognition
- Analysis of sentiments
- Risks assessment
- Prediction of real-world information
- Use of AI-based chatbots in trading
- Robo advisers for automated advisory

6.1 A BRIEF HISTORY OF ARTIFICIAL INTELLIGENCE

In a well-expressed definition of the term artificial intelligence (AI), it is said that "Artificial Intelligence can also be expressed as the development of smart machines with the aid of science as well as engineering, particularly intelligent computer programs" (Minsky and McCarthy, 1950s). If compared to the human cognitive ability to involve thinking, reasoning, learning, and problem-solving behavior to accrue knowledge, AI as a term can be explained as machines that imitated and depicted almost similar or found to have some link with the same. Before 1949, in acomputer system, only the execution of commands was there as storing the commands was not attainable. In 1950, Alan Turning focused on "computing machinery and intelligence" and enlisted the concept of intelligent machines and how to construct intelligence in a system. After an interval of five years, a proposal or paper related to programs was presented for the first time at the Dartmouth Summer Research Project on Artificial Intelligence (DSPRAI). Between the years 1957 and 1974, the concept of machine learning (ML) was improved due to increased access to computers. In 1970, in an interview with *Life Magazine*, Marvin Minsky stated that in three to eight years, machines would gradually take over the general intelligence of humans on average. Meanwhile, the notion of "deep learning" was established by John Hopefield and David Rumelhart, who had at that period described deep learning as approach enabling computers to acquire knowledge through experience. The expert system was coined by

Edward Feigenbaum, a system that could mimic human decision-making. The major constraint faced by the idea was the lack of proper governance related to the investment in this venture merged with public hype and curiosity. Taking all these things into account, AI performed brilliantly, reached new heights, and achieved numerous accolades through the next two decades. AI made the key stakeholders take notice in 1982 as the quantitative hedge fund Renaissance Technologies found its way into mathematical and statistical analysis by James Simons, an award-winning mathematician, who formerly worked as a code breaker during the Cold War. AI made its way into the business world in the year 2006.

In this ever-changing world, we live in businesses that need to put in extra effort to ensure that the target customers value their experience with their organization or company or the service they provide as well as recommend their services. The introduction of AI in customer service teams could add to the customer service experience in business avenues. As mentioned above, AI can automate boring and annoying activities, improve effectiveness, and help in uncovering hidden trends. Correct accounting codes can also be used to resolve file upload, reading, and classification issues. AI is error-free, 100% efficient, and never gets bored or tired. Therefore, it does not come as a surprise anymore that AI is becoming more popular. and making progress in this demanding field.

AI not only makes humans work more efficiently; it is bringing about a revolution in the process of business transactions. Recent trends indicate that by 2021, 86% of CEOs will be using AI as a focal point of their workplaces. AI has been offering help in the reduction of data entry errors as well as predicting customer behavior, it's becoming essential in previously unheard-of ways.

The top adoptions as well as applications of AI can be vividly seen in the fields that are listed below:

I. **Automation:** As a result of automation, time-consuming and error-prone processes such as data recording, classification of various transactions, restorations of accounts, the process of entering, and adjusting data from various sources such as receipts, bills, and invoices into transactions, evaluation of payment reports of employees, and keeping a tab on the dynamic price changes are some of the processes that end up taking a lot of the accountant's time and with the help of AI, people are no longer required to undertake these long and hectic courses of actions. All these

tasks can be done by AI with fewer errors than humans. Hence, the employees are spared from mental exhaustion and can devote their time to other duties that require attention.

II. **Data Analytics:** Where a normal data analyst would perform a data analysis manually, AI will be useful in finding new patterns and discovering relationships in the data sets with the process of automation, reaching previously unreachable insights.

III. **Natural Language Processing (NLP):** The benefits of natural language processing can be far-reaching such as the empowerment of search engines which in turn makes them more resourceful. To make chatbots more usable for people with disabilities, such as those suffering from hearing impairments and other sensory issues, certain design considerations must be made.

IV. **Lead Scoring:** AI helps in the prioritization of leads. Sales professionals may also benefit from these tools as they can give more time to specific customers based on what the consumers actually desire to purchase. With AI, computers can distinguish between various possibilities by aggregating data being focused in the right areas like social media engagement, demographic information, a company interaction with the targeted customers, etc.

V. **Sales Rep Chat/Email Bot:** Chatbots can aid in initiating the conversation by passing on a customized message, thereby making it simpler for the customers to interact instantly or come back later on. On average, they are said to enhance sales by almost 67%. To enhance operational efficiency and customer experience, many organizations are swiftly embracing intelligent technology solutions. With the help of AI, businesses and companies can obtain deeper insights relating to their target consumers. This in turn can massively reduce the marketing teams' workload and thus increase their efficiency.

VI. **Website Experience:** AI is useful in analyzing the various information acquired from a website that deals with a single user's location, demographics, and device, which in turn helps in target-resource-based analysis.

VII. **Push Notifications:** Individual users get help from the applications of push notifications in a way that the application studies their behavior and ensures that they get only the most important messages at the right time.

VIII. **Image Recognition:** Image recognition uses computer vision in ways such that the system can derive meaningful visual inputs from a wide array of options ranging from digital images as well as videos and then suggest or act appropriately. Business persons can then use this to withdraw the various pictures distributed daily to social media destinations to pick up an understanding of how and where items or administrations are utilized.

IX. **Search Engine Optimization:** Also known as "SEO," the concept of "search volume" is crucial, as it gives us a brief idea of what people are looking for in specific terms or sentences when they are searching for some services or items. To derive a better understanding of the aim behind the search term utilization and the material of searches, algorithms related to ML are being deployed currently. The identification of various bottlenecks that exist in claims or acquiring advantages of catchphrases that other competitors aren't using is another field where SEO strategies can be used. Websites may also benefit from the generation of various SEO-friendly marketing strategies.

X. **Semi-Automating Complex Process:** According to what data suggests, the market related to cloud-based finance computer programs was estimated to be $7.88 billion in the year 2018 and this figure is expected to reach $13.37 billion by the next few years. An enthusiastic approach can be seen in many company officials who are positively willing to contribute to progress as well as progressed AI-aided finance frameworks. AI is expected to bring about gradual changes in the future of payrolls. A concept that is completely different from computerization, AI is dependent on cause-and-effect, which means that a genuine AI framework can obtain information, as well as learn from failures, and solve issues purposively.

XI. **Running Outreach Campaigns:** An AI voice bot can address a wide number of target audiences and provide them with various

offers, listen to their queries, and forward them to a representative as per the interest is concerned. This idea seems to be far from reality for most business ventures as it requires a huge amount of capital from investors or real-life outreach operators.

XII. **Improved IT Processes:** Cybersecurity as well as maintenance of software could work well with the help of AI automation. A lot of money can be saved by business firms with the application of ML. It can spot potential threats faster than people, possibly protecting businesses from cyber-attacks. AI-powered apps help people working in the IT sector by maintaining the organization's systems and also ensuring the proper functioning of all tasks.

XIII. **Digital Transformation:** As we can see, on a global level, many business ventures are positively adopting advanced and updated technology. Trade forms are being mechanized, by the process of digitization and automation, so that customers are encouraged use modern technology-based apps. It could be anything from managing an account, traveling, healthcare options, and a trend over the past few years or decades, e-commerce. Information management and reduction of burden on IT operations can be achieved from the use of robotics and blockchain technology.

Some of the other uses of AI are listed below:

- It provides product suggestions, helping in predictingconsumer behavioral patterns.
- Helps in the detection of fraud.
- Messages related to marketing and advertising are personalized for each customer.

The entire amount invested in AI start-ups worldwide in 2011 was $25.88 million, andit rose to $1866.6 million in just six years (2011–2016). Numerous AI start-ups saw an increase in funding of 71.13%. With the greatest expenditure, the U.S. was driving this change around the world. According to Figure 6.1, which was created worldwide, 22 fields were considered, for example, autonomous vehicles, business intelligence, healthcare, etc. (Soni et al., 2018), to examine the investment in AI start-ups which has shown an exponential increase in recent years. Additionally, a percentage graph of 100 AI start-ups that have been created worldwide that have covered every industry where AI has had an impact.

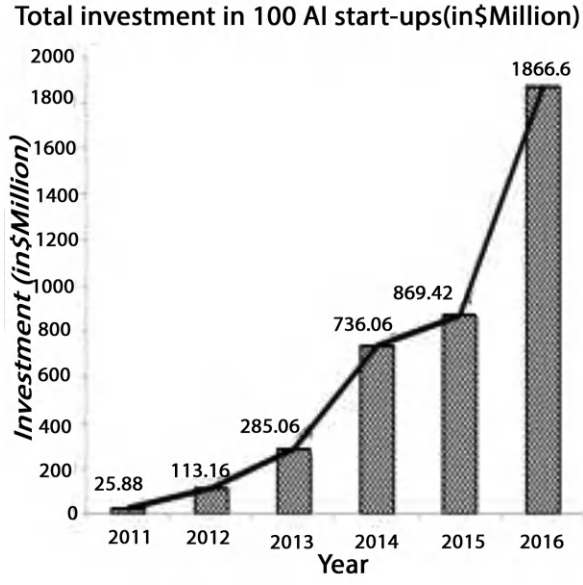

FIGURE 6.1 Total investment in 100 start-ups.

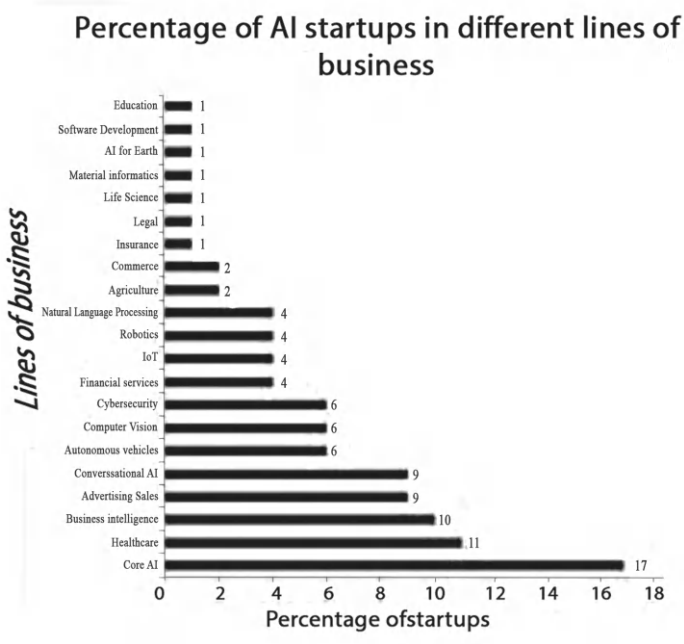

FIGURE 6.2 Percentage of AI startups in different lines of business.

6.2 AI AND TRADING: RELATIONSHIP

The voluntary exchange of commodities (goods and services) can be referred to as trade, i.e., producing all elements of a product in a home country and exporting a final product to a different country is termed as trade. It can also be referred to as the purchase and sale of commodities, or securities, in the financial market. There is another term called free trade, which means international exchanges of products and services, without obstruction by tariffs or other trade barriers (Adam Barone, 2022). In a macroeconomic context, the trade usually refers to the international trade where the global world is concerned with exports and imports. However, in recent times, this traditional trading represents about 30% of goods and services; 70% of it is actually segments of global value chains (GVCs) which can also be termed as the intermediate parts. Current concerns about the trading system focus if trade modernization has kept pace with changes in the global economy. While there are so many discussions going around the world on occurrence of a trade war and the position of global trade order, a much-needed conversation about the real issues regarding international trade is missing, i.e., how in the fourth Industrial Revolution, innovative technologies are transforming the process of trade by making it more inclusive and efficient. Although AI technology is still evolving and subject to limitations, it has shown its potential to enhance international trade in various ways. One is through increases in the productivity of adopters, which is associated with greater benefits from trade through exports.

6.3 SPECIFIC AI APPLICATIONS TO INTERNATIONAL TRADE

Over the last two centuries, international trade has grown, remarkably transforming the global economy by affecting employment, production, prices, and wages in a significant way. The rising trade deficits between the countries, trade wars, de-globalization trends, and recent COVID-19 pandemics have disrupted the flow of goods and services within and across the country. These uncertainties have made the global economy realize the importance of predicting future trading patterns. AI not only allows better future predictions, and associations to inform policy decisions but also its data analytics and translation services are reducing barriers to international

trade in many ways. For example, recent AI technology involves data democratization (Batarseh and Yang, 2020) which has increased transparency in the context of public decision-making, using the open data and big data initiatives presented in 2008 and 2012 (White House, 2008) in which data availability at www.data.gov helped in exploring the applicability of AI technologies.

6.4 AI AND GVC

The term "value chain" is concerned when a country specializes in one or several activities in which it has a comparative advantage. With the growing need to forecast future trends in GVC, various types of AI technologies are applied to create predictive solutions through data analytics. These technologies include digital networks, deep learning, language processing, ML, transfer learning, etc. to be precise. AI is also concerned with reducing the time, cost, and complexity of trade opportunities such that the concerned goods or resources can be assembled based on the predictions aided by AI which in turn saves time required for production as well as assuring timely delivery. The supply chain uses applications like R&D, design, robotics, etc., to maintain goods along the chain. To be specific, the introduction of Industry 4.0 design and IoT enables complete communications between enterprises along the supply chain through simple machines and self-maintenance at the factory level. This breakthrough in technology assisted the field of the supply chain to take a step forward by providing them with a larger scope of operations.

6.5 TRADE AND DIGITAL PLATFORMS

Digital platforms have a huge impact on evolving international trade, allowing better customer relationship management, easy transactions, as well as access to information technologies. For instance, a website like Upwork has made it possible for customers to select and choose between service providers from different parts of the world, such as Serbia, Pakistan, the Philippines, etc. Similarly, 3D printing when mass adopted and easier on the pocket of the customers has the potential to bring down global trade by one-fourth since it requires less labor involved and it will also reduce the need for imports.

A report from the World Bank Global Inclusion Data Base has revealed that access to bank accounts saw a rise of 20% for a period of three years, 2011–2014, due to the introduction of digital payment through mobile phones. Mobile money is a major inclusion in the financial world of today's economy.

6.6 CAN AI ENHANCE TRADE POLICYMAKING?

While much attention has focused on how AI can help design more efficient product offerings and firm strategies, there has been less focus on how AI can help governments design better policies (with the notable exception of the role of AI in achieving the sustainable development goals). AI can be a helpful tool to understand the impact of any uncertainty or specific shocks in the context of international trade as well as exposure to natural disasters, cyber-attacks, etc., by providing more timely and granular information to economic agents and policymakers. Besides the technical analytical capacities (both in terms of tools and methods and human capacities), Among the many challenges in using AI technologies in trade policymaking is the difficulty of finding insightful data sets on the recent trade patterns as well as the difficulty of ensuring the completeness of these datasets. In this regard, progress is being made with the deployment of high-frequency ML data to track timely economic activity (Woloszko, 2020).

AI can improve analytical capacities, helping governments make better choices. Forinstance, increased data points from earth observation data, port information, or financial transactions may be used to increase the accuracy and timeliness of information, including on trade-related issues such as identifying trade volumes and the evolving geographical distribution of trade. Enhanced analysis of data can also provide new insights on regional integration initiatives, and identify supply bottlenecks or nowcast trade and GDP. For example, recent OECD work (Jaax et al., 2021) combines ML techniques with dynamic factor models to "nowcast" aggregate services trade. This work relies on a variety of hard and soft indicators, including unemployment rates, retail sales, goods exports, business and consumer confidence, financial indicators (stock market prices), and Google Trend search indicators.

AI can also be used to study human dynamics and enhance value chain operations. AI can be leveraged to identify demand surges or bottlenecks in the international supply chain. A similar approach was proposed by

the UN Global Pulse project (Hurricane Odile project) to understand the effect of natural disasters on the economic resilience of people by analyzing financial transaction data (sale payments and ATM cash withdrawal data).

6.7 THE ECONOMICS OF DATA AND AI

One thing that makes AI systems thrive is data. Data is the foundation upon which algorithms are built, and these algorithms are trained to carry out a single or several tightly specified tasks. Data are meaningless by themselves. Only when it is processed using a combination of software, hardware, and the knowledge to guide or automate action can value become added. Additionally, data varies and is unique. Data is not a rivalrous good like "conventional goods." Thus, the ability of another user to use the same data is not affected by the consumption of one user. A specific unit of data can enable a wide range of value-generating activities if it can be used by a lot of users for a variety of reasons without being exhausted. This suggests the substantial size and scope of economies when data may be shared, particularly across national boundaries. Data features do matter, though. There are decreasing returns to data, even though additional data can lead to more accurate recommendations (Bajari, 2018). According to the economics of data for AI, having access to enormous volumes of data from many sources results in significant scale and scope economies. Unrestricted access to more data would encourage more competition and bigger economic gains for consumers from the standpoint of world welfare. However, this can potentially result in more data being misused. To prevent data from being misused, rules that might encourage increased usage and re-use of data, even across borders, are needed.

If AI can be implemented in the right way, it may help the company to become more efficient, and increase profitability as well as working efficiency with better decision-making based on modern innovations, human-based error removal, better customer base creation by predicting customer inclinations, and customized involvement of quality leads.

6.8 PRESENT STATUS OF AI IN BUSINESS AND TRADING

The concept of AI is introduced among academics and professionals as a business-disruptive technology which was seen in a chaotic and unstructured manner (Sestino, 2022). AI is an emerging technology that has been

deciding the fate of many users all over the world. There are very less exceptions where the technologies alone or in combination have not been explored. There are a variety of factors responsible for this which include advancements in computer technologies such as cloud computing and other forms, an increase in transparency through code sharing services like GitHub, as well as a large number of open-source software available for easy access. These emerging technologies have immense potential to transform and also enhance the living standards and the lifestyle they lead.

The working environment has been in a different setting since the COVID-19 outbreak as there have been recruitments over the Internet rather than physical interviews, and so shifting of focus on diversity has opened new dynamics and also strengthened the existing methods to remain competitive in new platforms, which highlightthe need for technologies and AI can be seen as the leader of this expansion.

The top priority in a customer interaction should always be effective customer service.A huge chunk of data is stored in contact centers and this is where AI has a vital role to play.Businesses can obtain a greater comprehension of their customers, with better help from AI.

6.9 THE FUTURE SCOPE OF AI

Undoubtedly, we will all agree on the fact that business and trade sectors are becoming more and more competitive by nature as time passes by. In this situation, a company's survival depends on its way to find quick and effective ways to tackle consumers' various needs and their responses. Regarding this, AI has proved to be a highly helpful tool, and that way an important area of further research in all fields including the business and trade sector. AI has already been incorporated into the hiring procedure as well as procedures that assess employee performance, train staff in a variety of job skills, and make managerial choices. The channels of communication between candidates and HR managers have been broadened by introducing AI technology, making several processes considerably more effective (Son et al., 2019). AI and chatbots are being utilized in customers' need of quick information, prompt service, and prompt support (Mowalie, 2021). It is expected that these chatbots will be more efficient in the future by providing strategies to cope with possible outcomes well in advance. However, this pattern will persist, and in the future, AI will be applied in a variety of other contexts to comprehend customers, their

preferences, and tastes, and even to address customer complaints. The personalization technique is already quite dominant and it will be more powerful in the future to the extent that customers' needs will be predicted with exceptional accuracy. The drive to eliminate human mistakes from commercial operations will come from AI.

As discussed earlier, it is evident that international trade is affected by a large number of unexpected occurrences where AI can be used as an effective tool for analyzing timely data and providing detailed information for better policymaking, which in turn contributes to understanding the impact of uncertainty or specific shocks that may occur. The way business and trade are done both nationally and internationally, has already been majorly changed, and AI will continue to speed up the processes in new and creative ways that are ultimately going to help in emerging entrepreneurship. In summary, there are no indications that the application of AI in business and trade transformation will slow off any time soon.

KEYWORDS

- **AI**
- **business**
- **trading**
- **finance**

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CHAPTER 7

Dynamics of Cryptocurrency in Emerging Markets: A Study on India and Africa

SHIVI MITTAL[1], SONI SHARMA[2], and BOLA YAYA[3]

[1]*IILM University, Greater Noida, India*

[2]*Jaipuria Business School, Ghaziabad, India*

[3]*Center for Women Inclusion and Strategic Development (CWISD), Africa*

ABSTRACT

Although cryptocurrency used to be a very new and significant financial innovation; now it is known to at least one person in a family who believes that it is a good option to invest in cryptocurrency. The concept of investing in crypto got light when people started getting multiple returns overnight. So, apart from investing in equity, investors started preferring to invest in virtual currencies including cryptocurrency. In India, cryptocurrency has been gaining popularity in the past few years as people have started to learn more about digital currency and what amendments will it bring with the adoption of cryptocurrency in India. Cryptocurrency transactions have grown exponentially in Africa pre- and post-pandemic, which is a pointer that despite the socio-economic downturn faced by most African countries, cryptocurrency is seen as a way out for the vast youth populace. The decentralization of blockchain technology has enabled undeterred participation in cryptocurrency transactions, favoring regions like India and Africa. However, issues of legal regulations of cryptocurrency have

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been the bone of contention across regions. This work navigates ways India and some African countries are exploring to include this fast-growing system in their economies, and it also assesses the ban on cryptocurrency in countries like Nigeria, Morocco, Zimbabwe, and Namibia. This paper talks about its adoption barriers, legal issues pertaining to investment, and regulatory framework of cryptocurrency in India and Africa. This paper also captures the present state of research on legal challenges related to the applicability of cryptocurrency in India and Africa by providing a critical review of the current frame of data. The author tries to review key systems and concepts, identifies contradictions when compared to the applicability in both countries, and provides explanations toward a common understanding. Toward this work, a well-reviewed and integrated construct has been proposed so that the probable investors would be able to know the accurate status quo and future implications of the same.

7.1 BACKGROUND

Digital currency is a virtual way of alternative currency that is predicated on a devolved community that helps in alternative transactions secured via way of means of public-key cryptography. In early 2009, a programmer named Satoshi Nakamoto delivered Bitcoin (Manimuthu et al., 2019).

Cryptocurrency in nature is decentralized, which means there aren't any servers concerned and no serious supervisory authority. The idea is similar to desk-to-desk grids for document allotment. In a decentralized communal like Bitcoin, the Blockchain era is used, i.e., a community record stalking of all transactions that are constantly passed off in the community and available to every person (Manimuthu et al., 2019).

This ensures that everyone in the community has access to the balance of each account. Each transaction is a document containing the public keys (wallet address) of the sender and recipient and the amount of the transfer. Transactions must also be signed by the sender with their private key. These are all basic encryption. Finally, the transaction is broadcast to the community but must be confirmed first.

Digital currency like Bitcoins is being employed in an extensive manner such as shopping, investment, mining, and other transactions meant for commercial enterprise and so on. Through the amount of surge that has happened inside the industry, more interest is now being rewarded with the aid of Governments and different stakeholders across the globe. Cryptocurrencies have become increasingly more mainstream (Vejačka, 2014).

The mounting usage and attention of people in these coins everywhere in the world and in India shows the need for a premeditated authorized agenda to deal with digital currencies both domestically and abroad. Law enforcement, tax authorities, and legal regulators around the world are working to recognize the concept of cryptocurrency and how exactly to comply with current guidelines and legal frameworks. The decentralization and anonymity of cryptocurrencies have additionally attracted a variety of illegal activities. Of the approximately 1500 additional cryptocurrencies issued since the launch of Bitcoin in 2009, approximately 600 are actively trading (ElBahrawy, et al., 2017).

All cryptocurrencies use the same reward system and underlying blockchain technology, but they often exist on separate transaction networks. Many of them are essentially Bitcoin clones but with slight variations in supply, transaction validation times, and other factors. Others have resulted from blockchain technology's underlying advancements that have been more significant (Di Silvestre et al., 2020).

Digital currency is a practical, secure, and attractive payment system model that can help your business grow. It is also used as an alternative payment method for banknotes, allowing users to easily conduct financial transactions such as remittance, exchange, purchase, and sale. Blockchain technology provides additional security for transactions. While several variables can contribute to a good improvement in the e-commerce, e-business, and e-payment sectors, there are also several negative factors that are detrimental to these kinds of transactions (Agarwal, 2020).

Governments everywhere in the world are concerned approximately using digital currency in money laundering, terrorist investment, and tax evasion schemes. Digital currency is likewise utilized in debatable settings inside the shape of online black markets, which includes the Silk Road. The legal fraternity has to be properly organized with the viable problems and attempt to foresee a maximum of them coming and additionally construct competencies to remedy maximum of them. It is crucial that the legal problems are addressed with the aid of using the legislators earlier than the judiciary is bombarded with numerous proceedings concerning cryptocurrencies. People are switching from traditional money to cryptocurrencies as a result of the push factors, according to the data. Losing faith in the government and financial institutions (Sas and Khairuddin, 2017), insecurity of conventional money (Baur et al., 2015), and government policies on conventional mOney (Baur et al., 2015) are some of these issues. These

findings suggest that governments and financial organizations lack the necessary capacities to oversee the current financial system, resulting in the unsecured nature of conventional money (Hemantha, 2021).

A secret network like cryptocurrency is intended to be an open-source protocol that, through programmable privacy, enables a variety of privacy-preserving tools and applications, thereby increasing the adoption and usefulness of decentralized technology (Pilkington, 2016). Users must have readily available alternatives to programs that violate their right to privacy in the blockchain space. Secret contracts, the newest iteration of smart contracts, enable this alternative. With these contracts, input, status, and output may all be encrypted, giving designers and developers a great deal of flexibility.

