globsyn
business school
AMBITION OF THE YOUNG

GLOBSYN
MANAGEMENT
JOURNAL

Artificial Intelligence (AI) in Human Resource Management (HRM): A Conceptual Review of Applications, Challenges and Future Prospects

Artificial Intelligence in Finance: Innovative Economic Strategies for Financial Inclusion

Artificial Intelligence in e-Commerce: Designing Marketing Strategies

EMBRACING AI for HUMANITY

AI & Energy: Problems and Prospects

Table of Contents

Globsyn Management Journal
Vol - XVII, Issue 1 & 2, January - December 2023

Case Studies

Book Reviews

Patron-in-Chief's Desk

Today, with more than two decades' legacy, Globsyn Business School (GBS) stands amongst the very best in management education in India. This has happened because of Globsyn Group's unwavering focus on evolving GBS into a global B-School with an education edifice that promotes Innovation, Research and Technology, and the tireless efforts and commitment of the entire Globsyn family to put the B-School way ahead of the learning curve. It has always been Globsyn's endeavour to create a knowledge driven society, which not only focuses on academics but also engages in activities that goes 'Beyond Education'. Globsyn Management Journal (GMJ) is one such 'Beyond Education' initiative that helps in perpetuating our vision of building a research-driven education edifice, amalgamating academics, corporate ethics and human values in the student development process.

With our constant quest of continuous innovation in management education over the past two decades, I strongly feel that by incorporating Artificial Intelligence (AI) literacy into the educational curricula, societies can empower individuals to navigate the complexities of this technological landscape. Recognizing this global phenomenon, this issue of GMJ will accentuate on the potential of AI to amplify human capacities.

This issue of will also focus on some aspects of this vast subject, which are of immediate relevance to academicians, practicing managers, management candidates, and society members in general, so that appropriate deliberations may lead to the greater good and prosperity of humanity along with the development of universal human values in organizations and leaders.

I wish the entire Research Cell of GBS all the success for their future endeavours!

Mr. Bikram Dasgupta
Founder & Chairman
Globsyn Group

Patron's Desk

I am delighted to acknowledge the commendable efforts of Globsyn Business School (GBS) as they embark on the publication of the 17th volume of their peer reviewed management journal. Sustaining and advancing a research journal like GMJ requires perseverance, fortitude, and decisive actions, and I express my gratitude to the dedicated faculty team at Globsyn for their hard work.

The forthcoming issue of the journal will encompass a diverse range of content, including research articles, case studies, book reviews, and perspectives. This year's theme, "Embracing AI for Humanity," underscores the focus on exploring the impact, challenges, prospects, progress, human values, and the future of AI on humanity.

GBS, with its belief in Knowledge Dissemination and Knowledge Creation as the fundamental pillars of educational excellence, actively encourages student involvement in research activities. It is heartening to note that GBS has incorporated student research work in GMJ, showcasing its commitment to fostering a research-oriented environment.

The editorial board of Globsyn Management Journal, comprising esteemed academicians and corporate professionals at both national and international levels, instill confidence in maintaining the journal's quality. I extend my best wishes to the editorial team and anticipate continued success for the journal.

I hope that the GBS academic fraternity will continue to give impetus to research culture in the times to come.

Prof. R. C. Bhattacharya
Vice Chairman
Governing Council, Globsyn Business School, Kolkata

Patron's Desk

Globsyn Business School is built around an intellectually stimulating edifice of Innovation, Research, and Technology, where Research forms the foundation of the academic delivery system from which emanates all other artefacts. The Globsyn Research Cell aims at bringing together academicians, corporates, and students to share research ideas involving various management fields of interest and expertise.