Nevertheless, much has been written and researched on cryptocurrency, but there is still no effective method for prioritizing the primary reasons why people invest in cryptocurrencies, especially in industrialized nations where using electronic means is quite uncommon. People are hesitant to employ technological technologies because they don't have faith in them. There is a requirement to look into these subjects. Mostly earlier research has centered on determining the reasons to invest in digital currency without giving enough weight to the primary drivers behind it. This chapter will be able to explore and present valid reasons and arguments for the existence and future of digital currency in India and Africa.

FIGURE 7.1 Dynamics of cryptocurrency: Its parameters.

7.1.1 ADOPTION BARRIERS OF DIGITAL CURRENCY IN DEVELOPING NATIONS LIKE INDIA AND AFRICA

Few people know that comprehending cryptocurrency is a fundamental concept, while for others it is a total mystery. These digital currencies have emerged over the past few years as the next big thing for a select group of investors while remaining a complete mystery to others (Inci and Lagasse 2019). In our society, time has become extremely precious and most individuals have been looking for new payment methods that provide security, both confidentiality and time savings. In the current scenario, most of the payments are made digitally. Investments certainly need a middleman, digital currency offers a different investment possibility by focusing on cryptographic proof for the investors (Kuiziniene et al., 2019; Yuneline, 2019; Joshi et al., 2018) claim that transactions are kept private and hidden because cryptocurrency conceals the identity of the individual conducting transactions. Investing in these various cryptocurrencies is becoming more popular despite several obstacles. A person with financial understanding is more likely to be in favor of using new technology. The familiarity with new technology, the simplicity, and the decision of an individual will also be influenced by the ease of use and the benefits obtained from usage (Gupta et al., 2020) Peer pressure and the availability of the necessary infrastructure also encourage someone to purchase cryptocurrency. People have a strong desire to adopt digital payment methods that could change as a result of technological advancements.

There is no organized system for teaching or understanding cryptocurrencies in African nations. However, it has been noted that a small number of important figures have a big influence on increasing public knowledge and comprehension of Bitcoin. Foundations, Bitcoin exchanges, people, and private companies are all included in this (Kamau, 2022). Twitter, YouTube, Facebook, TikTok, and Instagram are the most popular sources of social media platforms used by people to learn about Bitcoin and other cryptocurrencies. Additionally, they read books, and blog posts, and exchange resources made available by market titans like Binance, Paxful, Luno, and Coinbase. Most African and Indian media outlets avoid promoting Bitcoin and other cryptocurrencies out of concern for the reactions of local authorities as well as for potential restrictions and embargoes imposed by national banks. The biggest global obstacle to cryptocurrency ownership, according to Gemini's 2022 Global State of Crypto report, is education. Since most of the people didn't know how to buy and hold,

40% of respondents from Africa said they hadn't bought any cryptocurrencies. Uncertainty over Bitcoin price volatility and a lack of confidence were two further obstacles to adoption.

Henceforth, there are numerous reasons for barriers to adopting digital currency in developing nations which can be discussed under the following:

a. No law regarding cryptocurrency—As the government has not passed any specific law regarding cryptocurrency, Indians are still in dilemma whether trading and buying in cryptocurrency is legal or not. The Indian government has not taken a full stand on accepting cryptocurrency but has not completely denied cryptocurrency's existence either. Volatility is a major concern for cryptocurrency, African and Indian leaders are quite skeptical because it functions as a decentralized currency which no central authority has control over. Notwithstanding, African countries like Kenya and South Africa have regulatory bodies for crypto firms (*The Guardian* 2022).

b. The actual monetary system may be affected. The virtual currency system can affect the real-world money supply and demand. People might not use real money to buy anything. As a substitute, they will opt for virtual currency as a usage to exchange transactions. On the other hand, some sites will increase the demand for real money by allowing users to exchange virtual money for real money. These instabilities affect the real money system.

c. Lack of advanced technology—As for the mining of cryptocurrencies, supercomputers are required to mint new crypto which India lacks. Hundreds of supercomputers are required to mint a single Bitcoin. Unlike most conventional knowledge blockchain technology is still new, institutions and individuals are still trying to get a grasp of how to integrate it into learning systems, most African countries do not have the facilities required for Bitcoin minting, and understanding how it works is largely dependent on foreign knowledge.

d. Lack of knowledge—As cryptocurrency is still new in India and the crypto market is evolving, people are still learning something new related to crypto. Due to a lack of information, Indians still

fear trading in cryptocurrency. The uses, advantages, and disadvantages of cryptocurrency are still unknown to many. The same goes for Africa; crypto users are left with information they can only obtain from blogs, social media, and other educational sites on the internet. However, crypto firms are emerging with strategies to educate users to utilize the possibilities of cryptocurrency, for example, Binance, a cryptocurrency exchange firm founded by Champeng Zhao, has spearheaded cryptocurrency literacy programs that have educated thousands of users in Africa. (Forbes, 2022).

e. Strict regulations policies—The implementation of strict laws militates against the use of cryptocurrency in African countries like Egypt, Tunisia, Algeria, Morocco, Libya, and Nigeria. Most of these countries prohibit their banks from dealing with crypto firms, thus making it difficult for users in the countries to access brokers and Bitcoin (Forbes, 2022).

f. Fraudulent activities—Due to its decentralized feature and no central authority control, cryptocurrency is prone to fraudulent manipulations. Its security flaws have enabled hackers to penetrate its exchange over time; in simple terms, Bitcoin is susceptible to cyber thieves, leaving users in panic. Cryptocurrencies, like Ethereum, which have an open-source blockchain computing system have been hacked constantly, making large holders lose up to 50 million dollars (Agbo and Nwadiolor, 2020).

7.2 INDIVIDUAL AND LEGAL RISKS TO CRYPTOCURRENCY INVESTORS

The dynamic rise in the value and global acceptance of cryptocurrencies have inevitably come under better inquiry and added burden from worldwide administrations and an excess of supervisory authorities; government bodies, and international organizations have taken drastic and different approaches to cryptocurrencies (Morton, 2020). Loaded with questions of jurisdiction and fraud, these entities kept asking about its benefits to the world market. These entities carefully try to stabilize matters of countrywide money control and the hitches of digital currencies like money laundering and apprehensions of it being used to fund terrorism.

Another point of risk might be that if someone stores their cryptocurrencies on a tertiary service, there is a constant risk of their service being robbed. This is pretty much common in Bitcoin's short history. Thus, the user has to accumulate money in the system instead (Weaver and Neumann, 2018). Due to the novel nature of cryptocurrency, the flaws and oversights come off as huge risks to investors, for instance, without a phrase code, once a user loses his Bitcoin wallet it is impossible to recover except if it has been backed up previously (Agbo and Nwadiolor, 2020). Users must be heavily informed and well-grounded with transactions, risk management, and operating systems of blockchain technology to conveniently trade in the crypto market. The major challenge of Blockchain technology is the difficulty in understanding its operations; many users in Africa do not understand its functions, hence, they become passive users, dependent on automated software to do the bulk of their trading analysis and transactions, this method of cryptocurrency investment pose as high risks to individuals taking such routes.

E-commerce regulations are quite murky in the African Fin-tech ecosystems, bricks and mortar banking regulations that deal majorly with conventional currencies are archaic to cryptocurrencies and other digital financial assets. This disadvantage of no central control is a two-edged sword that also affects investors when ignorantly dealing with fraudulent firms and digital assets (Chivunga and Tempest, 2021). Popular cryptocurrencies have no fixed value rate; investors' funds are not secured in this regard due to the fluctuating tendencies of these digital currencies. Digital currencies are traded like commodities and are susceptible to serious fluctuations. The year 2022 reflects an all-time low in the crypto market, making investors lose billions globally, between 2021 and 2022 investors witnessed a huge gap in Bitcoin with over 150% increase with a worth of over 68,991 US dollars per Bitcoin in 2021 and a fatal nosedive in 2022 with a worth of 38,000 US dollars in May 2022 (dw.com, 2022).

The Central African Republic (CAR) in 2022 made a bold move to adopt Bitcoin as the country's legal tender, making it the only nation in Africa and the second nation in the world to make Bitcoin a legal tender. The Central African Republic lawmakers unanimously adopted the bill to make Bitcoin its authorized tender along with the CFA Francs; this measure was fueled by the ambition to circumvent existing colonial financial limitations. Unfortunately, proper structures like good Internet and technical know-how of how Blockchain technology works were not put in

place for this new policy to thrive, thus posing a huge risk to the country's economy and financial institutions as opposed to solving its financial problems (Guardian, 2022).

Cryptocurrency's effect on Africa's energy, industrial, financial, and consumer sectors is a major blow to financial firms, with each 10% increase in the crypto market, African firm's value reduces by 0.76%. Cryptocurrency is at a cutting-edge level of financial transactions and profit-making for individuals and organizations alike, leaving these conventional financial firms with little or no choice to either adopt new systems or be ready to be pushed behind (Sami and Abdallah, 2022). This stands as a disadvantage to financial firms with little experience as crypto directly affects the macro and micro economy of the continent. According to Sami and Abdallah (2022), there is an unbalanced response of firms in Africa to the cryptocurrency market, industrial, energy, and financial firms that offer low returns responded negatively while some sectors are not affected by the crypto boom such as real estate and IT sector. The only ways firms in any sector could thrive in a buzzing market like Africa's is to offer services that offer sought-after solutions and also be a game changer to beat the competitive market.

7.3 REGULATORY FRAMEWORK PERTAINING TO CRYPTOCURRENCY

Building an inclusive agenda that regulates all aspects of cryptocurrency trading seems like a daunting task. RBI can provide an administrative presence in the crypto space, depending on the structure of the blockchain.

The cryptocurrency space in India will not be regulated unless an appropriate regulatory framework is in place. While the Supreme Court ruling has revitalized the cryptocurrency market and India's cryptocurrency startups are launching and expanding new products, there are some concerns due to reports that the Ministry of Finance has submitted a government bill for interagency consultation that can ban cryptocurrencies. The central viewpoint of RBI concerning digital currency is that they are not legal tenders and cannot be used in the same way as the usual rupee. In fact, without regulation, using digital currency will pose risks in the future. For this, RBI has issued warnings several times as well.

In January 2021, "A high-level Inter-Ministerial Committee (IMC) constituted under the Chairmanship of Secretary (Economic Affairs) to

study the issues related to virtual currencies and propose specific actions to be taken in the matter recommended in its report that all private cryptocurrencies, except any virtual currencies issued by the state, will be prohibited in India." Further, a report revealed that "India could propose a law banning cryptocurrencies, fining anyone trading in the country or even holding such digital assets." Further, in November 2021, the Standing Committee on Finance, Blockchain, and Crypto Assets Council (BACC), among others, concluded that banning cryptocurrencies is a question, instead, it should be regularized. Also, investors must pay taxes on trading the cryptos.

Only a few countries in Africa have created regulations for cryptocurrency. Cryptocurrency is largely unregulated and most African states continue to stand against cryptocurrency payments (Crystal, 2021). The lack of legal restrictions on digital assets is largely influenced by the nature of crypto, which is its newness, and most countries' governments especially in Africa and India are still trying to figure out how to go about it. In Africa, Kenya and South Africa are the only countries that have made attempts to create regulatory agencies to oversee crypto firms and users.

The Central Bank of Kenya receives authority from the National Payment System Act to supervise all payment services in Kenya, this is to ensure a safe space for investors (Freeman Law, 2022). Cryptocurrency firms in Kenya must obtain licensing from the authorities before operating in Kenya.

In 2014, the South African Reserve Bank (SARB) issued a position paper that cryptocurrency is not legal tender in South Africa; the SARB warned on the risks involved for investors which include; volatility, exchange regulations violations, terrorist activities, and money laundering. However, on April 6, 2018, the South African government issued another document on tax regulations for cryptocurrencies called the "clarification on the tax status of cryptocurrency"; this document stipulates that all income tax rules apply to cryptocurrency transactions and all taxpayers are expected to declare their crypto incomes to avoid penalties. The South African government went further in providing regulatory agencies by creating the "Crypto Asset Regulatory Group"; this group is saddled with the task of investigating all cryptocurrency activities in the country with representatives from key financial agencies to ensure a safe arena for investors (Govchain, 2022).

While these countries are making moves to promote cryptocurrency activities in their territories, some countries are giving stern warnings against crypto transactions to their citizens. The Central Bank of Nigeria (CBN) issued warnings in 2017 to financial institutions in the country

on the dangers of cryptocurrency due to its decentralized algorithms, and no available substantive regulatory policies. The Central Bank of Nigeria made attempts, later on, to create a white paper for cryptocurrency regulations but failed due to the complexities of controlling blockchain technology, thus, concluding that cryptocurrency is a gambling platform that could Champion the rise of Ponzi schemes that could be detrimental to investors. Despite these controversies, Nigeria is the third main holder of Bitcoin globally (Agbo and Nwadiolor, 2020).

Between 2017 and 2018, cryptocurrency transactions were banned in six African countries, which included Algeria, Morocco, Libya, Zambia, Namibia, and Zimbabwe. While other countries in Africa choose to be indifferent toward the crypto trend, some have gone beyond their peers to create policies toward crypto regulations in their countries (McKenzie, 2018). In the second quarter of 2022, cryptocurrency has been banned in 26 African countries. This move shows the apathy of the African government toward creating regulatory policies for transactions.

7.3.1 COVID-19 IMPACT ON CRYPTOCURRENCY

COVID-19's implications have been proven to have a substantial impact on both economic and financial markets. Because of the virus, Bitcoin has experienced a lot of volatility in recent months. One of the key causes for Bitcoin's extraordinary volatility is investor attention drawn to it in pursuit of a safe haven asset. The behavior of cryptocurrencies is influenced by several underlying elements, including the asset's advantages and disadvantages, as well as national and worldwide economic uncertainty. Cryptocurrencies have shown long-term resistance to COVID-19, resulting in their stability. Furthermore, unlike stocks and commodities, cryptocurrencies provide huge diversification benefits. The reason for this is that the prices of important commodities like gold, silver, crude oil, and grain, as well as stock prices, are all influenced by the same variables. As a result, their returns are heavily connected, providing less diversification.

COVID-19 has positively affected the crypto market as when the stock market was crashing down continuously during the pandemic, the only alternative was the crypto market which was giving high returns but at the same time, it consisted of high risk. People started understanding the crypto market during this lockdown and also added to their portfolio to earn profit.

This universal pandemic has created economic uncertainty and financial discomfort. It turns out that the only way to reduce the anxiety caused by this uncertainty is to develop a treatment for COVID-19. People found various alternatives to increase their capital. They started investing in crypto where if they were given a chance, they would become millionaires overnight. Though the risk was huge. But they got one crucial asset which proved to be an effective hedge during economic turmoil (Jaffer, 2021).

The pandemic came with a pool of uncertainties and hopelessness, many folks were looking for alternatives as bricks and mortar jobs and establishments were on lockdown. Cryptocurrency, although popular, became a go-to for almost everyone to escape hardship and boredom. In most African countries, people started taking crash courses on how to trade crypto assets, and carry out transactions to reap the benefits of low transaction rates and high profits (Financial Times, 2021). During the pandemic lockdown, there was a recorded increase in unemployment, businesses were either laying off staff or not paying them, and people became more creative with their activities and ways to create other sources of income, despite the high risk involved more people were willing to take risks and maximize profit (Adesanya, 2021). The effective remittance role in the payment system which does not entail the restrictions of traditional banking systems is an added advantage for African users, the pandemic era brought a spike in cryptocurrency transactions within and outside the continent, and reviews so far of crypto transactions have been deemed as reliable and effective with minimal charges (Brookings, 2022). Bitcoin had an increased adoption rate in 2020 with a staggering 100 million users in the third quarter of 2020 (TechCrunch, 2021). Notwithstanding the ban, cryptocurrency investments have been on the rise in countries like Nigeria, South Africa, Ghana, and Kenya pandemic and post-pandemic. In general, merchants in Africa have started accepting cryptocurrency payments and this explosive cryptocurrency growth is being fueled by the increasing acceptance of digital assets (Guardian, 2022).

7.4 SCENARIO AND ACCEPTANCE OF CRYPTOCURRENCY IN INDIA

Cryptocurrency works through a network that employs a huge number of computers, which is why it is decentralized, and control of the money is not confined to the hands of a government or a central authority.

Cryptocurrency was a novel phenomenon that permitted people to purchase, sell, invest, and trade in money that had no material existence in an era when everything was available online. It stands out because, unlike other payment systems, it is decentralized and has no third-party involvement, which is why any cryptocurrency transaction is guaranteed to be successful. In India, a of total 40% population does have Internet access. In 2012, Bitcoin transactions started in India, and also companies such as pioneers like BtcxIndia, Unocoin, and Coinsecure accepted Bitcoin as a medium of exchange for their services; from there, Bitcoin started earning popularity gradually but it has a long way to go as the Indian government did not made any bill or made rules regarding the cryptocurrency due to which there always have been fear among people that Bitcoin can be banned anytime and they may suffer loss.

The crypto market in India has risen from a modest level in 2013 to what it is today, thanks to the spread of crypto trading and exchange platforms such as coins witch and WazirX which have given Indian users a platform where they can trade in cryptocurrency. When Prime Minister Narendra Modi declared the start of a demonetization policy on November 8, 2016, and people started to realize in the near future there might not be a physical form of money, they started looking for alternatives and that's how cryptocurrency started gaining more popularity in India and they also saw Bitcoins as an investment from which they will be benefited in future. On February 1, In the presentation of the Union Budget for 2022–2023 on Tuesday, Finance Minister Nirmala Sitharaman recommended a 30% tax on revenues derived from cryptocurrency trading. The finance minister also announced that the Reserve Bank of India will launch its digital currency by the end of the financial year 2023. A TDS of 1% on crypto is proposed in the budget 2022–2023 by the finance minister of India. The cryptocurrency market is vast and is increasing in India. For many, the imposition of a 30% tax on earnings gained from its trading is a severe blow. The announcement has generated many concerns. Indians are still playing safe with cryptocurrency as the Indian government is not taking a full stand on accepting cryptocurrency fully and also not passing a specified bill on cryptocurrency. But at the same time imposing tax has given hope that trading in crypto is finally legal which had a positive impact on crypto. As per the SWOT analysis done in the paper (Sharma, 2022), there are many strengths to investing in the market as a decentralized system, no involvement of third parties, etc. However, threats are there. As no party

is involved there are many chances of scams and fraud and so people are no longer able to develop trust to invest in crypto. On the contrary, there are 20 million Indians who have captured the crypto market. So, it can be said that India is a mature market in terms of investing in cryptocurrency.

It is estimated that Indians have invested more than 1 billion US dollars in the cryptocurrency market alone, even though the picture regarding cryptocurrency's legality remains hazy and unclear. This causes a lot of confusion among investors because the government has yet to take a firm stance on where cryptocurrency stands today and, more importantly, what its future holds.

The acknowledgment of digital currency as a mode of payment by Indian firms, as Microsoft, Wikipedia, AT&T—will additionally support the development of the Crypto Tech industry in India (Kaushik, 2021).

7.5 GROWTH OF CRYPTOCURRENCY AND ITS CURRENT POSITION IN AFRICA

Cryptocurrency has been a method of transaction and money-making for millions of Africans. Blockchain technology in cryptocurrency functions as a public ledger of all Bitcoin transactions, the blockchain grows linearly with every completed block with full information on addresses and balances from the first to last completed block (De le Rey and Chishakwe, 2016). The centralized system of financial operations that was in play before the blockchain technology was rigid in its executions, blockchain technology came as a solution to these flaws by providing a decentralized automated system of financial monitoring for users. African fintech (Financial Technology) is booming and blockchain technology is now a huge part of it. The decentralized system of blockchain technology allows for seamless and transparent transactions and it also creates unending possibilities (Diwakar, 2022). It is imperative to note that blockchain technology is not only relegated to Bitcoin and other cryptocurrencies alone; some cryptocurrencies are not decentralized and thus the blockchain algorithm is not compatible with them. Blockchain technology is also applicable to other digital assets, transactions, financial instruments, and smart contracts that are cryptographed and digitally transferable. Bitcoin and other cryptocurrencies built with blockchain technology function under the public

blockchain network which uses the distributive ledger technology (DTL) (Pilkington, 2016). Bitcoin, which is the most traded cryptocurrency, has other popular alternatives called altcoin, and the most used altcoins in Africa apart from Bitcoin are Litecoin, Dash, Lisk, Monero, Akoin, and Ethereum.

Currently, Africa is the third fastest-growing cryptocurrency market in the world; between January 2021 and January 2022, report shows a 1386.7% increase in monthly transactions in Africa. South Africa, Nigeria, Kenya, Uganda, and Ghana are the leading countries in Africa in terms of cryptocurrency transactions. Cryptocurrency found its way to the African market around 2010, no doubt, before cryptocurrency popularity, the continent was familiar with digital transactions in the form of mobile money and remittances (Crystal, 2021). This form of digital asset trading became a doorway to wealth for millions of Africans. Governments of African nations became skeptical about the legalities and influences of cryptocurrency on individual country's financial policies hence they issued warnings about the possible dangers. Despite these warnings, African investors continue to take high risks, due to high inflation and devaluation of national currencies, users are motivated to beat the curve and increase their gains. Also, low transaction fees are another factor for increased usage of digital assets, because users pay less than 0.001% of transactions made in cryptocurrencies (Akamo, 2022). Cryptocurrency firms are growing and thriving in the African financial space, and more indigenous apps and platforms are being established to serve investors. Below are the top nine cryptocurrency exchange platforms in Africa both local and international.

1. Kucoin
2. Binance
3. Quidax
4. Futures exchange trades (FXT)
5. Remitano
6. Baxful
7. Buycoin
8. Kraken

May 2022 witnessed a bearish cryptocurrency market; this instability has caused investment activities to slow down. This occurrence has confirmed the volatile nature of crypto assets. Countries in West Africa

are faced with harsh economic policies and conditions and at the same time dealing with the cryptocurrency crash, Nigeria being the second largest crypto market next to South Africa is facing a huge downturn due to the economic recession faced by investors in the country (Sangolade, 2022). Inflation, the end of the pandemic era, and volatility in crypto assets played a major role in Bitcoin's fall (Shirdan, 2022). The pandemic era witnessed a surge in investment, people invested money they couldn't use in cryptocurrency, at the time more and more investors were taking that route which led to an increase in Bitcoin's value. Since most places globally are open and people are returning to their activities. Reports show that the war in Ukraine also contributed to the crash of cryptocurrency in 2022; in the first 24 hours of the war, the global crypto market went down to 1.57 trillion dollars. The price of Bitcoin went down by 8.1%, investors became more careful with what they invest money in, and some started selling off their digital assets due to uncertainties, at least until some form of normalcy returns in Eastern Europe (Shirdan, 2022; Outlook, 2022).

KEYWORDS

- **cryptocurrency**
- **legal barriers in cryptocurrency**
- **investor's perception**
- **investor's conviction**
- **cryptocurrency ban**

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CHAPTER 8

Fintech and Artificial Intelligence: An Overview of Contribution to Banking, Investment, Financial Education, and Microfinance

GARGI SHARMA[1], UMESH SOLANKI[1], and VIKAS SOLANKI[2]

[1]*TAPMI School of Business, Manipal University Jaipur, Jaipur, Rajasthan, India*

[2]*Chitkara University Institute of Engineering and Technology, Chitkara University, Punjab, India*

ABSTRACT

In today's scenario, due to need or demand, every part of society, commerce, and economy is influenced by technology. The financial sector, one of the most important parts of the economy, is no exception to this. Finance with technology together have revolutionized the world economy. In this context, the banking sector is also adopting financial technology (fintech), which is putting a new route ahead the banking full of prickles. There are some threats to the traditional financial service industry in the coming future because of this exposure to fintech. However, various kinds of opportunities are also opening for financial services to tap into the unbanked areas including banking, trading and investments, financial education, credit management, and financial inclusion. With the digitalization of the financial system, fintech grew up rapidly. Fintech has been playing a critically important and advanced role in leading modern,

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digitalized, and technologically advanced societies, financial systems, and hence, economies. The financial system is one of the most prominent systems integrating with artificial intelligence (AI).

AI contributes a lot to the financial system by creating a lot more opportunities. Various applications of AI technologies will contribute to different in financial products, channels, and methods of providing services, credit financing, investment decision-making, and risk management. Financial institutions are including artificial intelligence in their operations and integrating these with financial services. The growth and development of AI-based financial services and hence, fintech firms has motivated other players too and encouraged collaborations and coalitions among financial service providers, technocrats or technological institutions, and wealth managers. Strong promising features of artificial intelligence of cost and time efficiency, increased differentiation, and intelligent services make it attractive across all dimensions as fintech companies can give more convenient experiences of financial services to their customers at lower costs.

The implementation of AI in the financial industry has been slower than the others and acceptance of its powers too due to various reasons such as volatility, uncertainty, complexity, ambiguity, regulations, lack of cyber security, loopholes in technology, and lack of fixed and sound standards.

AI is also used in financial education and financial inclusion to make for their advanced use in financial inclusion, banking, investment, financial management, credit decisions, trading, business transactions, and hence, financial education, etc. Automated creditworthiness assessment and robotic financial advice are examples of AI applied within the financial system.

In this chapter, we will try to explore the competencies and competitive advantages of financial institutions that adopt the latest fintech technologies, and their future opportunities in fintech with AI.

Fintech brings technology to financial services and AI brings a human touch to that technology. The new opportunities opened by fintech, and AI will impact directly or indirectly to the profitability or earnings of the banks and other financial institutions within the financial system by increasing their sales and profit margin, widening the clientele base, area of work, and boundaries. It will also reduce the cost, time, and fraud in services through automation.

There will be some positive and negative impacts of the combination of these two in financial services. But positive aspects will be more appreciable.

8.1 INTRODUCTION

With the exponential growth of technology, financial services are reeling under new disruptions. Digital transformation, fintech, artificial intelligence (AI), machine learning (ML), and big data (BD) are changing the face of the industry. We have seen a lot of fintech companies come up with disruptive solutions to address issues like accessibility, trust, and security in financial services. AI, ML, deep learning (DL), and BD have emerged as game changers for banks, stockbrokers, and third-party financial advisors by automating many mundane tasks that these institutions perform every day. These tools enable them to tackle complex problems using data science. The applications of fintech and AI within banking, investment, financial education, and microfinance are vast and continue to grow. Financial institutions are only just beginning to unlock the potential of these technologies, but the potential impact is significant. For example, fintech can help financial institutions offer more personalized and tailored services to their customers, as well as improve the efficiency of back-end processes. Meanwhile, AI can be used to identify patterns and anomalies, helping to prevent fraud and financial crimes. In the area of financial education, fintech, and AI can be used to create more engaging and interactive content, as well as innovative ways to present it.

8.2 LITERATURE REVIEW

AI and ML-enabled robots and medical services can help healthcare professionals as well as doctors to treat patients without coming into direct contact with them and sharing the loads. AI and DL can help in detecting and analyzing stress level patterns and mental health during such pandemics (Solanki Baliyan, et al., 2021).

Healthcare professionals can be protected and supported in surveillance, thermal scanning, epidemiology, patient diagnosis, research, and vaccine evolution, and can fight with COVID-19 outbreak or similar other pandemics, etc. through AI- and ML-enabled mechanization (Solanki, Baliyan, et al., 2021).

AI and its subbranches are a very powerful technology that has proven capabilities in various fields such as disease detection, health, stock market, agriculture, robotics, finance, image processing, etc. (Lamba et al., 2021; Solanki, Solanki, et al, 2021).

The banking sector is inclining toward the use of AI in many aspects to sustain in the competitive arena. It is hidden in the future how a machine

algorithm would be able to replace the real-time decision-making capabilities of human resources effectively (Padmanabhan and Metilda, 2021).

Banks are using AI mainly for the purpose of queries resolving points of customers as chatbots. This feature is very helpful in financial inclusion as a financial advisor. Some of the banks are going to the advanced level such as the State Bank of India (SBI) for Chapdex, and Industrial Credit and Investment Corporation of India (ICICI) for automating work office. On the contrary, at the preliminary stage, blockchain is used in banks mostly for know-your-customer (KYC), proof of concept (POC) documents storage, and remittance purposes. Now blockchain is used for financial inclusion as the online account opening and transfer of funds as well. blockchain and AI have immense scope in the financial sector, that is, the banking sector. AI is a major participant in the banking sector. Still the area of AI uses is unexplored, and it can be used at many levels of financial matters like compliance and management part (Meghani, 2020).

AI is already implemented in some areas of the banking arena but credit risk calculation, credit rating, better decision making, efficiency, bond rating, and image recognition can be the future scope. AI is the replacement as well and it can be proven full-fledged or semi-fledged performer as compared to human resources (Veerla Veeranjaneyulu, 2021).

The different algorithmic approaches could be implemented to dig out good results in the analysis of the stock market. The real stock market is composed of more complex data to work upon so accordingly the approach can be selected (Gao Zhao, 2019).

The microfinance arena is full of distributed data and human intervention as the end-users are of rural backgrounds. In view of the said context, the tree-based algorithms such as the decision tree algorithm and AdaBoost (ML approach) are useful to analyze the credit score and hit more lending. Further, the study suggests that social media data can be very helpful in creating a model for online and mobile penetration. An artificial neural network (ANN) model is also implemented for microcredit score forecasting (Bakshi Komal, 2021).

AI is assessing the consumer with voice and face recognition systems, interacting machines with human voices, organization of data collection, and market information, financial advisory, credit management, price setting, fraud and risk assessment, natural language processing, applications leading to fintech, and integration with other emerging technologies including Blockchain and cryptocurrencies (Milana and Ashta, 2021).

AI is impacting the banking sector in many aspects such as core banking, operational performance, customer support, etc. AI is creating a new banking model that is cost effective, technically sound, and more customers oriented. The future perspective of AI is immense and penetrates all areas related to banking and analytics (Kaur et al., 2020).

According to the study, microfinance banks have a limited inclination toward AI in record keeping due to some restrictions in that area. The microfinance bank requires some internal and international cooperation to adopt AI in the record keeping (Longinus, 2018).

AI is initially implemented in customer-centric services but gradually covered compliance, fraud detection, and credit processing. In the future, AI will be the path to achieving the goal of financial inclusion. Using blockchain technology with AI, strong cybercrime protection tools can be developed (Vijai, 2019).

AI adoption is still not highly favored by the financial industry. AI adoption depends upon many factors. The impact of AI is also related to the way of implementation and the ability to use it by the organization and its employees (Kruse et al., 2019).

AI is an effective tool in cutting costs, minimizing risk, and providing personalized services (Ashta and Herrmann, 2021).

AI adoption is in its nuisance stage in the financial industry due to some constraints such as complex algorithms, nonavailability of infrastructure, and decreasing level of clarity and skill set. Banks are using chatbots and other techniques of AI to create innovative customer services (R. Vedapradha and Ravi, 2018).

The worldwide development of digitalization has been taken into account and out of this AI opportunities have been explored in the boundaries of Bahrain. Already some of the players in the banking industry have already deployed AI in the working processes such as voice recognition and human machine (robots). In the upcoming future AI will be extending its hands in other areas of banks because of its highlighting features like cost cutting and efficiency. When it comes to some innovation or new technical up gradation, it brings some risks exposures as well. AI is also not untouched by this. However, the threats are to be taken into account and addressed; accordingly, the opportunities are immense for AI in the banking industry (Abdulla et al., 2020).

According to the study AI is offering diversified tools to financial industry and leaving behind the old banking procedures. AI is contributing

toward automate many processes starting from the internal administration to financial stability. The digitization brought many security issues to the financial world and to address that new functionality is being developed through AI (Ambika et al., 2020).

AI is an effective innovation in risk and fraud identification and resolution. According to the study, many factors contribute toward the use of AI (Rahman, Ming et al., 2021).

According to the study many factors contributes toward the adoption of AI in an organization. After the consideration of all the factors, policies can be evolved toward the implementation of AI tools for effective use (Sengupta and Srivastava, 2020).

The customers are well aware of the AI use in the provided services in banking and require more customized, innovative support from AI. AI is more used in the field of KYC/anti-money laundering (AML), security aspects, and chatbots. The perception of the consumers in reference to AI is very important in banking and financial services. AI is extending its hands to customers, marketing, risk mitigation, and compliance. The banking sector is inclined toward using AI in many aspects to sustain itself in the competitive arena. It is hidden in the future that how a machine algorithm would be able to replace the real-time decision-making capabilities of human resources effectively. (Geetha, 2021).

This study shows that now customers are adaptable to the digital mode. AI is still unaccepted in every part of work. Neobanks are in their nuisance stage due to the gap existing in related facts and skills (Thayaseelan et al., 2021).

8.3 OBJECTIVES OF THE STUDY

1. To study about fintech and AI.
2. To study about implementation of fintech and AI in different areas of finance such as banking, investment, financial education, and microfinance.
3. To study the impacts of AI in the finance industry.

8.4 DISCUSSION

"Fintech" money is handled through technology. Money-related matters such as investments, payments are on a single click of the user of mobiles, the Internet, and other innovations. Fintech has opened the path of

disruption of brick and mortar-based financial institutions to extend their services through technology.

Global fintech revenue has increased from $128B in 2018 to $310B in 2022. It has gradually increased year by year as it was $159B in 2019, which increased to $199B in 2020 and reached $248 in 2021 (www.T4.ai).

The pace with the fintech market is increasing; the financial services are going to be in fintech services only. In 2020, the global fintech market stood at size $110.57 billion whereas the prediction of 2030 is $698.48 billion by 2030, that is, growth of 20.3% compound annual growth rate (CAGR) from 2021 to 2030.

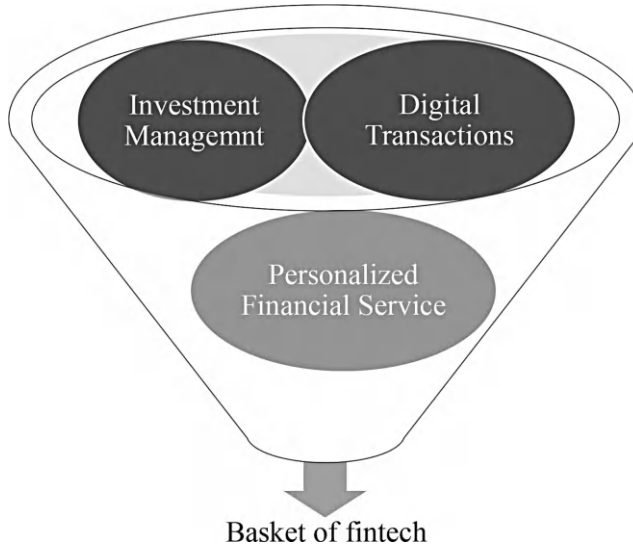

FIGURE 8.1 Basket of fintech.

Fintech is providing the solutions to different area of finance through the implementation of different technologies such as AI, blockchain, application programing interface (API), data analytics, and robotic process automation.

8.5 AI: THE NEW PATH

Fintech developed a new era of financial offerings to the customers. Now, one step ahead the technological services are analyzed on data basis and

extended through human touch. AI is all about developing a system that can think and provide a real-time solution like a human. AI is used in many services such as medicine, education, finance, and investment through Blockchain, ML, virtual presence, RPA, etc.

The global AI market is expected to grow from $387.45 billion in 2022 to $1394.30 billion by 2029, at a CAGR of 20.1% in the forecast period. The global AI in the fintech market size is expected to reach $41.16 billion by 2030, from 2022 to 2030 growing at a CAGR of 16.5%. From 2023 onwards, AI has become the key player in the following areas to provide the advanced experience of fintech.

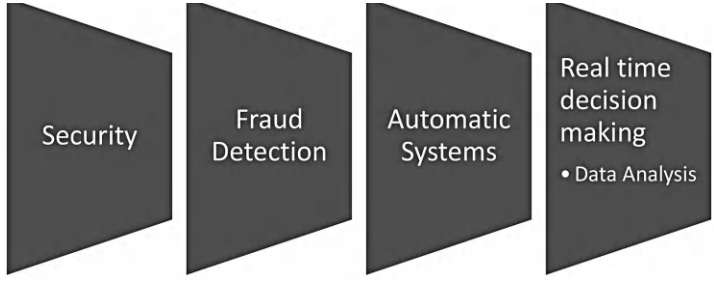

FIGURE 8.2 AI in fintech.

8.6 ANALYSIS AND INTERPRETATION

8.6.1 UPSTART

"Upstart," founded in 2012, is an AI-based lending medium that uses factors that are not traditional such as employment and education, to predict the creditworthiness with the partnered banks and institutions.

8.6.2 MODEL

Initially, "Upstart" used a model based on income and default prediction to assess the creditworthiness of a borrower. Apart from the factors that are used in traditional banking income, credit reports, and FICO scores, Upstart AI uses education variables—area of study, colleges attended, standardized test scores and grade point average (GPA), and work history for a statistical model of the borrower's potential and tendency of repayment.

Currently, Upstart is working based on the following models.

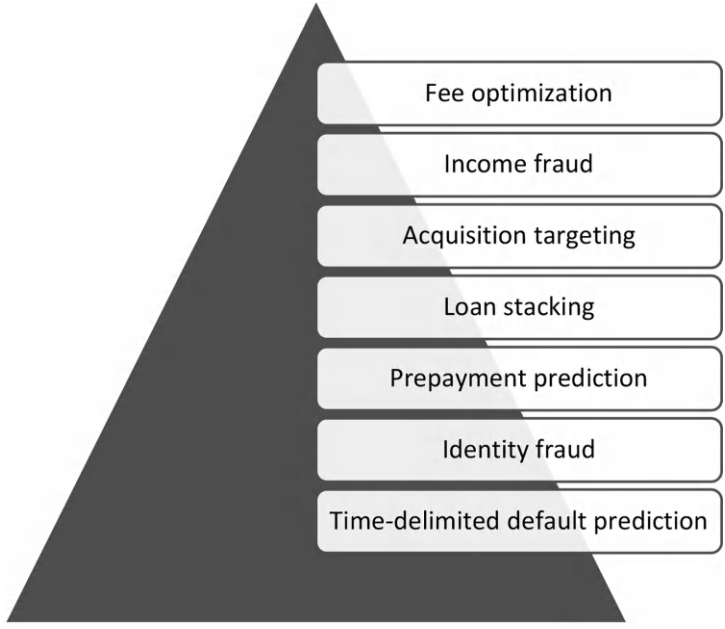

FIGURE 8.3 Upstart working models.

Services:

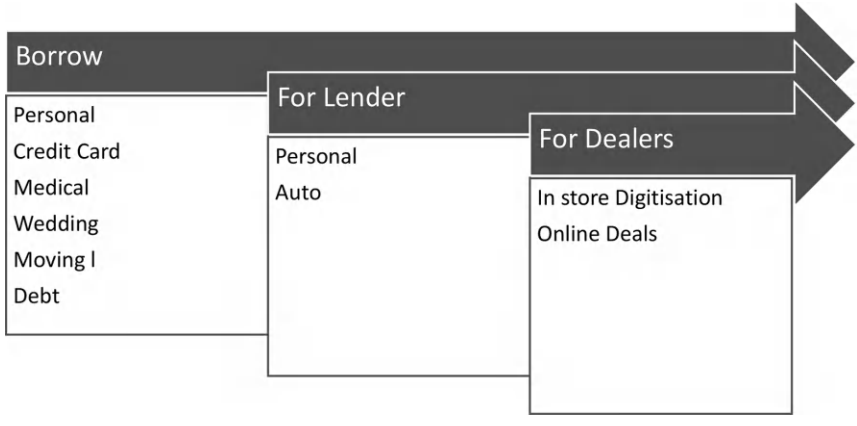

FIGURE 8.4 Upstart services.

Highlights

- With its models, Upstart claims 75% lower default rates than traditional banking credits and 173% more approvals.
- In fiscal year 2021 (FY-21), Upstart has achieved $800 million in revenue.
- Dealership increased to 291 in quarter 4 (Q4) of 2021 from 91 in Q3 of 2020.
- Sales increased 69% in 2020 from the previous year.
- In FY-21, the revenue touched the figure of $848.59, with an increase of **72.5% from the previous year**

8.7 SOFI

SoFi Technologies, Inc. was founded in 2011 as a finance institution for online services with a market cap of $7 billion. It offers a range of services in finance and investment space.

FIGURE 8.5 SoFi's models.

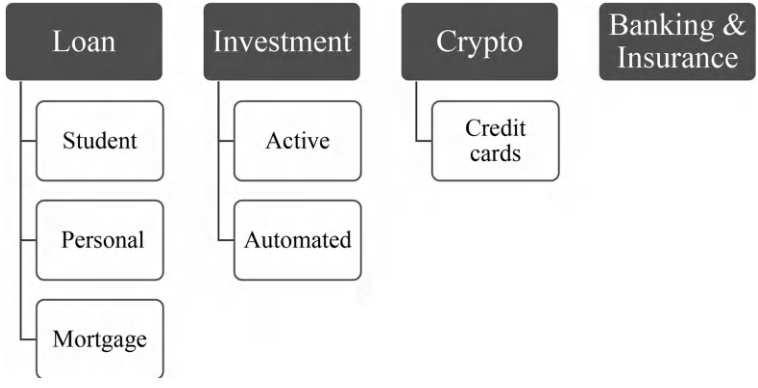

FIGURE 8.6 SoFi's service line.

Highlights

- The integration among technology, risk protocols, and working processes is vertical.
- It has a 2.08% part in the banking industry.
- The net revenue in FY-21 was $985 million, that is, a 74% increase from the previous FY-20 and adjusted revenue was over $1 billion.
- 3.5 million members increased in FY-21, that is, 87% more than that of FY-20.
- The total products increased to 5.2 million, that is, more than a 200% increase compared to (more than) that of FY-20.
- Galileo's tech blockchain technology-based tech was acquired in 2020 and achieved 67% enabled accounts in FY-21, that is, 100 million. The implementation of Galileo's tech will make the better customer experience through fast and easy access.

Galileo's has seen 6 quarters of accelerating growth in total accounts from the beginning of 2019 to the third quarter of 2020. Year-over-year (YoY) growth has changed in millions as follows:

- In 2019: Q1 (8%) 17, Q2 (23%) 20, Q3 (30%) 21, Q4 (62%) 25
- In 2020: Q1 (75%) 30, Q2 (83%) 36, Q3 (131%) 50

Source: Investor Relation

In Q3 of 2020, Galileo's digital accounts reached to the figure of 50 million in the world as compared to 21 million in 2019. SoFi can benefit in the following ways:

1. Both companies can utilize the customer base of each other. The customers of both companies can cross-sell and cross-buy.
2. The service quality will be increased to deliver advanced services.
    - After the acquisition of Technisys in February 2022, SoFi was able to deliver a range of services on API basis. With these developments under consideration, management is expecting an increase in revenue by the acquisition and expects to be approximately $500 million to $800 million annually through year-end of 2025.

8.8 RAZOR PAY—THE UNICORN

Founded in 2014, and funded $815.7 million (in June 2022)

Revenue $110.61 million (or Rs 844 crore in FY-21)
Valuation $7.5 billion (in December 2021)

"Razorpay," a fintech venture was founded in Bangalore, India in 2014. It was started as a payment solution for online payments. It provides a range of payment services to ease businesses, personal, start-ups, and others. It is not only providing solutions for payments but also providing an integrated system of managing it with security. The Reserve Bank of India (RBI) provided Razorpay with the status of payment aggregator as well.

Now Razorpay extended its line of product to neobanking and credit providers to Small and medium enterprises through Razorpay capital. The company has reached to the figure of 5 million in supporting the payments including the huge giants such as Facebook, Zomato, Swiggy, Ola, Indian Cred, Oil, and more.

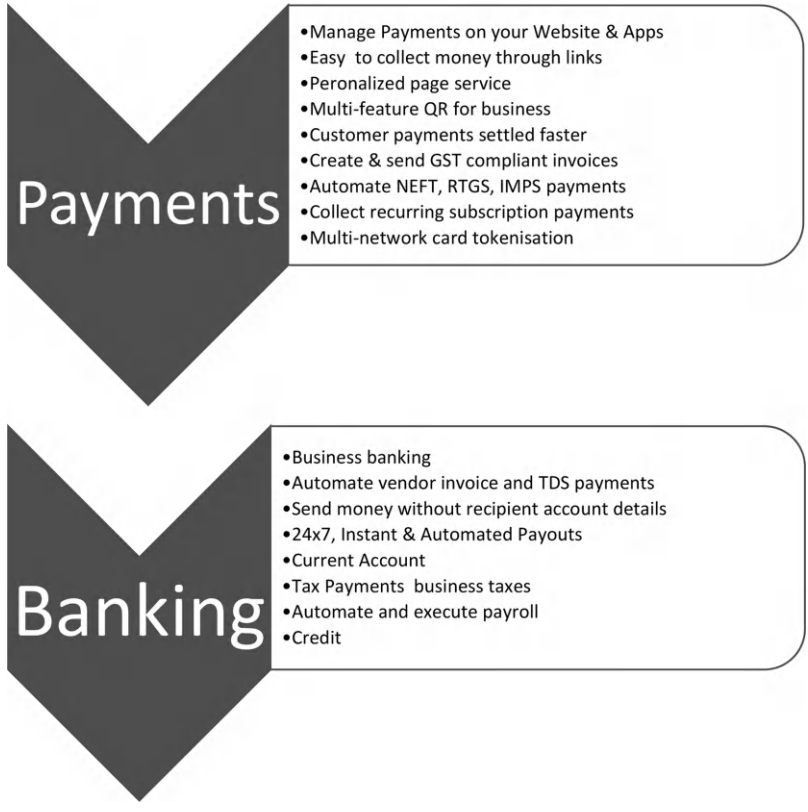

FIGURE 8.7 Razorpay's series of services.

Highlights

- The SME lending venture is Razorpay Capital, a small and medium enterprises credit solution that reached $30 million in disbursements.
- The introduction of Razor X was in 2018. AI-based service Razorpay X provides one-door solutions to all money-related matters of business.
- These new AI innovations are predicted to add 35% of the total company's revenues, that is, 5% more than the previous one.
- The month-on-month basis growth is 40–45%.
- The earnings in FY-20 were at the level of ₹5194 crore, and have grown to ₹844 crores in FY-21.
- The merchant increase is expected to rise by 10 million in FY-22 from 8 million.
- The total payment volume increased to $60 million in 2021, that is, 20% more than the previous year.
- The company is reaching to more than 50 banks across Asia and Africa.
- 60% increase in expenses from FY-20 to FY-21.

8.9 LENDIGKART

Founded in 2014

"Lendigkart" is a fintech start-up based on BD analysis to assess the credit quality of SMEs. It works on the current financials of the customers with its available tools to make them able to have capital in one click.

FIGURE 8.8 Lendingkart's services.

Model

- 2gthr – Enables a full-fledged lending experience to the borrowers.
- xlr8 – Real-time single window access
- Cred – Credit score of the borrowers based on the Lendigkart model
- Atom/Zero Touch – Microlevel processing for the customers

Highlights

- Capital adequacy ratio remained at 38.74% at the end of FY-21.
- Investments in AI and ML to enhance customer experience.
- New credit to more than 17,000 businesses worth Rs 1100 Cr in FY-21.
- Revenue generated in FY-21 was ₹500 crores.
- Assets under management (AUM) were ₹2465 crores in FY-21.
- More than 550 collection agents and 51 collection agencies with live tracking mobile app; 1 collection agent for every 100 loans, which is the best in the industry.
- More than 8,00,000 loan applications as of March 2021.
- Credit disbursement of ₹1,09,841.50 lakhs in FY-21.
- Gross income increased by 5.63% from ₹46,430.28 lakhs in FY-19–20 to ₹49,045.10 lakhs in FY-20-21.
- Presence in more than 2000 locations across India.
- CGTSME covered portfolio.

8.10 SUMMARY AND CONCLUSION

Fintech brings technology to financial services and AI brings a human touch to this technology. The new dimensions opened by fintech and AI impact directly or indirectly to the profitability or earnings. Using the fintech and AI-based application; banks are estimated to save $447 billion by 2023. Some uses, benefits, and impacts of these are:

- Identification and analysis of behavior patterns
- Widened the area of work and boundaries
- Increase in sell
- Increased margins
- More cliental base
- Accuracy

TABLE 8.1 Impact of Fintech Tie-up on Banks.

Bank	Tie up fintech	Facility	Use	Impact
Royal Bank of Canada	Extend	Online credit card application	For bank employees	Risk-free Customer base increases
ING	Kabbage	Single digital platform	For managing digital subscriptions, Lending services	Scale up cross boarder reach
Bank of America	Zelle	Solution of digital mobile transactions	For customers	$27 billion worth of transactions (100 million) in the first three months of 2020
Barclays	Flux	Alternative to paper checks in the form of digital receipts	For customers	To help preserve the environment. Cost cutting
Eastern Bank Limited	X Infotech	Migration of the card issuance system from magnetic strip to Europay, Mastercard, and Visa (EMV) chip cards	For customers	This authentication process is more secure and minimizes risks of fraud
Bank of America, Chase, Wells Fargo, and Citi		Embedded fingerprint identity (ID)	For customer	Reliable identification and security of financial data
JPMorgan, Wells Fargo, Citi, Fifth Third Bank, US Bancorp, PNC Financial Services, Signature Bank, and ICICI Bank	Blockchain solutions	Money transfer		
City Bank, Bank of America, SBI, ICICI, HDFC		Mobile banking App	For customers	More customer reach, less time consuming

TABLE 8.1 *(Cntinued)*

Bank	Tie up fintech	Facility	Use	Impact
Ally Bank	Ally Assist	Chatbot	For customers	Decreasing the operational cost. Increase productivity
Citi Bank	Citi Bot SG			
Bank of America	Erica			
Caixa Bank	Revelock	AI and biometrics-based security solutions for financial data protection	For Customers	Identifying fraud
Belize Bank	Wallet Factory's MFS Enabler platform	E-Payment	For customers	New revenue streams
HDFC Bank	MobME	Chillr	One-click payment app	Quick access, fast service
		PayZapp		
		EVA		
ICICI Bank	FingPay	Eazypay app	Payment app	Quick access, fast service
SBI Bank	Reliance Jio	YONO App	Mutiutility app	Quick access, Fast service
Varo Bank	Mobile banking platform	Mobile banking	App	Quick access, fast service
Simility	BD Company	Using ML to detect and control fraud in digital banking	For customers	To predict 85% fraudulent transactions, historically approved and a 70% decrease in manual reviews
Feedzai		A solution for retail banks to AML and fraud-fighting using risk management tools and ML		The increment will be reflected in approvals over 70% while avoiding an increase in loss due to fraud

TABLE 8.1 *(Cntinued)*

Bank	Tie up fintech	Facility	Use	Impact
Danske Bank		Fraud detection algorithm DL		The capability of bank's fraud detection should be increased by 50% and false positives should be reduced by 60%; automated decisions
Morgan Stanley's		Wealth/asset management application	More cliental interface	More customer access (10–15% more of their existing clients)
		WealthDesk	Better investment decisions	More than 15,000 financial advisers had adopted WealthDesk

- Reduce costs by automation tends to increase productivity
- More speed in decision making
- Enhancement in competitiveness
- Improvement in the quality of customer service
- Decreasing human resources
- Improvement in the work process efficiency and workforce
- Opening of new investment opportunities
- Enhanced security
- Early alarms for fraud
- In extreme issues such as economic slowdown, political instability, and disasters, future predictions can be helpful.

Impact on microfinance of fintech
Personalize watch and service delivery
Applications for online transactions
Turnaround time reduction

Impact on microfinance of AI
Scanning of loans deeply
Risk control
Fraud management
Advanced customer support enhanced customer experience
ML and control

Impact on wealth management/investment of fintech (WealthTech)
Wealth planner

Impact on wealth management/investment of AI
Consultant (Robo-advisor)

Negative impacts
Cost
Charges
Risk of data privacy
Absence of human involvement
Number of fraud increase

Apart from this, the area of AI and fintech should be widened with the help of blockchain, BD analysis, and ML.

KEYWORDS

- **fintech**
- **artificial intelligence**
- **fintech lending**
- **financial inclusion**
- **creditworthiness**

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CHAPTER 9

Fintech for MSME and the Role of Financial Education for MSMEs in Optimizing their Return as Investors

SHRUTI MALIK[1], KAMAKHYA NR. SINGH[2], and GODWIN EHIGIAMUSOE[3]

[1]*Shri Ram College of Commerce, University of Delhi, Delhi, India*

[2]*Director (Finance, Business and Operations), American Embassy School, Delhi, India*

[3]*Founder and Chair, LAPO Group, Nigeria*

ABSTRACT

Micro, small and medium enterprises (MSMEs) are drivers of economic growth in any economy. In India, MSMEs contribute significantly toward employment, GDP and exports. Traditionally, lending to MSMEs by formal financial institutions and banks was paper-based and time consuming. It used to take months for MSMEs to obtain a sanction letter. Given the challenges of traditional institutional lending, fintech has revolutionized the process of commercial lending to MSMEs. In this chapter, we illustrate the application of fintech in providing loans to MSMEs through the example of Small Industries Development Bank of India (SIDBI) promoted fintech that reportedly provides sanction of business loans to MSME in 59 min (also known as "PSB Loans in 59 Minutes1"). This mechanism provides the opportunity to MSMEs to get an in-principal approval of a business

[1] https://www.psbloansin59minutes.com/login.

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loan without any physical visit to the bank branch. This platform provides an opportunity for the applicant to avail loan in a hassle-free and timely manner. Further, given the challenges of the current COVID-19 pandemic situation, where there is an increased emphasis on digitalization of the financial services, this chapter will discuss how fintech-enabled loan platforms like "PSB Loans in 59 Minutes" could assist MSMEs to avail business loans digitally, using the concept of fintech. The analysis looks at a few of the limitations of this mechanism, seeking the experience of the industry experts and the loan applicants. Lastly, the chapter mentions the way forward/suggestions to improve such platforms.

9.1 OVERVIEW OF MICRO, SMALL AND MEDIUM ENTERPRISES (MSME) SECTOR IN INDIA

In recent years, the MSME sector has emerged as a significant driver of the Indian economy. The sector plays important role with respect to the entrepreneurship development, especially in rural counterparts of the country. As per the Micro, Small and Medium Enterprises Development (MSMED) Act, 20062, MSME has two major groups, that is, manufacturing enterprises and service enterprises. MSMEs have been further classified as micro, small and medium, based on the investment in equipment (plant and machinery) and annual turnover. The most recent classification of MSMEs in India is given in Table 9.1.

TABLE 9.1 Revised Classification of MSME (Applicable with effect from 1 July 2020).

Classification	Micro	Small	Medium
Manufacturing Enterprises and enterprises rendering services	Investment in plant and machinery or equipment		
	Not more than ₹ 1 crore	Not more than ₹10 crore	Not more than ₹50 crore
	Annual turnover		
	Not more than ₹5 crores	Not more than ₹ 50 crores	Not more than ₹250 crores

Surce: MSME website.

[2] https://msme.gov.in/.

As per the MSME Annual Report 2020–20213, the percentage share of MSMEs in the manufacturing sector, trade and other services were 31, 36, and 33%, respectively (Table 9.2). The micro-sector accounts for a large proportion of total estimated MSMEs (with more than 630 lakh estimated enterprises).

TABLE 9.2 Number of MSMEs (Activity-wise).

Activity category	Estimated number of enterprises (in lakhs)			Share (%)
	Rural	Urban	Total	
Manufacturing	114.14	82.50	196.65	31
Electricity*	0.03	0.01	0.03	0
Trade	108.71	121.64	230.35	36
Other services	102.00	104.85	206.85	33
All	324.88	309.00	633.88	100

Source: MSME Annual Report 2020–2021

*Noncaptive electricity generation and transmission

Micro, small and medium enterprises (MSMEs) have been contributing largely to meet the unmet demands of domestic and global markets. As per the Central Statistics Office, Ministry of Statistics and Programme Implementation (PI) Report4 in India, as shown in Figure 9.1, the share of MSME toward Indian gross domestic product (GDP) has been on the upsurge since 2016–2017. The share was reported to be 30.27% for the year 2018–2019. The gross value output of the manufacturing segment under MSME was found to be 36.9% for the year 2019–2020. Further, it was noticed that MSME-related products contribute significantly toward all Indian exports. During 2020–2021, despite the COVID-19 crisis, the share of MSMEs in Indian exports was 49.5%.

Besides this, MSME generates a large employment opportunity. During the year 2020–2021, a flagship program for MSMEsby the government named as Prime Minister's Employment Generation Programme (PMEGP), created employment for approximately 6 lakh people in various microenterprises (MSME Report, 2021).

[3] MSME Annual Report 2020–2021(Available at https://msme.gov.in/sites/default/files/MSME-ANNUAL-REPORT-ENGLISH%202020-21.pdf).

[4] Report on Contribution of MSMEs to GDP. Available at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1744032 (accessed on 15.09.2021).

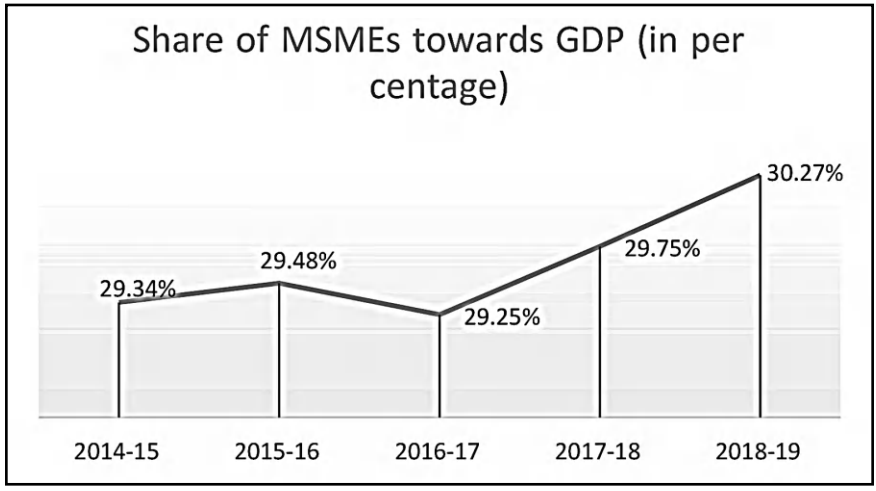

FIGURE 9.1 Year-wise contribution of MSMEs toward all India GDP (in percentage)
Source: MSME annual report 2020–2021

9.1.1 FINANCING OF MSME SECTOR

Because of the unique organization structure of MSMEs, especially for micro and small enterprises (MSEs), not only adequate access to finance but also timely access to finance becomes critical for their sustainability. The Expert Committee on Micro, Small and Medium Enterprises[5]' had identified access to timely and adequate finance as an important and continuedchallenge faced by MSMEs (RBI, 2019).

The committee further, identified three major barriers to lending to MSMEs:

1. High risk in lending to the MSME – The existence of high risk is reflected in the percentage of nonperforming asset (NPA) to total asset (amount lent by formal institutions), which was anywhere between 8% (for Micro) to about 18% (for the medium sector).
2. Inadequate coverage of MSMEs by lenders in large parts of the country leading to weaker access to formal credit by MSMEs.
3. From lending institutions' perspective, there exists high cost-to-serve, when it comes to serving MSMEs. Assessment of the creditworthiness of MSEs can be often difficult due to information

[5] https://www.rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=924.

asymmetry, especially with respect to the financial and operational performance of the business.

Considering the large offerings of the MSME sector to the economy and overall growth of the country, there are many schemes to promote the MSME sector in India. MSMEs could source debt from a variety of formal and informal institutions (Fig. 9.2).

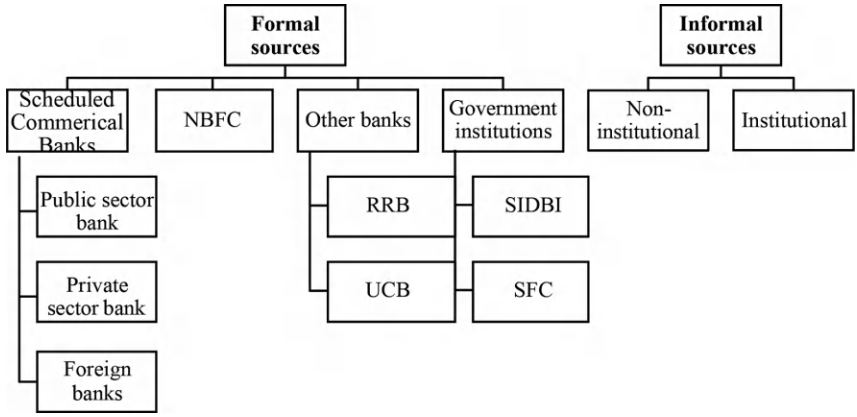

FIGURE 9.2 Sources of lending for MSME.

Source: Created by authors

In the formal finance category, scheduled commercial banks (SCBs) include public sector banks (PSBs), private sector banksand foreign banks. Among all these SCBs, PSBs have traditionally been the dominant lenders. Nonbanking financial companies are yet another attractive source of finance due to their efficient and less time-consuming process of sanction and disbursement. Nonbanking financial companies (NBFCs) contribute significantly toward term-lending for machinery and equipment as well as providing unsecured business loans that is used mainly for the working capital. Other banks, including urban cooperative banks (UCBs) and regional rural banks (RRBs), cater to the needs of small businessmen in rural and urban parts of the country. Among government institutions, Small Industries Development Banks India (SIDBI) has played an important role in facilitating and strengthening credit flow to MSMEs. SIDBI extends various credit options such as (i) direct finance, which includes support for term loans, working capital, receivables, equity, etc., (ii) indirect finance,

which includes indirect assistance in the form of refinance provided by various financial institutions, and (iii) microfinance, a facility of microloan to small entrepreneurs.

As most of the formal financial institutions look for factors like credit score, debt to income ratio, past credit history, etc. before sanctioning loan for new enterprises it is often difficult for MSEs to fulfil their criteria. On account of the difficulty in meeting the prerequisites of formal financial institutions for accessing capital, informal sources come in to meet the requirement and become preferred agencies for accessing capital. Within informal lending institutional sources moneylenders and chit funds predominate. Noninstitutional sources providing financing are friends, family, relatives, etc.

9.1.2 CREDIT GAPS IN MSMES FINANCING

Despite the greater emphasis by the government to increase MSME lending, a major proportion of MSME credit needs is unmet. As per the International Finance Corporation (IFC) Report (2018), in India, the approximate demand for external credit was ₹37 trillion, out of which only ₹14.5 trillion was met by formal sources; therefore, there is an overall credit gap of ₹20–25 trillion. Recently, MicroSave Report[6] (2020) estimated a whooping USD 1431 billion demand for credit by MSMEs in 2020. As per the World Bank data[7] in 2017, merely 10% of Indians had access to formal credit. A large number ofMSMEs lack the required documentation resulting in formal credit becoming unavailable to them. To compound the problem, several MSMEs have limited operational history, unstable equity patterns, and lack of collateral or a guarantee. These MSMEs also face inflexible policies, high lending rates and complicated procedures. Sometimes, lack of financial knowledge may also lead to low usage of formal credit by MSMEs (Choudhury and Chandana, 2019). Furthermore, a large number of MSMEs tend to be informal in their structure, with limited available public information makes it difficult to access formal credit. As a result, these MSMEs opt for the informal financial structure such as moneylenders, family, friends, etc. which at times may chargeexcessive interest rates. All these factors imply that the amount of financing demanded or required by

[6] "Bridging the Credit gap for MSMEs Gaps in access and solutions to bridge the gap". https://www.microsave.net/wp- content/uploads/2021/01/201207_Bridging-the-Credit-gap-for-MSMEs.pdf

[7] https://datatopics.worldbank.org/financialinclusion/country/india

MSMEs always exceeds the amount of financing that is available to the MSMEs, leaving a large financing gap.

9.1.3 EMERGING ROLE OF FINTECH IN MSME LENDING

In recent times, the inclusion of fintech has revolutionized the financial sector. Although application of fintech for assessingcredit risk is still a new and emerging field of research, the use of fintech for meeting unmet credit demand by MSME is expected to provide boost to the progress of MSMEs. With technological advances, fintech lenders have capitalized upon easy documentation proof requirements, and automated decision making with an option of instant disbursals (Fig. 9.3). One ofthe most important features of the digital lending platform is the speedier approval of credit. More particularly for small-ticket credits and advances, turnaround times are much smaller and quicker due to the use of innovative technologies such as "advancedanalytics," "artificial intelligence" (AI) and "machine learning" (ML). In comparison to traditional banking that use traditional asset-based data, fintech-enabled platforms use cashflow-based data from various sources (such as social media, utility, etc.) and combine these with the psychometric assessment to make a valued decision on creditworthiness of theborrower. Yet another benefit of using a fintech-based lending platform is the reduced operating cost. Traditional banking usually involves a high overhead cost. Digital lending options do not require the need to visit a bank branch physically which,conversely, reduces manual operating costs.

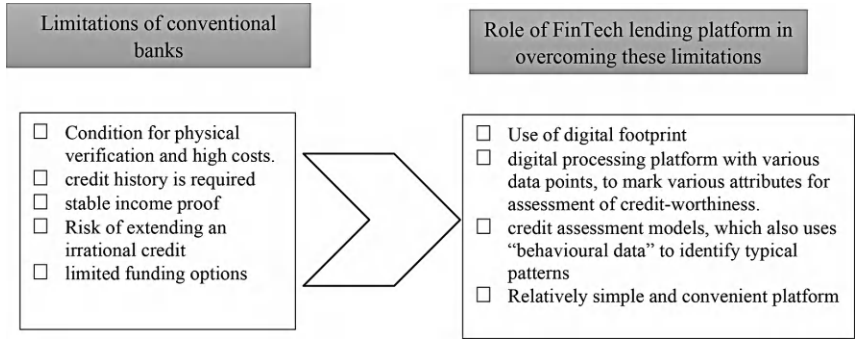

FIGURE 9.3 Role of FinTech lending platform in addressing limitations of traditional lending.

Source: Created by authors

Besides, digital lending provides an opportunity to reduce the fixed costs per loan and helps in cumulating a multitude of low-value loans, which is quite beneficial for low-ticket credit businesses/individuals, especially in rural counterparts. The benefit of the low operating cost of such a digital platform is passed to the beneficiaries which, in turn, makes the digital lending products more attractive to the users. Relative to traditional banks, the use of fintech provides an information advantage in credit risk assessment (Choudhury and Chandana, 2019; Frost et al., 2019).

9.2 A CASE STUDY ON SIDBI-PSB LOANS IN 59 MINUTES

9.2.1 INTRODUCTION ON "PSB LOANS IN 59 MINUTES"

"PSB Loans in 59 Minutes" is an online platform, which provides sanctions for business loans to businesses/individuals in 59 min (Fig. 9.3). SIDBI in collaboration with other BSBs, such as State Bank of India, Bank of Baroda, Punjab National Bank, Vijaya Bank, and Indian Bank has initiated a fintech based platform called "PSB Loans" in 59 min. On this platform, various types of loans such as business loans,personal loans, home loans, auto loans, and MUDRA loans [under the "Pradhan Mantri MUDRA Yojana" (PMMY) scheme] are offered. The maximum limit under all these loans is mentioned in Table 9.3.

TABLE 9.3 Loan Limit under PSB Loans in 59 Minutes.

Type of loan	Maximum amount
Business loan	₹5 crores
Home loan	₹10 crores
Personal loan	₹20 lakhs
Auto loan	₹1 crores
MUDRA loan	₹10 lakhs

Source: PSB Loans in 59 Minutes website

The main aim of this initiative is to promote easier access to loans, especially for MSMEs, in a timely and efficient manner. Typically, a loan approval process may take up to 30 days in traditional banking, unlike it takes less than one hour on the platform. As per MSME Pulse Report (2021), the turnaround time for MSME under various categories was as follows (Table 9.4):

TABLE 9.4 Turnaround Time for Lending to MSME (in Days).

Lenders	2016	2017	2018
NBFCs	24	19	18
PSBs	41	35	31
Private Sector Banks	32	29	29

Source: Report of the Expert Committee on Micro, Small, and Medium Enterprises by RBI, 2019

In addition, the regular sanctions from the banks post in-principle approval are not easy, rejections or delays are evidently seen (RBI, 2019). Apart from business and individual loans this platform also sanctions MUDRA loans. MUDRA loans[8] are loans provided to small businesses/ entrepreneurs for an amount of up to ₹10 lakhs. MUDRA loans in India are extended collateral-free under the PMMY scheme by the government to fulfill the growth/development requirements of the entrepreneur. With the use of fintech-enabled platforms such as PSB Loans in 59 Minutes, real-time decision making related to sanction/approval of loans can be done. The platform uses sophisticated algorithms with thousands of data points vide an Application Programming Interface (API) for the proactive matching of borrowers and lenders and making the right credit decisions. The various data points used are the details related to income tax (IT) return (ITR), bank statements, goods and services tax (GST) data, etc. (Fig. 9.4). The API platform facilitates interaction among fintech and financial institutions to extract or access data through real-time algorithms.

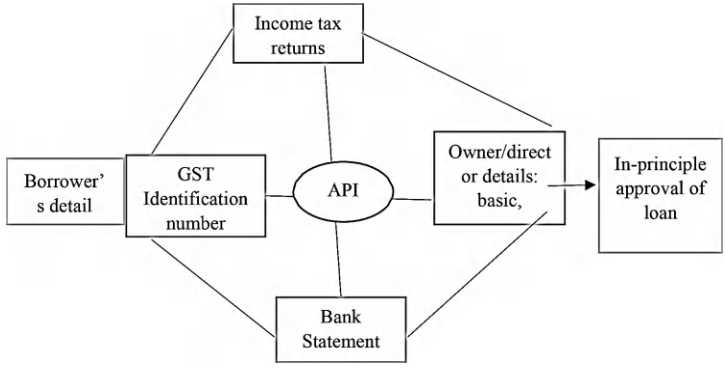

FIGURE 9.4 Business loan in-principal approval process in "PSB Loans in 59 Minutes" portal.

[8] Read more about Mudra Loan at https://www.mudra.org.in/offerings

Using smart data analytics, this platform assesses the applicant's information in real time from various third-party providers such as ITR, GST tax data, bank statements, and fraud databases. By using multiple technologies this platform provides a good opportunity to gather quality data for a faster and quicker decision-making process by the bankers.

The platform reduces turnaround time in such a manner that the applicant gets an eligibility letter and an in-principal approval within 59 min of submitting the required information on the website without the need to physically visit the bank branch, which used to take about 20–25 days (Fig. 9.5). Additionally, they can also choose bank of their choice. Postin-principle approval of the loan, the final disbursement of the loan is expected to in the next 7–8 working days, which was originally taking place in 60–70 days. The initiative extends in-principle approval for business loans (including term loans and working capital loans) for values between ₹1 lakh and ₹5 crores and MUDRA loans ranging from ₹10,000 to ₹10,00,000.

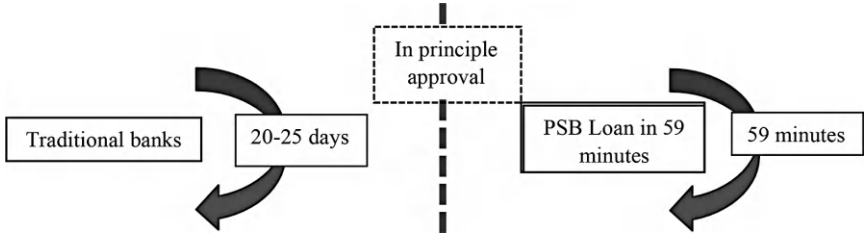

FIGURE 9.5 Loan turnaround period (PSB Loans in 59 Minutes official website).

The platform creates real-time scoring and credit appraisal in line with the existing credit policies of the chosen bank. Considering, the risk involved with the confidentiality of the financial data, the entire platform is secured by:

- front end layering by "Amazon Elastic Compute Cloud" (Amazon EC2),
- data standpoint – "Amazon Relational Database Service" (RDS)
- Platform traffic – "Elastic Load Balancing"
- Cost optimization – "S3 as both object store and archival" (which could help in optimizing the cost by 10%baseline)
- For the domain name – "Amazon Route 53"

The key features are as follows:

a. Majority stake of SIDBI and five major PSBs (SBI, Bank of Baroda, PNB, Vijaya Bank, and Indian Bank)

b. MSME borrowers need not to visit the bank branch physically to access the credit.
c. Advanced digital platform which is services driven.
d. Strong architecture with high-grade information security.
e. Inclusion of branch-level integrations (with "maker–checker–approver") which are aligned with the current systemsof PSBs.
f. Provision for bankers to create loan products based on the scoring models and assessment methods prescribed asper their credit policy.
g. Integration of various aspects such as GST, ITR, bank statement analyzer, and fraud in one platform
h. Availability of certain features such as check and bureau check—which are not available presently with other fintech-enabled lenders in the market.
i. Integration of Credit Guarantee Fund Trust for Micro and Small Enterprises (CGTMSE) for checking the eligibility of borrowers
j. Provision for borrowers getting loans up to ₹2 crores without the need of collateral.

9.2.2 HOW TO APPLY FOR PSB LOANS IN 59 MINUTES?

The loan application for PSB Loans in 59 Minutes is completely in digital mode without the requirement to visit the bank physically. After getting in-principle approval of the loan, due diligence is carried out, after which the loan amount is usually disbursed in the next 7–8 working days.

9.2.2.1 FOLLOWING ARE THE DOCUMENTS REQUIRED TO APPLY FOR PSB LOANS IN 59 MINUTES

GST Details

1. Single GST registration: GST identification number (GSTIN), GST username and one-time password (OTP).
2. Multiple GST registrations: GSTIN, GST username and OTP for each registration.The borrower must assign one registration as primary.
3. Not registered with GST: The borrower can provide their business and sales details manually by self-declaring thesame.

Income Tax Details

1. Term loan: Upload the latest income tax return (ITR) (3, 5, and 6 as applicable) in XML format.

2. Working capital loan: Upload the latest ITR (3, 5, and 6 as applicable) in XML and ITR-4 (as applicable) in XML/PDF format (Note: ITRs of past 3 years are mandatory for term loans, whereas ITR of minimum 1 year is required for working capital loan).

Bank Statement

Bank statements for the last 6 months need to be uploaded on the portal.

Details of "Directors/Partners/Proprietor"

Full details of directors/partners such as name, type of firm, address and other details need to be furnished.

Stages of loan application for applying under "PSB Loans in 59 Minutes"

The various steps for applying for "PSB Loans in 59 Minutes" are discussed as follows (Fig. 9.6):

In-principal approval on the online portal at the sanctioned bank

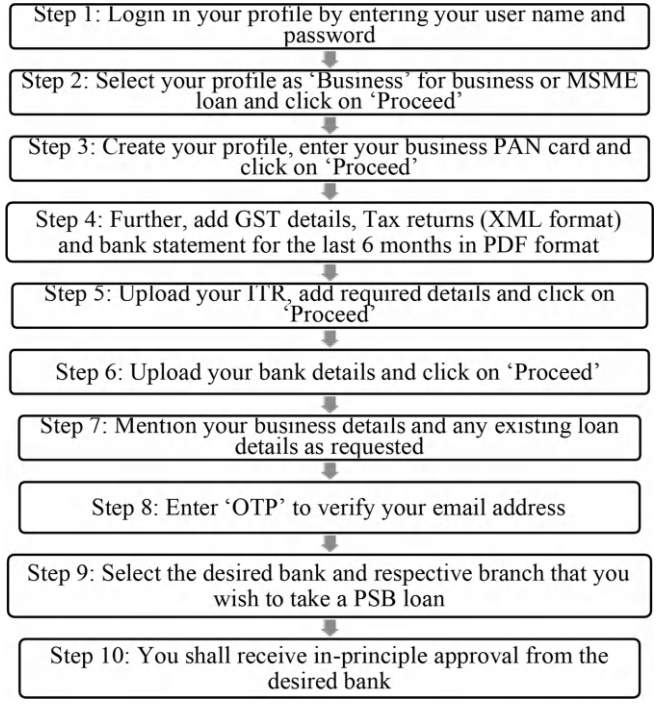

FIGURE 9.6 Steps for applying in "PSB Loans in 59 Minutes" portal.

Source: PSB Loans in 59 Minutes website

9.2.2.2 FINAL SANCTION

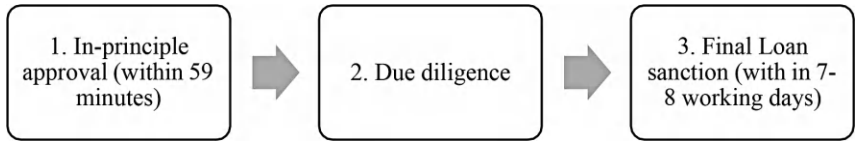

FIGURE 9.7 Final loan sanction.

Source: PSB Loans in 59 Minutes website

Post in-principle approval of business loan in the PSB loan portal, due diligence is carried out by the assigned bank (Fig. 9.7).Post assessment of KYC, verification of collateral such as land registration details, creation of required security, etc., the final loan amount is disbursed by the sanctioning bank within 7–8 working days.

9.3 COMPARATIVE ANALYSIS OF PSB LOANS IN 59 MINUTES WITH OTHER PLAYERS

The COVID-19 situation has provided a large opportunity for fintech firms to lend to the underserved population, who otherwise face difficulty in getting loans from traditional banks.

Below is the comparative analysis of PSB Loans in 59 Minutes with some popular fintech firms in lending space for MSMEs (Table 9.5):

As shown in Table 9.5, PSB Loans in 59 Minutes are far more attractive in comparison with other players in the lending space. This platform provides the feature of in-principal approval in 59 min of loan amounts up to ₹5 crores with minimal documentation requirements. Similarly, the interest rate is relatively low with minimal processing fee requirements. Hence, it is evident in comparison that 59 min of the loan portal provides a wide opportunity for MSME borrowers to fulfill their credit requirements in a more timely and efficient manner.

9.4 ISSUES AND CHALLENGES

Despite the large benefits of using PSB Loans in 59 Minutes by MSMEs, the latest official statistics available on a news portal[9] shows marginal growth

[9] An article on Credit for MSMEs published in Financial express. Available at "https://www.financialexpress.com/industry/sme/msme- fin-credit-for-msmes-5-key-schemes-beyond-eclgs-cgtmse-meant-to-ease-small-businesses-capital-woes/2349482/" (accessed on 14.10.2021)

TABLE 9.5 Comparative Analysis of Online PSB Loans in 59 Minutes with Other Players.

Company's name	Lending kart	OfBusiness	Indifi	Neogrowth	Online PSB Loans in 59 Minutes
Inception	2014	2015	2018	2013	2018
Document required	Proof of business registration, last 12 months' bank statements, PAN card details, GST and IT filings, and KYC information in digital format	Company and promoter KYC, last 9 months' bank statements, GST payment for the current FY till date and financial for the last three FYs.	PAN card, Aadhaar card address proof of self, and firm business registration proof, bank statements for the last 9 months, In case of a loan that is >₹15 lakhs, latest ITR	Documents for individuals, financial statements, business registration proof, and documents of business	GST details, IT details, last 6 months' bank statement, details of proprietorship/ partners/directors, and electronic know your customer (e-KYC) documents of the loan applicant
Interest rate	15–27%	18% onwards	₹50 per day per lakh or 1.5% per month, calculated on a reducing balance	24%	13–19%	Starts from 8.5%
Loan turnaround time	In-principle approval – 1 day and final sanction within 3 working days	Approval within 3 days	Approval within 2–3 days	Approval within 3–5 days	Loan disbursement within 3 working days	In-principle approval within 59 minutes and final disbursement in 7–8 working days
Processing fee	2–3%	2%	2%	3%	2–3%	₹1000 + GST convenience charge
Maximum ticket size	₹2 crores	₹2 crores	₹1 crores	₹75 lakhs	₹50 lakhs	₹5 crores

Source: Respective websites of aforementioned companies

in many applications being sanctioned increasing from 2,12,091 loans as of August 2020 to 2,34,905 loans as of September 2021. Previously, as per the RBI report (2019) as of 31 March 2019 approximately 50,706 proposals have received in-principle approvals and 27,893 proposals have been sanctioned on this portal. Surprisingly, the loan disbursement rate in comparison to last year was seen as quite high[10] (above 90 per cent) with 2,14,534 loans involving ₹62,105 crore till March 2021. Thus, it is evident from the unmet demand for credit from MSMEs, despite the presence of efficient platforms such as PSB Loans in 59 Minutes that a number of difficulties and challenges remain on the ground, which are not letting the optimum utilization of the facilities offered by such platforms. A few of the issues and challenges noted are as under:

- *Poor financial/investor's education and lack of Information and awareness:*

While discussing PSB Loans in 59 Minutes, it emerged that lack of wider awareness about the platform and inadequate level of financial education and financial literacy were significant reasons for lower usage of digital platforms like PSB Loans in 59 Minutes. A segment of general public and MSEs perceive that availing loan in digital mode could expose them to financial fraud and scams. Many a times, the fear of getting cheated and defrauded coupled with poor digital literacy compels MSEs to prefer going to the bank branch physically rather than using fintech.

- *Limited scope for new entrepreneurs*

At present, the "PSB Loans in 59 Minutes" portal caters to the need of only existing entrepreneurs having information such as GST payment, ITR, and bank statements from at least the last 1 year. There is a need to focus on the new and buddingentrepreneurs who want to start their businesses.

- *limited industry involvement*

The portal lacks wide industry engagement for providing services to MSME borrowers. There is a need for large-scale publicand private sector companies' involvement to further aid in the assessment of the creditworthiness of the applicant.

[10] An interview with Jinand Shah on PSB loan published in Financial express. Available at "https://www.financialexpress.com/industry/sme/cafe-sme /msme-fin-interview-we-want-to-double-msme-loans-under-sidbis-59-min- scheme-in-2021-online-psb-loans-jinand-shah/2233283/" (accessed on 10.12.2021).

9.5 SUGGESTIONS AND WAY FORWARD

Though there is no gainsaying that fintechs are an efficient institutional mechanism for providing financial services like lending, one of the most important challenges faced by agencies such as PSB Loans in 59 Minutes is the lack of widespread awareness and financial education to fully exploit the potential offered by the mechanism. It is not very tough to encourage MSME borrowers to start using the PSB Loans in 59 Minutes portal, especially someone who possesses a smartphone and is aware of digital transactions, to fulfill their credit requirements. It is incorrect to make the assumption that only tech-savvy and well-educated people use digital platforms, as it has been seen that a number of microenterprises and small and poor service providers like street vendors, shopkeepers, roadside tailors and cobblers, etc. regularly use various payment apps such as Paytm, PhonePe, Google Pay, etc. for doing financial transactions. Sometimes, attitude and mere avoidance of change couldbe reasons for the lesser usage of such digital platforms among MSME borrowers. To promote the usage of such digital platforms on a large scale, the following can be considered:

a. Enhance awareness of fintechs and digital financial transactions such as PSB Loans in 59 Minutes as a better alternative than traditional physical banking.

   Promoters of MSMEs, who, as entrepreneurs, set up their unit with the aim of maximizing return on their investment. On account of a lack of full and proper financial education, something as basic as bookkeeping, accounting for all the costs, including that of the promoter, etc. gets neglected leading to inappropriate capturing of information related to profit and loss, and balance sheet (BS) of the MSMEs. For this, a good starting place could be evaluating the financial literacy of MSMEs as per the OECD toolkit for measuring the financial literacy of MSMEs.[11] Properly designed financial education programs for MSMEs can help the MSMEs in better recognition of their income and asset as also making prudent decisions related to their finances.

   Provide financial education, especially to emerging entrepreneurs to fulfill their credit requirements. Practical training could be

[11] OCED survey toolkit (2019) to Measure the financial literacy (available at OECD website).

imparted through specialist institutions and related stakeholders such as financial regulatory bodies, development finance institutions (DFI), etc. Most prominent programs of financial education and related training carried out by the government sector agencies/institutions are the programs of financial education/literacy carried out by the National Centre for Financial Education (NCFE), Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Investors Education and Protection Fund Authority (IEPFA), National Rural Livelihood Mission (NRLM), State Rural Livelihood Mission (SRLM), etc. Properly designed programs of financial education can positively modify attitudes toward their financial decisions (Fig. 9.8).

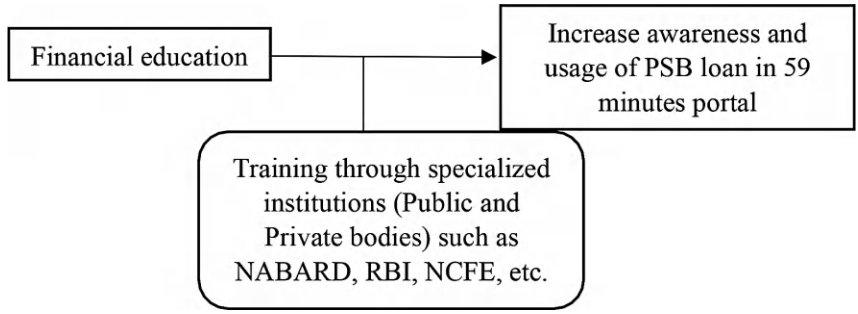

FIGURE 9.8 Use of financial education to increase awareness for PSB Loans in 59 Minutes.

Source: Created by authors

b. Enhance user confidence by increasing the safety and security of the web portal.
c. Reduce processing fees and interest rates further to make it more attractive to especially low-earning businessmen.
d. Create an enabling environment and infrastructure in terms of mobile and internet connectivity, especially for entrepreneurs in rural places.
e. Integrate e-KYC with the present API framework of the platform.
f. Onboard white label platforms and NBFCs may extend credit facilities using “PSB Loans in 59 Minutes”.
g. Support the need to move toward “cash flow”-based lending.

h. Further increase the upper limit of credit from ₹5 crores to ₹10 crores.
i. Link portal with other authorities' databases such as land records, Central Registry of Securitisation Asset Reconstruction and Security Interest (CERSAI), social footprints, etc. so that the platform becomes better in terms of evaluation of risks of lending to MSMEs. Better evaluation of risk could lead to offer of finer rates of credit by lending institutions to the MSMEs.
j. Algorithms need to be periodically reviewed to provide insight into the reasons leading to final loan rejections by the banks.
k. Increase the capability of the platform to provide in-principle sanctions within less than an hour.

KEYWORDS

- **MSME loan**
- **fintech**
- **PSB Loans in 59 Minutes**
- **MUDRA loan**
- **loan turnaround time**

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CHAPTER 10

Exploring the Role of Smart Technologies' Influence on the Consumers' Decision-Making to Select a Tourist Destination

ABHIMANYU AWASTHI[1], SUBIR KUMAR MALAKAR[2], and RUCHIKA KULSHRESTHA[2]

[1]*Learning and Development Manager, DoubleTree by Hilton, Gurgaon-New Delhi, India*

[2]*Amity School of Hospitality, Amity University Haryana, India*

ABSTRACT

Tourism is a process of choosing to spend some period outside the hometown in quest of entertainment, tranquility, and gratification while using commercially paid services of touristic facilities. A person, an individual, or a group who takes tourism is a tourist who is further described as an individual who travels intending to achieve one of the three major goals: Amusements and entertainment, research, and wellness tourism, or commercial and/or professional activities and known as a tourist, while artificial intelligence has a considerable part in influencing the process of making a decision of a tourist. Further, this technology for tourism is a part of computer science in which computers and machines mimic tourist intellect. Where machines are conditioned to think such as tourists, and they accomplish things that only human intelligence is capable of! Additionally, it makes use of tourist-related issue resolution and enhances judgment-making competency. In this article, the authors have tried to establish smart technology's role in

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making of decisions of the users of the hospitality and tourism industry. The recent technological advances have resulted in the birth of technical smart solutions that provide different perspectives regarding use in the tourist business. The goal of this study is to close the knowledge gaps between technological solutions and experience customization to understand how smart technologies might encourage customized development within the context of tourist spot-making decisions. Using a qualitative methodology, this article contributes in two main ways: a) it outlines the requisites of technological solutions for decision-making, such as data synchronization and prevalent smart technology, and b) it demonstrates how smart technology integration can result in a better decision-making process for choosing a tourist attraction. The findings imply that tourist thinks developing intelligent technologies and incorporating them into overall policy and operational processes of the tourism service deliver destination without compromising the human touch as a result, technologies will not be able to replace physical human interactions. Rather, they are tools for strategically improving human resource-led operations by providing individual tourists with technologies to better the services and experience generation procedure. Digitally Intelligent tools and systems must consequently efficient selection of tourist destinations to limit the products' compatibility of tourism and boost economic edge allowing for the harvesting of superior worth. Besides practical and conceptual consequences, some constraints are highlighted and they may be addressed in future studies. The targeted research might be viewed to be the crucial instrument that depend on the environment and may be used in the all-around touristic service delivery system to drive apt involvement and expand prospects for tailored tourist–experience construction for the destination. This has, especially, important consequences for a tourism destination, as it is very much reliant on the effective production of personal experiences needed for effective and broadened to include several examples in addition to the specific study. This would enable a thorough transinvestigation, validation, and extrapolation of the results to a broader industrial environment. Because the results are composed of a single study in the tourist sector, this study does not attempt to claim generalizability outside the study's local setting. Further in-depth research might concentrate on the emerging interpersonal role of employee and consumer coordination to provide light on the interconnectedness of employee autonomy at the workplace, the ability to use technologies aptly, and experiences of cocreation methods.

10.1 INTRODUCTION

A significant essence of Tourism is that it spans several areas of the economy. Tourism demands commercial, societal, ethnic, and natural resources. It is commonly regarded as diverse in this manner. In each nation, no one structure reflects the business. Eateries and retail complexes are popular tourist attractions in Italy and France, though not in the Russian region. However, the most basic elements of the tourist business, such as hotel and logistics, can vary per country. In the UK, many travelers reside in individual houses for bed and breakfast (B&B) provisions; comparable arrangements are not accessible in the region of Thailand. In the transport industry, elevated concentrations of automobile ownership and extensive road systems attracted many visitors in the United States and Western Europe to drive or take buses. Most tourists in Indonesia and India travel via air. Therefore, gaining a larger number of tourists per tourist destination seems highly challenging, a high level of smart technological advancement, green technological innovations, globalization, and a touristic attractions environment are required. Browsers, internet distribution methods for tourism, online tourist groups, and different types of social networking have grown exponentially in the last decade, allowing to get traveling more comfortable and informed choices. These technologies and systems are linked to or influence, various online booking mechanisms that the travel and tourism sector has long incorporated. With the integration of informational searching, communications, recreation, community connecting, and maneuverability functions to help passengers, wide cellular technological proliferation, such as smartphones, has further accelerated this trend. Furthermore, the increasing capability of integrating and linking a wide range of labels, detector systems, and portable gadgets with the physiological surroundings has led to a greater upbeat belief to respond. With this paper, the researchers have tried to identify how smart technologies can be used for the experience creation of the tourist The researchers identify smart technology requirements for experience creation, such as information access, prevalent mobile connectivity, and realistic syncing, and illustrate that intelligent technological linkage could also contribute distinct echelons of tailored travel understandings. According to this statement, this work aims to fill the gap for both intelligent technology and experiential customization to answer the central study concern if, and in what way, smart technological advancements might promote customized

engagements in the tourism industry. The study begins by reviewing existing studies on advanced technologies and experiential development in tourism domains. The authors conclude by developing a model that depicts the various stages of experience customization and discussing the ramifications for hospitality management and research. To gain a thorough knowledge of intelligent technology for creating tailored solutions, a qualitative research analysis approach was used.

10.2 LITERATURE REVIEW

Digital markets in a range of businesses, particularly banking, retailing, and tourist industry, have been penetrated by advanced technology. industry according to Alt and Klein in 2011. Advanced technologies, which combine the phrases smart and intelligent, are usually used to describe a brand, state, or action of technology that has several features that may be tailored to certain conditions as discussed by Worden et al. in 2003. Advanced technologies have attracted broad involvement in the tourist arena, given their limited use to date, as society and businesses progress and details and communications expand. Especially in recent years times, technology advancements have resulted in a revolution in the way tourist and hospitality experiences may be generated as reported by Tussyadiah and Fesenmaier in 2009 and Wang et al. in 2012 in their respective studies. Technological advances are no more only utilitarian instruments but also have grown into main contributing factors for the construction of modern experiences as researchers found in the studies conducted by Gretzel and Jamal in 2009.

Contemporary technologies based on the Internet, online tools, and cellular technologies have enabled organizations and customers on an unimaginable level to engage, collaborate, and pursue opportunities. The global market has shifted toward consumers having increasing control and authority, aggravated mostly by emerging participatory characteristics of technologies as discussed by Alt and Klein in 2011. With customers taking an active role in consumption and production as reported by Buhalis and Law in 2008, it's indeed critical for firms to leverage technologies to increase customer engagement on a much more personalized level as advocated in the studies of Pine and Gilmore, 1999. While Gretzel in 2011 emphasizes the possibilities of smart applications in the travel sector

to address the dispositional and contextual, therefore, in a way, tourists' expectations are met.

Nevertheless, there's minimal understanding, in what manner well firms may proactively employ intelligent solutions to meet rising consumer satisfaction and demands according to Gretzel and Jamal, 2009. A recent study discusses the value of technological solutions giving even better-customized tourist encounters; for example, cellular phones' involvement in tour and travel industry deliberation as discussed by Wang et al. in 2012 as well as highlighted by Wang and Fesenmaier, in 2013, while the use of situationally aware smartphone platforms in travel and tourism as discussed by Höpken et al. in 2010, through use of technologically advanced tools for assisting in creating high-touch travelers experiences as reported by Neuhofer et al. in 2013. Additionally, the acceptance of digital trip guides for personalized route options and destination-specific details is also of paramount importance highlighted in the current studies according to Schmidt-Rauch and Schwabe, 2013. Besides a few exploration works, research into expert machines outside modern technological viewpoints is quite sparse (Gretzel, 2011). Going by that logic, the purpose associated with this particular research is to narrow the gap distance across technological solutions and experiential customization to answer the fundamental study issue if, and to what extent intelligent technological solutions might promote individualized life experiences in the tourism industry. The report's main strength is the development of an integrative system representing the intelligent digital technologies needed, and procedures required for the generation of tailored touristic experiences and delivering what is expected by the travelers.

10.3 TOURISM AND SMART TECHNOLOGIES

When defining the term smart technologies, it is much essential to understand the terms: smart and technologies. However, these terms are widely used in various domains and are in practice also, yet there is not much clarity on the difference between these two terms. Additionally, the term intelligent when used in context with smart technology contributes to being a novel product concerning a specific setting, situation, or shift of technological skill that adjusts to specific roles or is customized to certain conditions (Worden et al., 2003). The capacity to notice and acquire from

one's surroundings is the unique ability of novel systems in context with smart technologies. For the tourism industry, these systems not only anticipate user needs but also incorporate thorough and specialized experience pliable to customer involvement as reported by Gretzel in 2011. Despite various approaches, the notion of advanced technologies has yet to be understood outside recent technological disciplines, and descriptions are mostly unclear according to Lee, 2012a.

With technology's rising prevalence across sectors, the use of technological solutions has formed a major emphasis of interest. Advanced tools have introduced a novel momentum for investment possibilities within various segments according to Lee, 2012b, which include home well-being processes as discussed by Patsadu et al. (2012), merchandising outlet utilization highlighted in their studies by Lee (2012b), metropolitan leadership as reported by Himmelreich (2013), and situation designing learning reported by McCardle (2002), and power management systems in accommodations as highlighted by Rogerson and Sims (2012). In the literature reviewed so far, the use of advanced technologies has been seen as a supportive mechanism to create a better experience for the users, like enabling buyers to pay through machine-readable codes. Furthermore, according to Komninos, in 2013, smart technology instruments such as radio frequency identification (RFID), cloud computing, and RFID tag systems were deployed by enterprises in conjunction with developed urban regions. Apart from the healthcare, power, retailing, and government industries, the notion intelligent technologies are developing popularity traction in tourism, which is a dynamic industry with a continual demand for innovative and advanced technological adoption (Zach et al., 2010).

10.4 TOURISM TECHNOLOGICAL ADVANCEMENTS

As discussed by Sheldon (1997) that as a rapidly expanding business, the tourist industry has constantly been at the cutting edge of technologies and has expressed an interest in fostering linkages involving technologies and the travel industry as reported by Buhalis and Law in 2008. As a result, technology breakthroughs during the last few years have influenced how the tourist business is active as suggested by Buhalis in 2003 and Middleton et al. in 2009. Enterprises had to undergo significant structural, operational, and strategy reconfiguring to capitalize on the best ability to

develop Information and communication technology as argued by Wang et al. (2010). Buhalis (2003) and Buhalis and Law (2008) reported that technological tools have evolved into a driving force in the operations of tourist enterprises, as well as a critical component in the creation of goods, systems, and administration as discussed by Hjalager (2010) creating it a facilitator of tourist engagement and retainment according to Werthner and Klein (1999).

A multitude of publications has highlighted the new use of smart technologies in the tourist sector. CRUMPET, for instance, a platform aimed at providing novel information distribution and integration capabilities, integrates 04 major features of tourism: customized services, SmartWare along with technology being a subagent, of systems tracking destination's location, and transmission of cellular information as discussed by Poslad et al. in 2001. Furthermore, numerous forward-thinking organizations operating destinations have proven the intelligent technology's productive deployment in various ways.

10.5 EXPERIENCE CREATION IN TOURISM

10.5.1 TOURIST INVOLVEMENT IN THE DESIGN OF EXPERIENCES

The conversation, conceptualization, and investigation of experiences have grown significantly in recent years. Customers are seeking experiences achieved via the use of things and services rather than just acquiring services and products as reported by Morgan et al. in 2010. According to Pine and Gilmore in 1999, with the progressive marketization of products and commodities, the marketplace shifted to the quest for experience as a method of giving added value to customers and creating a competitive edge. A movement toward consumer-centric attitudes has been caused, particularly by technological improvements, in which customers have a major role in the conception and ingestion of encounters according to Ritzer and Jurgenson (2010). Customers have now become major agents in the cocreation of encounters and values, rather than passive recipients of predesigned encounters. communication and Information technologies have had a significant impact on expanding an interaction connecting consumers and producers (Shaw et al., 2011) and allowing customers to co-create their encounters as reported by Ramaswamy and Gouillart

(2008). Consequently, the major concern for organizations is how to effectively incorporate smart technology to cocreate value user experience.

10.5.2 TECHNOLOGICAL INNOVATION FOR CREATING TAILORED EXPERIENCES

Gonzalez et al. (2004) observed that for this process to occur, creative processes and technologies which permit enterprises in providing an appropriate user experience intended area only at correct moment are required. As reported by Gupta and Vajic, 2000, it is also vital to regularly analyze clients and their preferences to enhance the level of personalization with innate inclinations when working in a service-related atmosphere. This means it is really critical to gather, analyze, and react to relevant details about consumers' need and desire. Based on several studies conducted by authors, the researcher has found that tools of information and communication technology, contribute to enterprises by helping them to interact with customers and to collect the relevant information profitably and modestly. Businesses may utilize information and communications technologies systematically to acquire, combine, control, and evaluate customer wants on an unprecedented scale to promote custom-fit solutions and deliver the perceived experience to them (Piccoli et al., 2003).

10.5.3 TOURISM INDUSTRY & RELATED EXPERIENCE OF CUSTOMERS INVOLVING AI

According to Uriely (2005), for even over five decades, tourists' memories and associated experiences have been a significant notion in all sorts of tourism supply and study. Indeed, according to Pizam (2010), the development of happy memories has been defined as the core soul of the tourism sector. While several aspects such as locality and pricing may be important in the choosing of a destination, according to Barsky and Nash (2010), experience is the most important element in the decision of a destination. As a result, the need to encourage destination development so that travelers may construct their unique tourist satisfaction. Piccoli et al. (2003) claimed that the introduction of adaptive technology platforms might serve as a possible driver of transformation, transforming

standardized offerings into individualized services founded on the idea of serving diverse customers uniquely. In this spirit, although it is restricted in practice, tourist organizations are encouraged to adopt information and communication technologies for experiential customization (Van Limburg, 2012). Through this assumption in view, this study investigates the use of intelligent technologies to provide individualized service experiences in the tourist sector and related industries.

10.6 RESEARCH DESIGN

To acquire a full grasp of advanced technological systems for the output of individualized experiences, a qualitative research study technique was used. The proposed study was chosen and characterized by two major predefined factors. Initially, the tourist industry and enterprises must be integrated with use of intelligent technological solutions in the tourism perspective, and second, they must choose technological solutions that exemplify an appropriate yet contemporaneous practice by delivering appropriateness for the viable realization of technology-supported and enhanced personal experience of tourists.

10.7 CONCLUSIONS

The hotel and tourism industries are growing and extremely competitive in today's modern liberalized market, owing to high customer expectations, commoditization, and competitive pressure, all of which keep driving this need for a distinction to remain in business. To deal with the concerns, it is essential to integrate smart tools for developing individualized encounters. With the increased possibilities provided by advancement in the portable electric sector, consumer support and encounter customization reached unprecedented heights.

The research attempts to link the existing gaps between advanced technologies and personalized experiences, as well as contribute to conceptual underpinnings on two major levels. Raising awareness and knowledge of the critical elements of smart technology and differentiation of personalized experiences on mainly two stages: Tourism technological advancements and experience creation in tourism.

From the conducted studies' point of view, this study investigates whether, and the ways, in which intelligent technologies may be leveraged to generate customized tourism-experiences sector and also how management is incorporating customers' point of view in selecting the destination using the smart technologies.

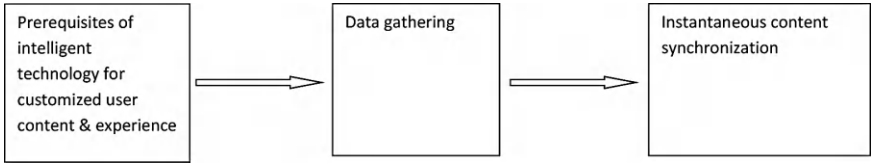

FIGURE 10.1 Technologies required for tailored experience creation for tourist.

The qualitative investigation indicated three major technology prerequisites as follows: a) Prerequisites of intelligent technology for customized user content and experience, b) Data gathering, and c) Instantaneous content synchronization. These are depicted in Figure 10.1 and described in detail in the following.

a. Prerequisites of intelligent technology for customized user content and experience

   The methodical collection of customer details to promote service customization is critical as discussed by Shen and Ball (2009). The results show that smart technologies should enable for information sharing across the whole supply network, before the tourists' advent, throughout the service consumption process, and also after-service delivery point. Earlier research has confirmed the necessity of gathering statistics throughout all phases of travel, including pre-, throughout, and even post journeys as reported by Buhalis and Law (2008). Previous involvement with the visitor proved crucial in gathering crucial details via the dedicated tourist web. This webpage must generally fulfill the aim of initiating communication, participating in conversation, and gathering details about unique wants, demands, and choices. During this phase, data is collected from customers and saved in the firm's centralized websites. This webpage must generally fulfill the aim of initiating communication, participating in conversation, and gathering details about unique wants, demands, and choices.

During this phase, data are collected from customers and saved in the firm's centralized system.

b. Data gathering

Various human contacts and service exchanges occur in the tourism setting. According to the research, such interactions occur in a range of divisions. Given the complexities and interconnection of divisions, workers, and visitors, one critical necessity of advanced devices is portability. This implies that the technologies must be transportable and reachable to anybody, anyplace, and at any moment.

Because of one of its fundamental aspects, adequate data collection, the intelligent digital system can give such solutions to enable such meetings. If all personnel are supplied with a portable device such as a personal digital assistant (PDA), they are continually linked and may obtain tourist information in this regard through the given digital platform in the PDA devices. It enables users to collaborate, obtain available data, and alter, update, and submit additional information while on the go. Because of its dynamic nature, experiential enhancement will also no longer be limited to stationary computer accessibility but may be conducted prevalently throughout the tourist organization based on the position of the passengers.

c. Instantaneous content synchronization

Employees may communicate data instantaneously linked, not only just to cellular devices but also to orchestrated digital collaborative platforms. As a result, smart systems have two basic capabilities: i) adapting current data depending on evolving requirements and ii) adding new demands and choices meanwhile. This has significant consequences for the creation of customer experience. Tourist encounters which used to be more stagnant and planned with the help of tourism service sources, on the contrary, are constantly made and customized instantaneously between tourists and staff during the service delivery process. Simultaneous synchronization is a requirement for smart technologies which involves significant modifications including how data are handled.

10.8 IMPLICATIONS

The case study's findings have many critical implications for the widespread usage of Information and communication technologies and the Internet of Things (IoT) for customer production of experiences. Intelligent tools can act as ideal agents facilitating service, that is ever-changing contacts, nimble consumer screening, and participating in equitably balanced creation practices by businesses and customers. The results indicate that companies should capitalize on evolving intelligent solutions and incorporate these into the overall plan & operational systems environment. As a result, technologies will not be able to replace face-to-face human interactions. Rather, they are tools for strategically improving operations driven by human resources providing specific workers with tools to help in the operations and knowledge development procedure. Intelligent systems must be viewed as an important solution that, depending on the context, may be used in the entire service delivery system to promote optimum connection and expand the prospects for making individualized experiences. It creates, especially, big ramifications for tourism as it is very much reliant on the effective conception of individualized encounters to decrease such interoperability of touristic products and enhance competitiveness enabling greater worth retrieval and customer-enhanced satisfaction.

10.9 LIMITATIONS

Aside from such practical and theoretical consequences, some constraints are highlighted and may be properly dealt with in future studies. The study might be broadened such that numerous instances are reviewed in conjunction to this specific study. Then it might enable a thorough trans investigation, corroboration, and generalization of the insights to a wider industrial environment. Since the outcomes are focused on a specific study in the tourism sector, this study does not attempt to establish generalizability outside the study's specific perspective. Further focused research might concentrate on the emerging relational function of staff activities to provide light on the interconnectedness of staff empowerment, technologies, and experiential methods for cocreation. Supplemental–focused research might concentrate on the emerging staff and customer interactions-related

relevance to shed light on staff capacity building, and technological and experiential developmental processes as these are all interdependent.

KEYWORDS

- **tourist**
- **smart technologies**
- **decision-making**
- **tourist destination**

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CHAPTER 11

Business Model Innovation and Digital Transformation: A Way Forward

SAURABH TIWARI

O. P. Jindal Global University, Sonepat, Haryana, India

ABSTRACT

There has been a sea change in industrial operations since the advent of the "smart factory" and "Industry 4.0." To describe the "integration of digital technologies into business processes," a term known as "digitalization" is employed. To take advantage of digitization, they need to digitally alter their current business models. To make digital transformation possible, digital technologies are being applied across functional, organizational, and geographical boundaries. The objective of this chapter is to establish a business model framework for firms who want to digitally transform their businesses, as well as the theories of digitization, digitalization, digital transformation, and business model innovation. This study will aid in developing new tools to assist companies in digitally transforming current elements of their business models.

11.1 INTRODUCTION

Transforming your business digitally has become more popular recently (Kane et al., 2015). It is also known as "digitalization" when it derives from digital transformation (Liu et al., 2011). The barriers to integrating their products and services in terms of organizations, functions, and

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geographic boundaries no longer exist in adopting digital technologies (Sebastian et al., 2020). Due to their "power" to upend the existing condition and spur technological change, digital technologies expedite the alternate and propel significant alteration across various industries (Ghezzi et al., 2015). The business function technique has changed in digital technologies, ushering in "Industry 4.0" (Tiwari, 2022) and "the smart factory." Digital platforms have accompanied afresh of doing business that has caused value networks to shift dynamically for industries and institutions in a "business ecosystem." Technology has transformed business and society (Ng and Wakenshaw, 2017), and new circular and sharing economy approaches have emerged. Digital technologies, such as artifacts (digital) and platforms (digital), have three qualities that allow for layered modular design (Yoo et al., 2010) and give companies the option to pursue a digital innovation strategy. Many digitized products incorporate digital components into physical products with related ecosystems. Thus, the term "platforms" was coined in the literature to describe businesses that use a web platform as the foundation of their business models (BMs) (Presch et al., 2020). Data analytics, three-dimensional (3D) printing, and cloud computing are required for rapid scaling as part of new tools under digital infrastructures (Huang et al., 2017). Since digital tools and concepts have a significant impact on how companies address new managerial challenges and innovate while also cultivating relationships and carrying out business, digitalization blurs the line between the two (Bresciani et al., 2018). The company's ability to compete in platform economics for data collection, integration, and usage and implementation on digital technologies and platforms (Petrakaki et al., 2018). According to the findings of recent studies, businesses use outer venture methods to create vigorous resources (such as startups and accelerators) (Enkel and Sagmeister, 2020). Businesses must recognize growth prospects, adjust to policy economies (Petrakaki et al., 2018), and employ digital technologies and policy for data gathering, incorporation, and utilization to compete in the new digital environment (Subramanian et al., 2011).

Furthermore, current investigation demonstrates that companies use startup programs and accelerators, among other external venturing strategies (Enkel and Sagmeister, 2020) to create dynamic capabilities (Bagnoli et al., 2020). By using BMI, which is transforming several sectors (Autio et al., 2018), businesses pursuing digital transformation make formerly

efficacious BMs outdated (Kiel et al., 2017). According to the literature (Björkdahl, 2009), it may even be possible to capitalize on the latent entrenched value in innovation by evolving an appropriate BM. Contrary to conventional BMs contexts, businesses implementing digital technologies (Zott et al., 2011), for instance, view data flows as essential and give them a key position in establishing their digital transformation policies (Pigni et al., 2016). It was discovered that the evolution of innovative BMs and changes to strategic BMs are inextricably linked to digital technologies (Sebastian et al., 2020).

According to Zott et al. (2011) in the digital environment, BMs have advanced into a modern analytical unit for studying the altering impacts of digital technology on the ways that companies employ BMI to generate and deliver value. In a networking activity system, the research suggests that BMI offers opportunities to boost firm performance and profit (Zott and Amit, 2010). The BMs role is crucial in defining the crucial components of a digital strategy. It aids businesses in employing a digital lens to modernize their BMs and generate the correct new estimates (Berman, 2012). Business owners and managers still have many questions, particularly about integrating business transformation strategies with digital transformation strategies (Bharadwaj et al., 2013; Tiwari and Bahuguna, 2022). This procedure is still being developed (Ferreira et al., 2019) to understand the "digital business strategy" (Matt et al., 2015). The latest survey found that the digital transformation opportunities for BMs in all industries are just beginning (Atluri et al., 2018). BMI is reshaping many industries, thanks to companies embracing digital transformation. Accordingly, digitalization is now regarded as a method of entrepreneurship (Kiel et al., 2017). Creating an effective BM has been shown to fully realize the embedded value potential in innovation (Björkdahl, 2009).

Compared to more traditional forms of business, digitally adopting companies view data flows as essential and give them a crucial position in maintaining their plans for digital transformation (Pigni et al., 2016). Digital technologies are now inextricably related to the expansion of recent BMs and the evolution of current BMs (Sebastian et al., 2020). BMs have gained a new analytical unit in the digital context through BMI. According to studies, BMI can enhance firm performance while providing opportunities for profit capture in a networked activity system (Foss and Saebi, 2017; Tiwari and Tripathi, 2012). Identifying critical elements of a digital strategy necessitates the involvement of the business manager. That's

correct; using the digital lens to innovate BMs helps businesses create new value. The digital transformation and business transformation integration process is still in its infancy, even though entrepreneurs and managers still have many questions about how to do so successfully (Ferreira et al., 2019). Since BMs define everything from value propositions to target markets to value chain organizations to revenue capture components (Teece, 2018), BMs in every industry remain at an initial phase of digital transformation. Corresponding to Foss and Saebi (2017), BMI denotes planning modifications to the architecture linking the key components of a BMI. It can be said that a BMI is when the individual components and overall structure of a body are altered. When developing digitally enabled innovation strategies, the rise of BMs is a promising analytical unit. This work contributes to our consideration of the digital transformation of BM by filling a void in the literature (Visnjic et al., 2016). This definition of BMI considers changes in the individual.

Additionally, this study may guide specialists from diverse industries looking to turn BMI into a value-creating company. Practitioners in existing businesses who are starting a digital transformation of their BMI and are forced to make several interrelated strategic decisions may find the study's findings especially helpful (Aspara et al., 2013). This study aims to emphasize the theoretical underpinnings of the triad models of digital transformation, BMI, and the relationships between them in literary works. This paper develops a framework that clarifies how companies can digitally translate the components of their company models to create BMI, improving comprehension of digital transformation concepts and BMI. It can be accomplished by making a map that displays the identified constructs for each concept and any predominant subjects. This study's objective is to create a theoretical framework demonstrating how firms can digitally translate current BM components to produce new BMs. Consequently, the primary investigation question is: How can companies use digital transformation to update existing components of their BMs?

1. What concepts underpin BMI and digital transformation?
2. What connects the two concepts of BMI and digital transformation?

The paper's first section covers the introduction of digital transformation. The remaining six sections are organized conferring to the stages of digital transformation. BMI is discussed in section three. The fourth section explains the advantages and enablers of digital transformation. The

framework for BMI and digital transformation is presented and developed in section five. Sections six and seven, which are written consecutively, offer a conclusion and future research.

11.2 DIGITAL TRANSFORMATION REQUIREMENT

Three main external aspects drive the requirement for digital transformation:

1. Increasing global adoption of the www and associated tools such as smartphones, cloud computing, online payment systems, crypto-currencies, and speech recognition. When implemented in business, Industry 4.0, and emerging digital technologies (Tiwari, 2020; Tiwari, 2022), which consist of big data, AI, blockchain, IoT, and robotics, will get comprehensive significance for the industry (Ng and Wakenshaw, 2017). These technologies assist firms in lowering their cost structure by digitally transforming their business by replacing more expensive humans in service delivery or optimizing logistic streams through AI and blockchain, as well as lowering supply chain costs with the assistance of robots or simulated agents.
2. When these new digital technologies are adopted, the business environment is significantly altered, increasing completion. Due to this technological disruption, sales have shifted to relatively young digital firms, causing a shift in the retail landscape. In response to digital transformation, companies are beginning to focus on digitalization and digital transformation, resulting in new BMs (Venkatraman, 2017).
3. Customers' buying habits have changed due to the digital revolution, with online purchases taking precedence. Digital contact points play a significant part in the client voyage, affecting online and offline sales. Social media, digital marketing, and new search technologies have made consumers more connected and informed, and active in their purchasing decisions (Verhoef et al., 2017). With digital technologies, customers can design and customize products, perform last-mile distribution by adding value to the products and services that businesses offer based on their needs, as well as assist other customers by sharing product reviews.

11.3 PHASES OF DIGITAL TRANSFORMATION

Verhoef et al. (2021) categorized the digital transformation process into three phases, viz., digitization, digitalization, and digital transformation. Phases 1 and 2 are required to achieve the unavoidable phase of digital transformation, as revealed in Table 11.1.

TABLE 11.1 Phases of Digital Transformation.

Digitization	Consequently, for computers to gather, process, and disseminate information, digital signals, and information are converted into bits and bytes. Alternatively, a digital task can be converted into an analog task without altering its value or introducing any new creation processes.
Digitalization	Digitalization may be used to alter current company practices using IT or digital technology by concentrating on cost optimization/ savings and process enhancements including communication, distribution, and business relationship management that can enhance customer experiences.
Digital transformation	The phrase "digital transformation" refers to an organization shift that impacts the entire business and its operational procedures, resulting in the formation of innovative BMs. It is regarded as the most ubiquitous phase, which goes beyond digitalization by introducing minor adjustments to organizational procedures and activities.

11.4 BM INNOVATION (BMI)

A company's BM is defined as the foundation of all of its competitive advantages (such as politics, the economy, health, and so on) that set it apart from the products and services of other companies. To innovate a company's BM, look for new ways to outline its value proposals and create and enhance value for its clients, consumers, vendors, or allies (Casadesus-Masanell and Zhu, 2013). For a long time, researchers have studied the concept of BMI. Digitalization and digital transformation have developed as part of Industry 4.0 in latest years, but it is important to emphasize that these two theories are very distinct from one another. The issue is that these concepts' fundamental traits, parts, or constituents are contradictory. Rather than the known components of a BM (Latifi and Bouwman, 2017) provide a random list of BM components. Digitalization and digital transformation are influenced by a variety of elements,

including strategy, digital capabilities, management competency, consumers, knowledge, and structure (Orji, 2019). However, various writers have added several more characteristics, such as digital procedures, financing, value chain, system, and analytical abilities (North et al., 2019). Amit and Zott (2012) identified that BMI is significant for any company's long-term viability, profitability, and competitive advantage. Customers, suppliers, and partners benefit from BM innovation because firms test new approaches to defining value propositions. BMs include digital ones (Weill and Woerner, 2013) as well as service-based ones (Kastalli et al., 2013) social ones (Hlady-Rispal and Servantie, 2017) and sustainability-driven ones (Esslinger, 2011; Tiwari et al., 2022a). Businesses are linked to their surroundings by BMs (Zott et al., 2011; Dubey et al., 2012). This means that the organization's success is highly dependent on how well it can respond to changes in environmental conditions (Zott and Amit, 2010). For this to be possible, the company and its environment must proactively anticipate and implement changes. A BM focuses on the activities of a business and how they conduct and manage to know the requirements of their clients. Therefore, the BM outlines the company's efficiency, strategic goals, and ability to generate value for all stakeholders (Dubey et al., 2015). An organization's BM comprises various elements, such as a value proposition, profit, customers, and the company's strategy, resources, and processes. The value offering element, as suggested by Matt et al. (2015), captures the company's value proposition, which is responsible for its market positioning. It is through identifying and utilizing a company's core competencies and resources that value is created for its stakeholders. A firm's distribution channels, core actions, and value chain, all on their own, contribute to creating value. The cost structure of a company's profit generation is described by its revenue streams. Customers and suppliers are external stakeholders who generate value for businesses through their internal processes and relationships. For business value creation and capture, the BMI implies major alterations to the BM's foundational elements, as opposed to small, daily adjustments within a company (Vils et al., 2017). Since the business ecosystem is changing, companies need specific capabilities. Entrepreneurs must first develop their core competencies (Carcary et al., 2016). For digital success, some capabilities are more critical than others. These include those that lay the groundwork for other critical processes and activities (Catlin et al., 2015). These

abilities are critical for business leaders to transform their digital business strategies and company cultures by digital talent (Carcary et al., 2016). The value proposal, structure, income model, and value chain aspects, such as goods or service industries, promotion, and transaction activities, can all have an influence on BMI. The term "innovating the BM" describes to a method of rearranging a BM's internal operations and organizational structure to uncover links between distinct processes. An organization that generates and captures value in novel and unique techniques is referred to as a BMI, according to Teece (2018). A company's BM is successful when it meets customers' needs while also charging the finest price that consumers are ready to pay to cover costs and generate a profit (Teece, 2018). As a result of this, one or more aspects of the BM must be modified, and new skills must be acquired. When discussing BM innovation, authors frequently refer to dynamic capabilities (Teece, 2018), which combine the vigorous capabilities framework with BM components in addition to the requirement for digital capabilities. The capacity of a company to incorporate, structure, and alter its internal and external capabilities so that it may adapt to quickly changing circumstances is defined as having "dynamic capabilities." Incorporating the BMI method could alter how a company interacts with its internal and external shareholders. The first stage in emerging a novel BM is identifying customer demands that aren't being satisfied in the present market, as well as the consumer's readiness to pay for a solution to those needs. Latifi and Bouwman (2017) claim that strategy is a driving force behind BMI because it provides guidelines for developing a BM and necessitates constant re-designs to keep the company on track. Thus, a BM allows a business's strategy to be operationalized. To successfully implement digitalization and digital transformation, organizations will need a solid strategy to guide (Bharadwaj et al., 2013). In the 21st, businesses use digital technology, such as the Internet of Things, to inform customers about their environmental status using tangible objects that can sense and transmit data. This data explains how customers use a company's products and services. An organization can use its intellectual capital to make better future decisions and help them to grow. According to Spieth and Schneider (2016), BMs for the 21st century must outline the organization's logic, locate, and seize opportunities, and then commercialize novel concepts and technological advancements. Adapting BMs to the fast-moving digital technology business ecosystem

takes time. Traditional BMs and non-digital products and services have new issues due to the challenges of integrating digital technologies (Nylen and Holmstrom, 2015). Consequently, new BMs ranging from evolutionary fine-tuning to the revolutionary removal of obsolete models can be developed. Recent research indicates that the level of modernization in a company's BM impacts its longevity (Velu, 2015). Using the value proposition and the target customers, Dmitriev et al. (2014) propose two entry points for a business. When it comes to commercializing new ideas, both terms refer to innovation driven by new technology and innovation driven by the market. The performance of companies has been shown to be negatively impacted by changing BMs, even if the change is only temporary (Visnjic et al., 2016). Modifying BMs can help organizations perform better (Cucculelli and Bettinelli, 2015). However, the mechanism by which new BMs are created is a mystery. Firms oversee defining, creating, and capturing the value, they create (Landau et al., 2016). For BM transformation to be successful, it must take a systemic and holistic approach that considers all aspects of the BM. The resources and competencies of a company interact dynamically with its value proposition and organizational system, which can positively or negatively affect that company's performance when one element is changed (Demil and Lecocq, 2010). A new way of linking activities that adds value can lead to innovative BMs. According to the authors, BM design elements (such as governance) can be configured and connected to various themes to investigate alternative BMs (e.g., novelty). There seem to be differences between a BM's fundamental characteristics and elements because this is a relatively new phenomenon, which ultimately results in differences in what BM innovation entails. As per Bouwman et al. (2017) BMI is characterized as the requirement to alter the current BM fundamentally, also referred to as the firm's value proposition. Corresponding to Koen et al. (2011), the three major parts of a BM are value networks, value conception, and value capture. In contrast to Dmitriev et al. (2014) suggestion that one must begin with the value proposal and consumer pointing, some writers (Girotra and Netessine, 2014) assert that identifying the menaces in the value chain should come first in the innovation method. The components of the BM must relate to the purpose of producing and capturing value (Erying et al., 2011). Table 11.2 shows the BMs components.

TABLE 11.2 Components of Business Models.

Components	Author
Value proposition	Abdelkafi and Täuscher (2016); Landau et al., 2016; Dmitriev et al. (2014); Matt et al. (2015); Mustafa (2015); Velu and Jacob (2016); Casadesus-Masanell and Zhu (2013)
Value creation	Abdelkafi and Täuscher (2016); Landau et al., 2016; Velu and Jacob (2016); Casadesus-Masanell and Zhu (2013); Landau et al. (2016); Zott and Amit (2010)
Value capture	Abdelkafi and Täuscher (2016); Erying et al. (2011); Landau et al. (2016); Velu and Jacob (2016)
Cost/revenue structure	Mustafa (2015); Osterwalder and Pigneur (2010)
Governance	Zott and Amit (2010)

11.4.1 DIGITALLY TRANSFORMATION BENEFITS

The accessibility of information drives the supply chain and leads to its digital transformation. Having the right organizational structure and governance in place can increase dependability, flexibility, and effectiveness across digital platforms. Organizations will be driven to transition from conventional supply chains to digital supply chains due to the danger of falling behind the competition and the performance gap between the two. They will need to embrace a digital operating archetypal that incorporates digital competencies from information technology, corporate governance, procedures, and data (IT). Figure 11.1 illustrates the main advantages of transforming processes to be more digital.

1. *Automation of process*—Complete execution and automation of an endwise process, that aids in the process and eliminates the need for rekeying or manual intervention
2. *Increased organizational flexibility*—The organization is better equipped to support specialization or reduce process costs because of this, depending on the level, complexity, and degree of centralization, which aids in decreasing different expenses across regions such as local labor costs and productivity levels.
3. *Corporate asset management in the digital era*—By capturing both physical flows and "digital fingerprints," all corporate assets can be seen more clearly. A small additional fee can be used to display the use of a particular production line, truck, or administrative task.

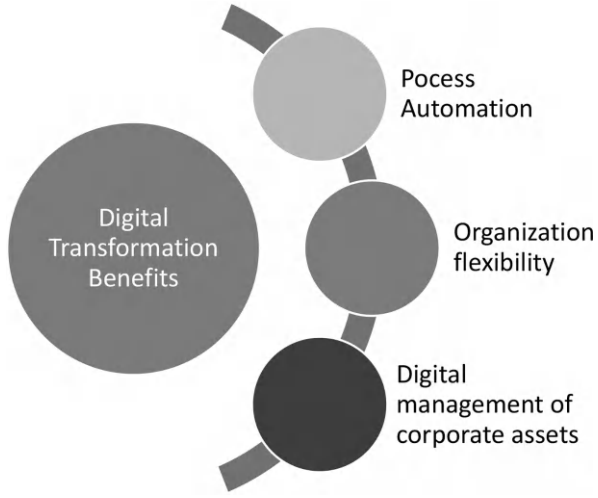

FIGURE 11.1 Benefits of digital transformation.

11.4.2 ENABLERS OF A DIGITALLY TRANSFORMATION

As a result of the preceding discussion, below depicts the primary enablers for the digital transformation. A digitally transformed process is driven by the following factors.

11.4.2.1 LEADERSHIP BASED ON DIVERSITY AND INNOVATION

Organizations must have a strong leadership presence to implement alteration and innovation. Leadership may be stated as "doing the right thing," although management can be explained as "doing the right thing." Managers should perform a significant part in the digital transformation of any firm. As role models, managers must steer their organizations through the essential transition processes. Digital transformation requires a manager who can be a digital leader while also winning and maintaining employee trust throughout the entire process of transformation. Subsequently, the company's digital transformation's success, changes in work design, and organizational leadership occur (Schwarzmuller et al, 2018). Innovation and digitalization success is dependent on variety, which provides precisely the assets required to succeed and can be further divided, particularly gender diversity in addition to cognitive diversity. Innovation and digital transformation are more successful when there is a

diversity of perspectives. Innovation, creativity, flexibility, organizational culture, transformation preparedness, exposed and apparent communication, employee progress, and equivalent talent groups are some of the significant aspects that can be classed and grouped for the digital transformation of mandatory organizations.

Integration: The effective integration of processes is critical to their efficiency and success. As a result of process integration, businesses can easily communicate real-time information, increase productivity and efficiency, and improve their ability to produce faster and better products/services. In addition to reducing costs, the enhanced coordination of information sharing enhances supply-demand balance.

Collaboration: Through the cooperative process, two or more firms share or exchange responsibilities for planning, management, execution, and performance measurement information. When it happens to effective supply chain management, collaboration is the ultimate core skill. The recent exponential growth in digital platform businesses has increased the need for inter-enterprise and intra-enterprise collaboration. Using data analytics and available information through the supply chain may be improved through collaboration with strategic supply chain associates.

Coordination: To achieve a goal, coordination is demarcated as the act of regulating interdependence among activities. To synchronize the multiple aspects of the businesses confronting issues with purchasing, inventory, procurement, marketing, logistics, manufacturing, and operations. The primary reason for supply chain members' poor operational performance is poor coordination (Simatupang et al., 2002). To develop logistics processes in reaction to quickly altering market situations and to attain flexibility, coordination is seen as vital, and it is required for an organization's advancement to succeed.

Strategy: It is possible to establish a resilient supply chain and organization processes by combining ICT with specialized methods. As emphasized by (Mensah et al., 2015), a resilient supply chain can be developed and consists of the following key points: (1) building resilience into the system by re-engineering the supply chain ahead of a potential disruption; (2) detecting and controlling risk via close coordination with supply chain partners; (3) responding quickly to the unexpected by achieving the necessary agility; and (4) risk management as a culture to be nurtured and embedded. Kotzab et al. (2003) examine supply chain strategy design in complicated situations. Management responsible for the development of e-SCM.

Organization adaptability (flexibility): As part of their research, Kassem et al. (2019) analyze the ICT control part in conjunction with the service and manufacturing industries, utilizing the organization culture and business excellence results criteria, which include both the former (mission and adaptability cultures) and the latter (consistency and involvement cultures) principles (customer, people, society and business results). It is easier to adapt to changes when there is visibility in the processes.

Technology transfer and skilled workers: Technological advancements are altering the dynamics of an organization and its processes, and skilled people are playing a critical part in this shift. RFID, big data, cloud computing, augmented reality, cognitive intelligence, simulations, cyber security, additive manufacturing, robotics, and IOT are among the disruptive technologies that are transforming organizations and are part of Industry 4.0. With RFID, one of the newest technologies, supply chain association, and perceptibility can be improved, allowing for the integration of inheritance systems and supply chain management on a real-time basis, which can lead to evolutionary changes. In recent years, interest in studying big data analytics has grown because of enhanced Internet usage and advances in information technology. With the availability of storage, networks, and telecommunications, businesses can now access large amounts of real-time data Rather than focusing on new hires, larger firms are instead focused on upskilling and retraining their existing workforces to achieve the proper skill mix and better retain their employees. Another important aspect on which companies are focussing for their employees is the development of problem-solving approach and softer skills, such as communication. The adoption and implementation of ICT will help workers to focus not only on a lifelong approach to learning but also to acquire and adjust to different and existing skills. Consecutively improve the employability of graduates, many companies using ICT have designed and developed programs for enhancing and developing employee skills of their employees by providing certification courses related to their technologies, or in collaboration with some academic partner or education sector for creating curricula either using their resources or through some vendor.

Work culture and environment: Hartl and Hess (2017) focus on organizational culture to identify cultural values based on a value-centric approach critical for digital transformation success. The success of digital transformation revolves around organizational values and is considered very crucial; culture, on the other hand, is required to master digitalization.

As compared to conventional change management, digitization with an increased reliance on technology has the potential to generate culture change and is easily being managed in a planned/top-down—emergent/bottom-up manner. Although the transition to a digital culture is a rapid phase, the result is a culture that values constant change. The role of the digital workplace and based on identified three major differences: time, place, and device which create a difference between the traditional workplace and the modern workplace. The pros of digitally transformed workplaces and their impact can be computed as commute-less, paper-less, and waste-less.

11.5 BM INNOVATION AND DIGITAL TRANSFORMATION FRAMEWORK

The construct map of digital transformation and BMI is shown in Figure 11.2 using a Venn diagram. The digital transformation primarily consists of digitization and digitalization, which are required to achieve the most unavoidable phase of digital transformation. The various components include digital product, digital technology, digital strategy, digital change management, digital capability, and digital leadership, similarly, the business innovation models consist of a resilient organization, business process, and business ecosystem. The association between digital transformation and BMI consists of coordination, collaboration, integration, skilled labor, organization flexibility, and adaptability, various stakeholders including customer, buyer, retailer, and seller, etc., various product offerings, value propositions, and governance. Companies can transform their BM digitally using BM elements, resulting in BMI as shown in Figure 11.3. The framework components are shared by digitization, digitization, digital transformation, and new BM development. The structure demonstrates how to digitally alter business processes, making the system more efficient and adaptable to new industry standards and changing the process. Digital transformation necessitates all three of these changes in BMs, processes, strategy, and collaboration with the entire ecosystem according to industry experts (Tiwari et al., 2022b). They support the outcomes of business processes, a company's environment, and organizational strategy. The success of BMI in digital transformation, needs several things, including digital products and associated digital technology, digital leadership, and change agents, digital strategy and capability, organizational flexibility

and adaptability to accept new changes, collaboration and coordination between various functions in the organization, work culture and environment, technology immersion/transfer, skilled labor, and training.

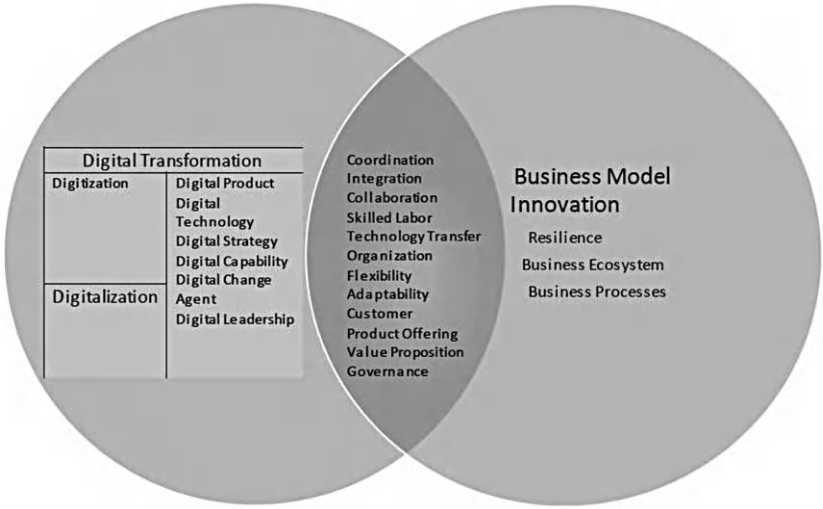

FIGURE 11.2 Construct map.

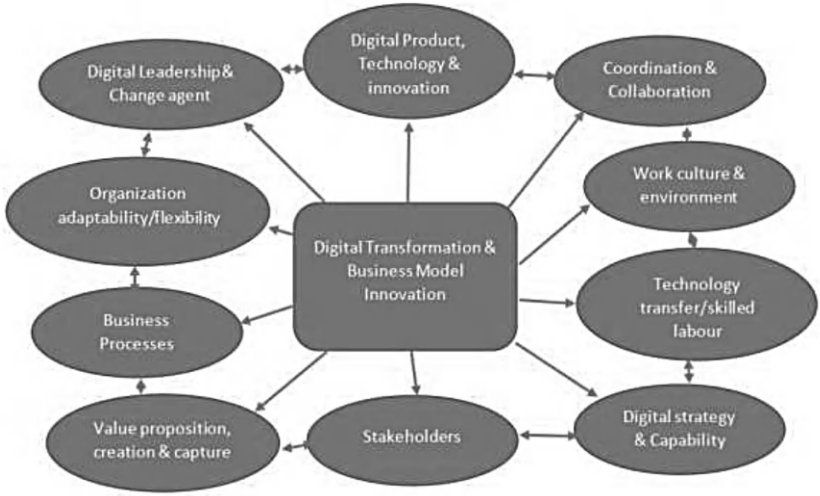

FIGURE 11.3 Framework for digital transformation and business model innovation.

11.6 CONCLUSION

This paper explains how the BMI digital transformation field has developed, as well as the advantages of BMI digital transformation and the research framework it provides for the future. The focus of organizations has shifted to new enabling technologies from digital environments and disruptive technologies over a period. With the growth of this area from a nascent stage of maturity to an advanced stage, we recommend that organizations, the environment, and various stakeholders work together more closely. With the advent of digital transformation, BMs have acquired new significance in the perspective of generating and capturing new types of value. This study harnesses both aspects, i.e., theoretical and practical, for the digital transformation of BMs. Disruptive technologies were the catalyst for digital transformation, but they also serve as a bridge between technological advances and the tactical management of disruptive modernization essential to address stakeholder challenges. This study, which involved a range of stakeholders, shows how over time, digital transformation has affected value generation, distribution, and control in nearly every business. By implementing servitization strategies and expanding their current product and service portfolio to include digital offerings, companies can work with their customers to co-create value, create novel value over digital platforms and environments, and address sustainability concerns while meeting the very precise requirements of their clients. Companies must reassess their capabilities, roles, accomplishments, and competencies due to the shifts in value creation. Organizations should have first-hand experience with digital technologies and a clear understanding of how these technologies can benefit them and how they can create value for them.

11.7 FUTURE SCOPE

An investigation into new directions in digital transformation and BMI would show that the complexity entwined with these processes is made possible by the opportunity to look into the role of various stakeholders, their involvement, and their contribution at each step along the way. This is especially true of the involvement of stakeholders like suppliers, manufacturers, or consumers, as well as their integration with new technologies.

This is because of the adoption of digital technology, a digital strategy, and digital capability that have been developed over time with the help of the organization's digital leadership, as well as by its digital agent to deliver a compelling value proposition, generating new value, and capturing that new worth for customers and participants in the business environment. It provides an opportunity to conduct in-depth research on the various structure components and their effect on BMI through digital transformation.

KEYWORDS

- **digitization**
- **digitalization**
- **digital transformation**
- **business model innovation (BMI)**

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CHAPTER 12

Artificial Intelligence in Cyber Security: A Bibliometric Analysis

PRIYANKA CHADHA[1], RAJAT GERA[2], YOGITA SHARMA[3], and SAURAV DIXIT[4]

[1]*Amity Business School, Amity University, Noida, India*

[2]*Dean Management, Commerce, Economics, Liberal Studies Cluster, CMR University, Bangalore, India*

[3]*Manav Rachna University, Faridabad, India*

[4]*Division of Research and Innovation, Uttaranchal University, Dehradun, India*

ABSTRACT

The purpose of the study is to review and understand the field of AI and cyber-security research to identify areas that need further investigation. The bibliometric methodology was followed which included productivity analysis to evaluate the total article productivity and impact through citation analysis and the most impactful authors, sources of publication, and countries. Through scientometric analysis, the intellectual and conceptual structure of this research domain was systematically mapped with WordCloud, trend analysis, co-occurrence network, and thematic mapping. For systematic review, the "Preferred Reporting Items for Systematic Reviews (PRISMA)" plans were followed for article search and selection from the Scopus Index for the period 2000–2022. The niche and emergent nature of this research domain is evident from the

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productivity of the most prominent authors in this field. The majority of the significant contributions come from Europe and the USA, followed by South Asia, a few African nations, and countries in middle-east Asia. The emerging field of AI in cyber security is mostly confined to the AI tools of learning systems and machine learning (ML) and business domains of IOT, network cyber-attacks, and security which shows a selective focus of research in this domain on specific AI techniques and applications. Conclusions are drawn and future research areas are identified.

12.1 INTRODUCTION

Artificial intelligence (AI) and cybersecurity have made rapid advancements in recent years. Its implementation has had a significant positive impact on markets, institutions, and legislation in addition to being extremely helpful in the field of finance. It is improving the state of the world. AI is in charge of simulating computers that are sufficiently clever replicas of humans. Finance AI is transforming how we interact with money. Processes in the financial sector are made more efficient and effective through their use, including credit decisions, marketing, economic risk management, and quantitative analysis. This study's major objective was to examine some effects of AI in the contemporary world.

The expansion of AI has made the world more intelligent and inventive (Soni et al., 2019). It is basically related to the statistical analysis of what is also called intelligent performance (Brands et al., 2016). The ability to acquire and utilize a wide range of comprehensive abilities and awareness to unravel a particular task or problem is what is generally meant by the term "Intelligence." Both human and AI are used. Over the past ten years, researchers have mostly explored how the intellectual machine is expanding. On the critical human intellect, layout, problems, reasoning, and learning activities are carried out here (Shabbir and Anwer 2018). Its development has made it the center for enhancing the presentation of all ongoing growth of industries and technologies (Soni, 2019). Through research and innovation, creating new customer markets and enlightening existing customer's markets (Soni et al., 2019).

Data science stands for a multifaceted field that uses techniques, system technologies, and algorithms to bring information and data from organized, unstructured, and acoustic data and then applies that information and data to other systems. Under the rubric of Big Data, science is supported by cutting-edge art AI technology. Survival information, which is hidden and unique, stimulates a few users and researchers with the appropriate skills to increase the data capacity of today's systems. Big Data is a collection of information that is complex, diverse, enthusiastic, and potentially valuable but is challenging to process and evaluate on time (Shi et al., 2011). Accordingly, due to the resulting security dangers and the widespread usage of the internet, cyber security is one of the most pressing global demands.

Organizations and enterprises across a range of industries have been impacted by security incidents. A cyber threat, according to the global banking and financial sector, can cost over $360 billion every year. Global cyber-attacks have recently had an impact on financial institutions. Data security and privacy have been highlighted by Mahalle et al. (2018) in relation to cloud-based banking services. The examination of monetary issues and crime sectors where AI systems have functioned successfully face one of the most significant challenges from the ongoing frauds (Kaur et al., 2020). Spam emails, suspicious behavior, and security flaws can all be tracked and predicted (Table 12.2).

12.1.1 BATTLING BOTS

Bots are an important part of internet circulation in today's world, and they can be deadly. AI makes it possible to analyze gigantic volumes of data and lets cybersecurity groups modify their plan in response to a constantly dynamic environment. Businesses will learn the responses to the inquiries "what does an average user journey look like?" and "what does a risky atypical journey look like" by diagnosing behavioral patterns. We can now establish the purpose of their website circulation and get and stay ahead of the harmful bots, according to "Mark Greenwood, Chief Technical Architect and Head of Data Science at Netacea."

12.1.2 BREACH RISK PREDICTION

To allocate resources and plan to regions with the highest dangers, firms can use AI-based systems to forecast where and how security is most

expected to be broken. Insights from AI-based analysis that are prescriptive allow firms to modify and enhance processes and controls to surge their cyber resilience.

12.1.3 IMPROVED ENDPOINT PROTECTION

AI is critical for protecting all of the endpoints used for isolated effort and various devices are used for their protection. It's possible that signature protection won't prevent a new sort of malware attack. By repeatedly training the endpoint, AI-driven endpoint security establishes the device's performance baseline. AI is accomplished by seeing anomalies and, if essential, taking the right act, such as alerting a specialist or restoring security following a ransomware assault. According to "Tim Brown, vice president of security architecture at Solar Winds," this process prevents assaults before they happen rather than waiting for signature changes. In their research, *Reinventing Cybersecurity with Artificial Intelligence*, the "Capgemini Research Institute" examined the function of AI in cybersecurity and made the strong recommendation that AI be used to bolster cybersecurity defenses. The 850 executives who participated in the study agreed that an AI-enabled answer was required since cybercriminals are by now using AI technology to carry out cyberattacks.

Previous review studies show that a comprehensive review of AI with cybersecurity has not yet been undertaken by scholars. Some of the review studies on related topics are by Choithani et al. (2022), who undertook a "Comprehensive Study of Artificial Intelligence and Cybersecurity on Bitcoin, Crypto Currency and Banking System"; Sarker (2022)—"Machine Learning for Intelligent Data Analysis and Automation in Cyber security"; and Tuptuk et al. (2021)—"A systematic review of the state of cybersecurity in water systems" (Coulter and Pan, 2018).

12.1.4 CYBER SECURITY SYSTEMS

Cyber-security is "the process of preserving information by preventing, detecting, and responding to assaults," according to "NIST (National Institute of Standards and Technology)" (Jang and Lee, 2017). The "confidentiality, integrity, and availability (CIA)" triad—three security objectives are used to define the stoppage of crimes and attacks on systems of

Information Technology. To preserve security, these objectives are also applied to CPS. System resources or data "are not disclosed to unauthorized individuals, processes, or devices," according to confidentiality.

Integrity involves "protecting against unauthorized information change or erasure, and includes ensuring information nonrepudiation and validity." Integrity violations could make CPS less reliable and safe while also interfering with its operation. "Timely, dependable access to data and information services for authorized entities" is what availability is all about. Since many CPSs are constant systems, a loss of accessibility could result in system shutdowns and production process interruptions. For essential cyber-physical systems, integrity and availability are typically of the utmost importance. However, the importance assigned to each of these security objectives depends on the dangers involved in losing these features in the context of a specific system.

12.2 METHODOLOGY

In this study, we explore and elucidate the concepts of AI and cybersecurity to suggest areas that need further investigation. "The use of quantitative approaches, such as bibliometric analysis—for example, "citation analysis on bibliometric data, such as units of publishing and citation," was done using the bibliometric methodology (Broadus, 1987; Pritchard, 1969)." The fields of "business, management, and accounting," "economics, econometrics, and finance," and "social sciences" all make substantial use of bibliometrics. Large volumes of bibliometric data can now be easily acquired thanks to the introduction of scientific databases like "Scopus and Web of Science," and tools like Gephi, Leximancer, and VOS viewer make it possible to analyze this data in a highly practical manner. Numerous areas of business research have used the bibliometric methodology, including business strategy "(Kumar et al., 2021b), electronic commerce (Kumar et al., 2021a), finance (Durisin and Puzone, 2009; Linnenluecke et al., 2017; Xu et al., 2018), human resources (Andersen, 2019), management (Ellegaard and Wallin, 2015; Zupic and Čater, 2015), and marketing (Backhaus et al., 2011; Donthu et al., 2020d; Donthu et al., 2020b; Donthu et al., 2021; Hu et al., 2020; Samiee and Chabowski, 2012; Donthu et al., 2020c)." Two methods for bibliometric analysis are science mapping and performance analysis. The number of

citations and publications per year or each research component are the two most important performance analysis metrics; publications are a proxy for productivity, whilst citations are a gauge of effect and influence. Other metrics that combine publications and citations to gauge the effectiveness of research elements include citations per publication and h-index. Despite being descriptive, the analysis acknowledges the significance of several components in a research field. "Science mapping examines the relationships between research constituents (Baker et al., 2020)." The analysis focuses on the structural relationships and intellectual exchanges between research elements. The structural linkages and intellectual interactions between the research elements are the main subjects of the examination. Some of the techniques utilized in "scientific mapping include citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis."

For the systematic review, PRISMA—The Preferred Reporting Items for Systematic Reviews criteria—was followed. With the help of a set of research queries the relevant publications were analyzed and evaluated. The publications were found using a search method and a collection of electronic databases. Each publication's eligibility was evaluated using inclusion and exclusion criteria. The appropriate evidence for analysis was then manually extracted from the eligible papers.

12.2.1 IDENTIFICATION OF SOURCES AND SEARCH TERM

"(KEY (artificial AND intelligence) AND KEY (cyber AND security)) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT TO (EXACTKEYWORD , "Artificial Intelligence") OR LIMIT-TO (EXACTKEYWORD , "Cyber Security") OR LIMIT-TO (EXACTKEYWORD , "Cybersecurity") OR LIMIT-TO (EXACTKEYWORD , "Sustainable Development")."

Searching was restricted to publications that had been available from 2000 to 2022.

12.2.2 CRITERIA FOR SELECTION OF PAPERS

The following selection criteria were used to find publications for a systematic review:

- AI in cyber security must be addressed

- Must have a business content
- Must have undergone peer review and been available in a "workshop, conference, or international journal." The following publications were excluded from the search: "books, book chapters, theses, editorials, feature or opinion pieces, essays, government and industry guidelines, other non-peer-reviewed or non-research publications, publications" in languages other than English, and publications found in journals, regional conferences, and workshops. Review publications were not included in the analysis, but the manual reference search was used to analyze their content, and important contents are cited.

12.2.3 PAPER SELECTION

A CSV file with the publications' details was created after an online database search turned up 1104 results. The remaining peer-reviewed papers that had been published in internationally renowned conferences, workshops, or journals had been eliminated after any duplication, and they were chosen for closer examination. To address the research topics, a set of 114 papers was finally finalized.

12.3 RESULTS AND DISCUSSION

Citation analysis, which is based on the idea that citations signify the intellectual links between publications as a result of one article referring another, is a crucial technique for scientific mapping (Appio et al., 2014). The process enables the identification of the most important papers in a specific field of study. According to Table 12.1, publications published in 2011 received the most total citations on average (42) per year, followed by those from 2014 (32) and 2015. (24.25). The average number of citations per year was highest for articles published in 2014 (4.0), then 2015 (3.46).There is an increasing trend in Mean TC per year and Mean TC per art which shows the increasing impact of publications in this research domain. There is a significant increase in total citations per art from 2020 onward which could be due to the increasing digitalization of businesses accompanied by cyber security threats and use of AI with cyber security.

TABLE 12.1 Average Citation per Year.

Year	N	MeanTCperArt	MeanTCperYear	CitableYears
2006	1	3.00	0.19	16
2007	0	0.00	0.00	0
2008	0	0.00	0.00	0
2009	0	0.00	0.00	0
2010	2	16.50	1.38	12
2011	2	42.00	3.82	11
2012	2	9.00	0.90	10
2013	1	11.00	1.22	9
2014	1	32.00	4.00	8
2015	4	24.25	3.46	7

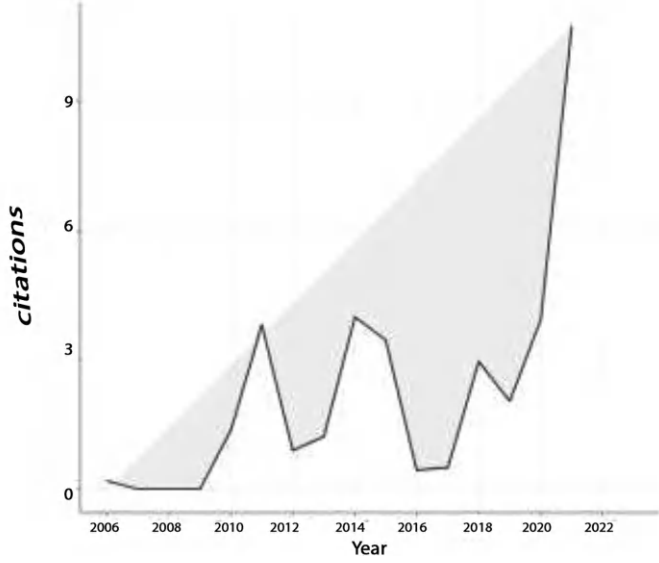

FIGURE 12.1 Total citations per year.

The most relevant sources (journals/proceedings/books) for publications in this research field are shown in Table 12.2 based on a number of articles available in Scopus-indexed journals and are clustered in the domains of computers, information management, AI, and security applications. The most influential sources of publication are computers and security, electronics, computers and AI, information processing

and management, technology, intelligence, humans, and organizations. Conference proceedings are the dominant source of publications due to the emergent nature of the subject.

TABLE 12.2 Most Relevant Sources.

Sources	Articles
"Computers and Security"	4
"Proceedings of The 11th International Conference on Electronics, Computers And Artificial Intelligence, ECAI 2019"	4
"Advanced Sciences and Technologies for Security Applications"	3
"IEEE Security and Privacy"	3
"IEEE Transactions on Engineering Management"	3
Information Processing and Management	3
"Proceedings - 2021 21st ACIS International Semi-Virtual Winter Conference On Software Engineering, Artificial Intelligence, Networking And Parallel/Distributed Computing, SNPD-Winter 2021"	3
"Proceedings of The 12th International Conference On Electronics, Computers And Artificial Intelligence, ECAI 2020"	3
"2015 IEEE International Conference on Intelligence and Security Informatics: Securing The World Through an Alignment of Technology, Intelligence, Humans And Organizations, ISI 2015"	2
"2019 IEEE Technology And Engineering Management Conference, TEMSCON 2019"	2

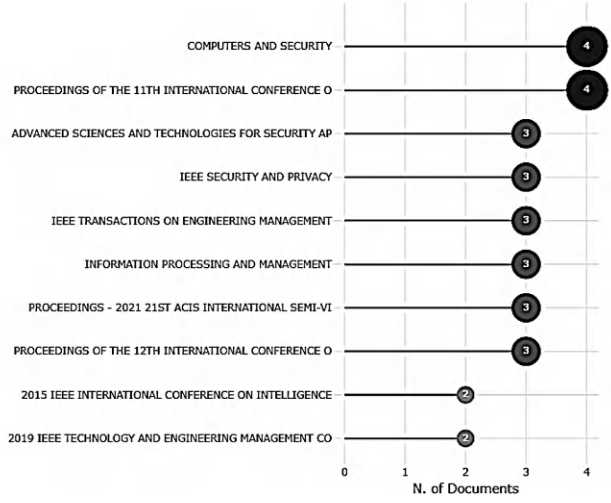

FIGURE 12.2 Most influential sources of publications.

Based on their h/g/m index, overall citation count, total number of publications, and starting year of publications, Table 12.3 lists the most influential publications. "Chartered Association of Business Schools' Academic Journal Guide, Australian Business Deans Council, Chinese Academy of Sciences (CAS), China Computer Federation (CCF), BFI (Denmark), Science Citation Index, Expanded Computing Research and Education (CORE) Journal Ranking, The Publication Forum (Finland), Science Citation Index Expanded, Scopus, and SCImago Journal Rank (SJR)" ranked the high impact journal "Information processing and Management" based on its h and g index of (3) and "publishes cutting-edge original research at the intersection of computing and information science concerning theory, methods, or applications in a range of domains, including but not limited to advertising, business, health, information science, information technology marketing, and social computing." *Artificial Intelligence Review* has the highest number of citations of 74.

TABLE 12.3 Source Local Impact.

Element	h_index	g_index	m_index	TC	NP	PY_start
"Information Processing and Management"	3	3	0.75	27	3	2019
"2015 IEEE International Conference on Intelligence and Security Informatics: Securing The World Through an Alignment of Technology, Intelligence, Humans And Organizations, ISI 2015"	2	2	0.25	93	2	2015
"Artificial Intelligence Review"	2	2	1	174	2	2021
"Computers and Security"	2	3	0.4	60	3	2018
"Decision Support Systems"	2	2	0.154	115	2	2010
"IEEE Security and Privacy"	2	2	0.222	37	2	2014
"IEEE Transactions on Engineering Management"	2	3	2	10	3	2022
"Journal of Network and Systems Management"	2	2	1	24	2	2021
"Proceedings - Frontiers in Education Conference, FIE"	2	2	0.182	9	2	2012
"Proceedings of the 12th International Conference on Electronics, Computers and Artificial Intelligence, ECAI 2020"	2	2	0.667	7	2	2020

12.3.1 MOST INFLUENTIAL AUTHOR

The most significant author in this field is Chen, H., who has published three times. For example, Benjamin and Chen (2015)—"Developing understanding of hacker language through the use of lexical semantics 2015 in IEEE International Conference on Intelligence and Security Informatics: Securing the World through an Alignment of Technology," published in "ACM Transactions on Management Information Systems"; Samtani et al. (2020)—"Trailblazing the Artificial Intelligence for Cybersecurity Discipline: A Multi-Disciplinary Research Road and Exploring dangers and weaknesses in hacker web: forums, IRC channels, and carding shops is a 2015 paper presented at the IEEE International Conference on Intelligence and Security Informatics: Securing the World via an Alignment of Technology, Intelligence, Humans, and Organizations. The most cited article of Chen H, titled), Exploring threats and vulnerabilities in hacker web: Forums, IRC and carding shops published in 2015 aimed to develop an automated methodology for identifying tangible and verifiable evidence of potential threats within hacker forums, IRC channels, and carding shops. The most influential authors in the inter-disciplinary field of AI in cyber security.

TABLE 12.4 Most Relevant Authors.

Authors	Articles	Articles fractionalized
"CHEN H"	3	1.08
"BENJAMIN V"	2	0.75
"CARROLL F"	2	0.37
"DANESHKHAH A"	2	0.37
"DUMITRU V"	2	0.38
"HOSSEINIAN-FAR A"	2	0.37
"IONESCU O"	2	0.38
"MACDONALD S"	2	0.37
"MONTASARI R"	2	0.37
"PRICOP E"	2	0.38

Based on Table 12.5, it is evident that the most influential authors' productivity is 1–2 articles per year with total citations per year ranging from 0.5 to 11.625 per year. Thus, the niche and emergent nature of this research domain is evident from the productivity of the most influential authors in this field with impact measured by total citations per year per author mostly below 5.

TABLE 12.5 Authors' Production over Time.

Author	Year	freq	TC	TCpY
"BENJAMIN V"	2015	2	93	11.625
"CARROLL F"	2021	2	7	3.5
"CHEN H"	2015	2	93	11.625
"CHEN H"	2020	1	13	4.333
"DANESHKHAH A"	2021	2	7	3.5
"DUMITRU V"	2019	1	2	0.5
"DUMITRU V"	2020	1	2	0.667
"HOSSEINIAN-FAR A"	2021	2	7	3.5
"IONESCU O"	2019	1	2	0.5
"IONESCU O"	2020	1	2	0.667

Chen H is most impactful author with H index of 3.0 (Fig. 12.3 and Table 12.6) followed by Banjamin V, Dumitru V, Ionescu, O, Pricop E, Zhang Z, with h index of two each and Ababneh, N, Abbas N N, Adams J and Adler R M with h index of one each on this topic in Scopus online database. The low local impact of the most influential authors is because of very few scholars contributing to this research field with a focus on the business domain. Chen H and Benjamin V were the most productive authors in 2015 while Ionescu O and Dumitru V are the most productive authors in 2019–2020. Carroll F and Hosseinian –FAR A published two articles in 2021 and hence were the most productive authors in these years.

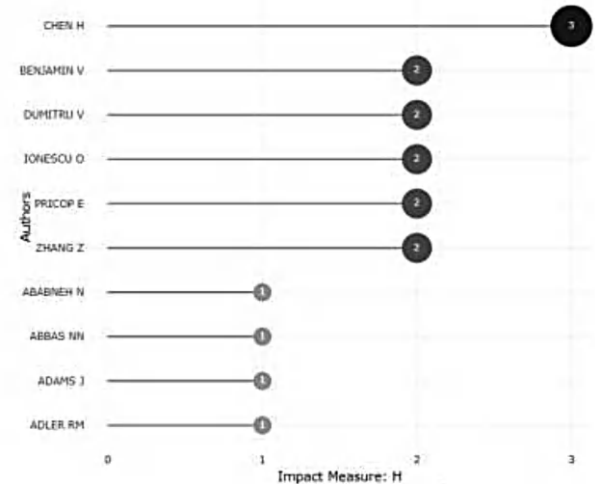

FIGURE 12.3 Author local impact.

TABLE 12.6 Most Influential Authors.

Element	h_index	g_index	m_index	TC	NP	PY_start
CHEN H	3	3	0.375	106	3	2015
BENJAMIN V	2	2	0.25	93	2	2015
DUMITRU V	2	2	0.5	4	2	2019
IONESCU O	2	2	0.5	4	2	2019
PRICOP E	2	2	0.5	4	2	2019
ZHANG Z	2	2	0.5	21	2	2019
ABABNEH N	1	1	0.5	12	1	2021
ABBAS NN	1	1	0.25	13	1	2019
ADAMS J	1	1	0.25	10	1	2019
ADLER RM	1	1	0.1	11	1	2013

Most relevant affiliations of the corresponding author: Masaryk University along with University of Science and Technology; Beijing has a maximum number of six publications. Corresponding authors affiliations of Masaryk University are Švábenský, V., Husák M., Sadlek L., Špaček S., Laštovička M., Javorník M., Komárková J., Mohanty S., Vyas S., Švábenský V., and Vykopal, J. Masaryk University is the second largest university in the Czech Republic

TABLE 12.7 Most Relevant Affiliations.

Affiliation	**Articles**
"MASARYK UNIVERSITY"	6
"UNIVERSITY OF SCIENCE AND TECHNOLOGY BEIJING"	6
"KING SAUD UNIVERSITY"	5
"STATE GRID INFORMATION COMMUNICATION COMPANY OF HUNAN ELECTRIC POWER CORPORATION"	5
"SWANSEA UNIVERSITY"	5
"THE UNIVERSITY OF TEXAS AT DALLAS"	4
"AMITY UNIVERSITY"	3
"AMRITA SCHOOL OF ENGINEERING"	3
"CENTRAL QUEENSLAND UNIVERSITY"	3
"DIT UNIVERSITY"	3

Most cited countries are USA (173) followed by Singapore (159), United Kingdom (79), Australia (34), South Africa(28), China (16), Canada(13), Pakistan(13), Saudi Arabia (13), Jordan(12) shows the dominance of

developed countries in this research field (Table 12.8, Fig. 12.4). Most of the impactful contributions are from Europe and USA followed by South Asia and some countries of Africa and middle-east Asia which could be due to the greater digital footprint of these countries. The number of citations from the USA, Singapore, and the United Kingdom is 76.1% of the total citations of the top ten cited countries which shows the skewed impact of the highest cited countries. However, the average article citation from Singapore (159) is significantly higher than the USA (15.73) or the UK (11.29).

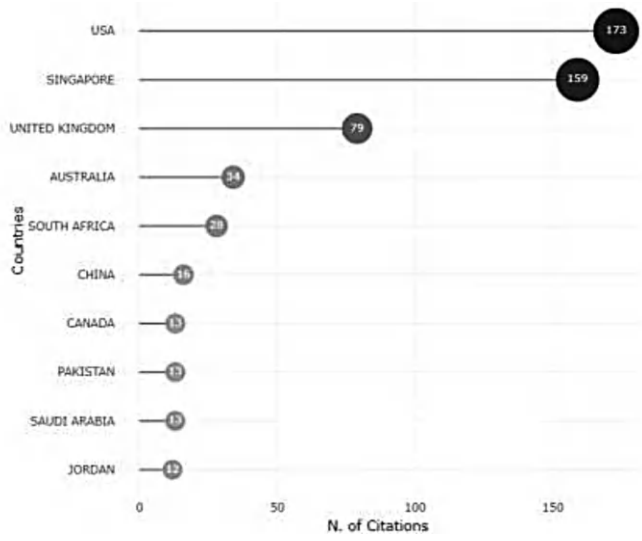

FIGURE 12.4 Most cited countries.

TABLE 12.8 Most Cited Countries.

Country	TC	Average article citations
"USA"	173	15.73
"SINGAPORE"	159	159.00
"UNITED KINGDOM"	79	11.29
"AUSTRALIA"	34	8.50
"SOUTH AFRICA"	28	28.00
"CHINA"	16	5.33
"CANADA"	13	13.00
"PAKISTAN"	13	6.50
"SAUDI ARABIA"	13	13.00
"JORDAN"	12	12.00

The terms AI, cyber security, internet of things (IoT), learning systems, data security, computer crime, cyber-attacks, and machine learning (ML) are most frequently used by writers in this research field (Fig. 12.5). Based on the most frequently used keywords by authors, it can be deduced that the growing field of AI in cyber security is primarily restricted to the business domains of IoT, network security, and cyber-attacks, as well as the AI tools of learning systems and ML. This selective focus on particular AI techniques and applications demonstrates the field's recent research efforts. Scholars' attention is primarily focused on the use of AI (learning systems) and machine learning (ML) for the goal of network security and prevention from cyber assaults due to the emergent character of this research topic.

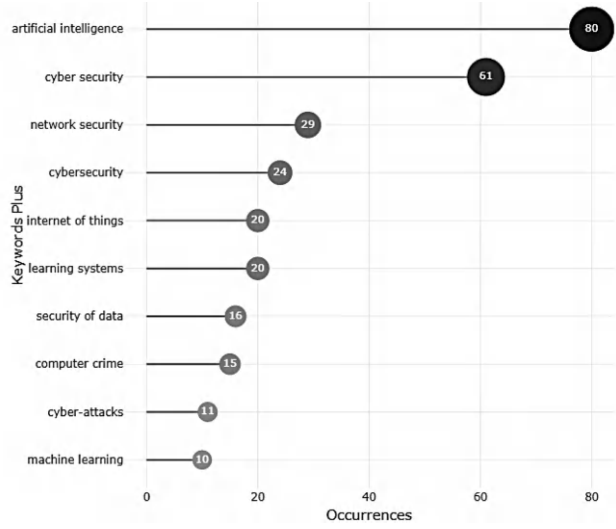

FIGURE 12.5 Most frequent words.

12.3.2 WORDCLOUD

A 'word cloud' is a visual representation of word frequency. The more commonly the term appears within the text being analyzed, the larger the word appears in the image generated. Network security is the most frequently used keyword by scholars followed by cyber security, learning systems, IoT, security of data and cybercrimes (Fig. 12.6). The WordCloud shows the predominance of research in AI in cyber security in applications

of learning systems and IoT and protection from cyber-attacks and computer crimes. Risk management, data privacy, risk assessment, decision support systems, information systems, and denial of service attacks appear as minor terms which indicate that research is primarily focussed on the protective role of AI in cyber security as compared to system design and risk management functions.

FIGURE 12.6 Word cloud.

12.3.3 TRENDING TOPICS

The most trending topics based on frequency of occurrence of keywords in the periods between 2011 and 2013 were information systems, information management from 2016 to 2020, security systems from 2018 to 2020, cyber security from 2018 to 2022, cyber-attacks, computer crime from 2018 to 2020, IoT and network security from 2019 to 2021, AI from 2018 to 2021, automation, machine learning, cyber security from 2020 to 2022(Fig. 12.7). Thus, the focus has shifted from information systems and information management and information systems in 2011–2020 towards cyber security, cyber-attacks, IoT, and network security from 2020 onwards. The predominant technique of AI (machine learning) is being deployed for predicting cyber-crimes and cyber-attacks and to strengthen network security systems.

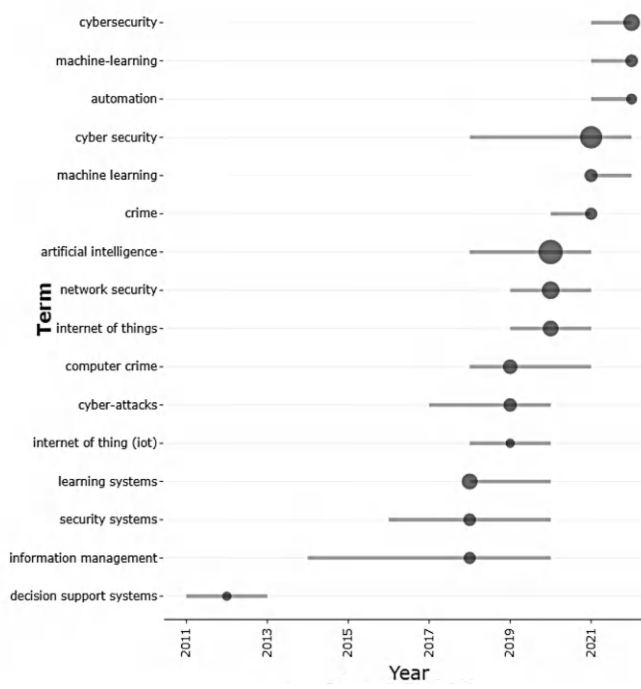

FIGURE 12.7 Trending topics.

12.3.4 CO-OCCURRENCE NETWORK

The co-word analysis methodology created in the 1980s was primarily designed to assist scholars in understanding the dynamics of science and technology (Chen et al., 2002). Co-word analysis has been utilized by researchers to look at subject areas in different fields and historical changes (Cho, 2014). Co-word analysis is a method that looks at the publication's real content. When author keywords are not available, notable words can also be retrieved for the analysis from "article titles," "abstracts," and "full texts." Author keywords are frequently used to generate the words in co-word analyses (e.g., Baker et al., 2020; Burton et al., 2020; Donthu et al., 2020; Emich, Kumar et al., 2020; Liu et al., 2019). Similar to co-citation analysis, the co-word analysis assumes that words that frequently appear together have a thematic relationship with one another. The disciplines co-occurrence analysis examines the cross-disciplinary involvement and cooperation in a certain research field; the key co-occurrence network shows the existence of three networks of disciplines (1). "Cyber security,"

(2). "Cyber security" and "artificial intelligence," and (3). "Network security," "IoT," and "learning systems" (Fig. 12.8). The intellectual structure of research in the field of AI with cybersecurity.

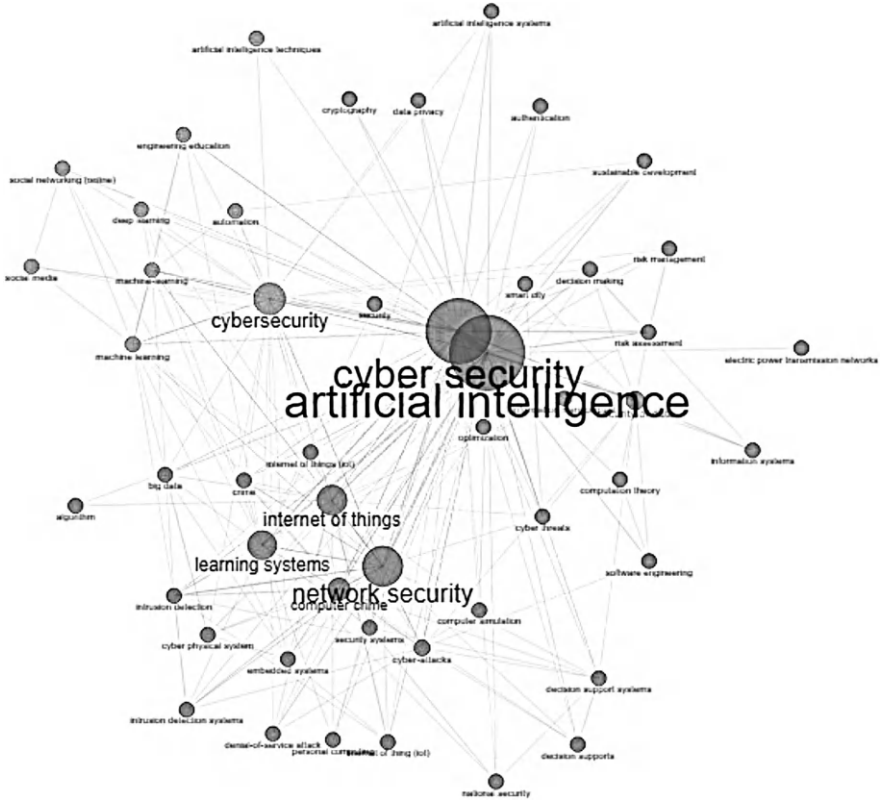

FIGURE 12.8 Co-occurrence network.

12.3.5 THEMATIC MAP

To comprehend the issues covered and identify which are the most significant and latest, we concentrated our attention in this area on the conceptual organization of publications. The basic idea is that terms that co-occur in a text, such as keywords, terms generated from titles, or terms found in abstracts, can be shown using a term co-occurrence network. Using this technique, it is possible to identify subcategories of strongly related phrases, where each subdivision is related to a particular area of interest or area of research in the collection being examined. After further investigation, it is feasible to display the findings in a so-called planned or thematic diagram (Cobo et al., 2011).

Upper-right quadrant contains what are referred to as "motor themes," which are developed and significant for the subject of inquiry due to their high centrality and density. Cloud computing systems, cloud computing settings, competition, security of data, information management, information systems, and cyber security and machine learning are the five driving themes in this quadrant (AI, cyber security).

Security of data, information management, and information systems: For 20 years, scientists have studied security information management in the context of protecting nations, cities, and workers, including those who work for organizations. However, there has been a discernible pattern of extremely high dynamics in business development in the area of technology that could be copied by rival market participants since 1997. In the subject of management sciences and in terms of how interest groups in the business communicate, the safety management process is crucial.

The consequences of not having a security strategy in one`s organization may result from bankruptcy to serious legal and financial consequences (Kamil, 2019).

Environments, systems, and cloud computing competition, cloud computing idea allows for the rapid deployment and release of a shared pool of reconfigurable computing resources (such as services, storage, networks, services and servers) with no administrative effort or service provider participation. As more enterprise organizations integrate cloud computing into their business operations and infrastructure, the field of IT is developing. According to a study by the International Data Corporation (IDC), a company that specializes in information technology market research, analysis, and advisory services, the cloud computing market would grow from a multimillion-dollar industry to a multibillion-dollar industry.

Along with its numerous benefits, the shift from a personal computer-based paradigm to a cloud computing paradigm entails significant hazards, not the least of which is the loss of security and control (Latifa et al., 2012).

12.3.6 AI AND CYBERSECURITY

Information security depends more and more on AI and machine learning, which can swiftly analyze millions of data sets and uncover a variety of cyber threats, from malware threats to suspicious behavior that could result in a phishing attempt. AI is capable of quickly, correctly, and efficiently analysing massive amounts of data. An AI-based system can predict future

assaults that will be similar to those that have already occurred by using threat history, even if the patterns of those attacks vary. Because of these factors, AI can be applied in cyberspace: AI can manage enormous amounts of data, identify fresh and important changes in attacks, and continuously enhance the response of its security system to threats.

12.3.7 ML AND CYBERSECURITY

Cybersecurity threat detection by hand is not as accurate as threat detection using ML and deep learning. By combining cybersecurity techniques with ML approaches, this is accomplished. This is very helpful in the identification and diagnosis of any medical anomalies. Only cybersecurity algorithms and strategies were used in earlier methodology. To identify every cybersecurity danger, manual work is needed. Even currently active cybersecurity threats can be detected in this. The effort required to identify an existing attack type is equivalent to that required to identify a new attack type. Given that there are millions of cybersecurity threats occurring worldwide, this task is virtually impossible. Therefore, it is crucial to identify these hazards as soon as possible. In the area of cybersecurity, this can be accomplished by applying "ML and deep learning algorithms." The following is the algorithm used to identify cyber security threats: "Support Vector Machine (SVM), (CNN) Convolutional neural networks, Recurrent Neural Network (RNN), Deep Belief Network (DBN), K-Nearest Neighbor (KNN), and Decision Tree."

Commonly referred to as a subset of "AI," ML is closely related to computational statistics, data mining and analytics, and data science, with a focus on teaching computers to learn from data. To uncover intriguing data patterns or to detect or forecast behavior, ML models often consist of a collection of rules, procedures, or sophisticated "transfer functions," which could be crucial in the field of cyber security. Smart meter energy, testing protocol security, network intrusion detection, keystroke dynamics authentication, human interaction proofs, cryptography, spam detection in social networks, and phishing detection usage profiling are all applications of ML.

- The lower-right quadrant themes are referred to as "fundamental and transversal themes," which are distinguished by high centrality and low density. These themes are significant for a domain and address broad topics that cut across the field's several research areas; the main theme in this quadrant is (crime, risk assessment, and automation).

- The lower-left quadrant themes are referred to as developing or declining themes since they are marginal, weakly developed, and have low centrality and density; Computational linguistics, information science, state-of-the-art, budget control, expenses, electricity distribution, security controls, and AI technologies are the five themes in this quadrant (cryptography cybersecurity systems, physical unclonable functions, and hardware security).

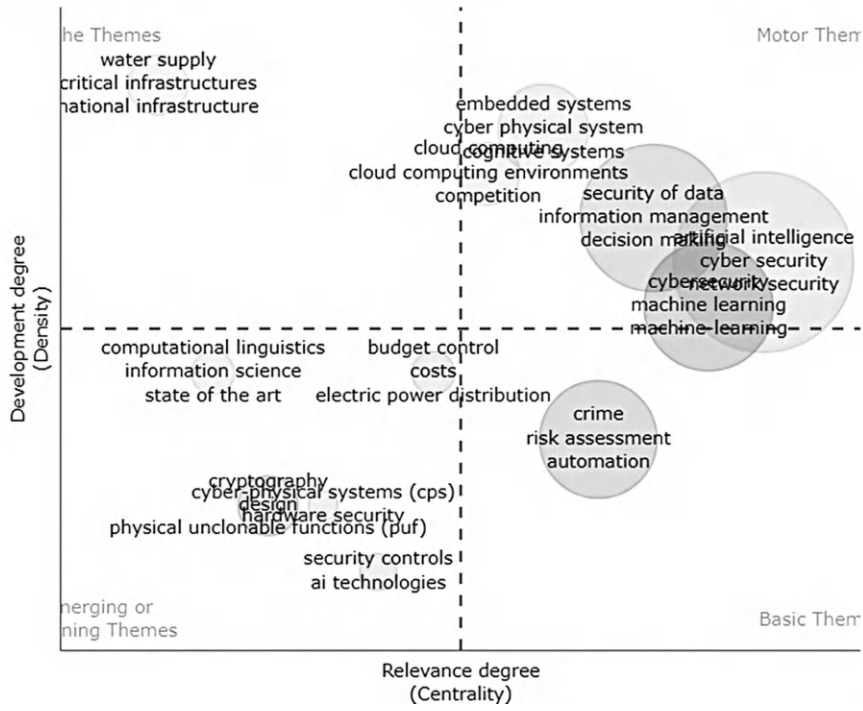

FIGURE 12.9 Thematic map.

The upper-left quadrant themes are referred to as isolated themes and the highly developed themes. They have insignificant outward links (low centrality) but well-developed internal links (high density), indicating that their field-specific significance is relatively modest. Because it is a specialized topic, the theme represented by the keywords "water supply," "vital infrastructures," and "national infrastructures" is of limited significance to this research field.

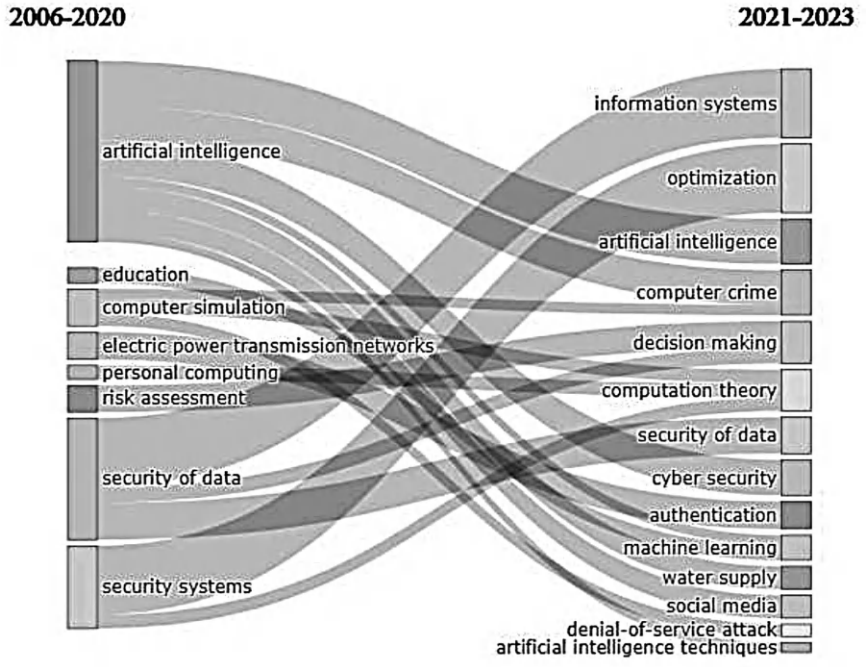

FIGURE 12.10 Thematic evolution.

12.4 CONCLUSIONS

The study of AI in cyber security is still in its early stages, with few researchers and publications committed to it. The most important publications are from the fields of electronics, computers and AI, computers and security, information processing and management, technology, human intelligence, and organizations. Because the topic is still developing, conference proceedings are the most common source of publications. Most well-known authors produce 1–2 papers annually, and their total number of citations ranges from 0.5 to 11.625 annually. The productivity of the most important writers in this field, whose effect is gauged by the total number of citations per year per author, is largely below 5, demonstrating the narrow and emerging nature of this study domain.

The majority of the significant donations come from Europe and the United States, followed by South Asia, several countries in Africa, and Middle-East Asia. This could be because these nations have a larger digital footprint. Masaryk University has a combined maximum of six

publications with corresponding authors, together with the University of Science and Technology, Beijing.

In cyber security, the burgeoning field of ML is mainly limited to business domains of IoT, network security, and cyber-attacks, and demonstrating the selective concentration of research in this domain on particular AI techniques and applications. Scholars' attention is primarily focused on the ML and use of AI (learning systems) for network security and defense from cyberattacks due to the emergent nature of this research topic.

Information systems, information management, and information systems were the main topics of research from 2011 to 2020. From 2020 onward, the focus switched to internet security, cyber-attacks, IoT, and network security. The most widely used AI (ML) approach is being used to boost network security systems and predict cybercrimes and cyber-attacks.

KEYWORDS

- **artificial intelligence**
- **cyber security**
- **bibliometric**
- **PRSIMA**
- **machine learning**
- **IOT**

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