As a postgraduate management institute with more than 20 years' legacy of continuous innovation, we have always been able to ensure that the young learners are exposed to the most contemporary research methodologies, and also develop a range of academic artefacts, not only limited to case studies or classroom learning but encompassing Seminars, Conferences Presentations, Journal Submissions, amongst others. The Globsyn Management Journal has been a significant effort in this direction. Over the years, several volumes of the Journal have encompassed topics like 'Innovation and Entrepreneurship in Management', 'The Next Normal: Visualizing Emerging Trends across sectors in a Post-disruptive Economy', 'Economic Development & Sustainability in Dynamic Global Market', amongst others.

I am very happy that this year, too, Globsyn Research Cell had selected such a befitting topic for the Globsyn Management Journal Vol. XVII – 'Embracing AI for Humanity'. This selection of topic becomes all the more significant with the realization that we are living in an era dominated by rapid technological advancements, and therefore, the integration of Artificial Intelligence (AI) into our daily lives has become inevitable.

However, to ensure that there is a harmonious coexistence between humanity and technology, it is imperative for technology to align with basic human values, such as, Ethics, Sustainability, and Governance (ESG). This is something we want our students to recognise, learn, and imbibe. Our mission at Globsyn Business School has always been to provide our students with the best academic experience so that they become relevant and responsible leaders and managers, ready to take on the challenges of the corporate world from the day they graduate.

The objective of Globsyn Management Journal is to provide academicians with a platform to push their research findings and come up with relevant solutions that is plaguing the world, and empower students to publish their conceptually sound and methodologically rigorous papers by collaborating with global scholars. We have always believed in knowledge acquisition by application and behavior, and this is the best way for us to help our young managers become future-ready.

Mr. Rahul Dasgupta
Director, Globsyn Business School, Kolkata
Trustee, Globsyn Knowledge Foundation

Editor's Desk

Dear Readers,
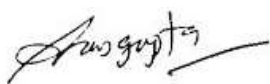
Greetings!

It is my privilege to present before you, Globsyn Management Journal 2023, Volume XVII. The Globsyn Management Journal (GMJ), a multi-disciplinary journal, indexed in EBSCO, ProQuest Database, OCLC, ABI Inform, ICI, J-GATE, Google Scholar and several such databases, is a double-blind peer reviewed journal. Having been published over the last 17 years, GMJ has successfully positioned itself as a signature research journal for all management educators, academicians, corporates, researchers and students globally to come together, contribute and experience the power of diversified and interdisciplinary management education. This issue of GMJ (VOL XVII) is focused on the theme: 'Embracing AI for Humanity'. This edition of the journal will focus on how Artificial Intelligence is shaping humanity and the civilization. On one side, there are elements of progression where the advancement of human civilization and the sustainability therefore is reliant to Artificial Intelligence. On the other hand, the human values may be questioned and thereby compromised under the influence of Artificial Intelligence. The debate, therefore has multiple layers and the application of Artificial Intelligence in human lives, is therefore multi-fold. The custodians of technology and Artificial Intelligence need to have a nuanced understanding in terms of implementation of Artificial Intelligence in daily lives. Every article in this journal will be catering towards a knowledge base which will be useful for the readers to introspect and implement Artificial Intelligence in varied and effective way for the benefit and advancement of humanity.

As an editor of this journal, I have ensured every possible level of quality research output with my team so that this journal infuses every reader with curiosity and enriches their understandings about the specific topic under discussion. I am sure this journal would interest and add value to corporate, academicians and all stakeholders alike and reach newer heights in the years to come.

Thank You!

Regards,

Dr. Sabyasachi Dasgupta
Editor, Globsyn Management Journal
Head, Research and Publications, Globsyn Business School, Kolkata

Research Articles

Dovetailing Artificial Intelligence with Human Resource Management

Prof. Debaprasad Chattopadhyay

Faculty, Globsyn Business School, Kolkata

Dr. Preethi.K.A

Assistant Professor, Center for Management Studies, Jain deemed to be University, Bangalore

Abstract

Advancements in Technology have been taking place at a rapid pace, over the last few decades in general and COVID and post-COVID era in particular. Naturally, such technological innovations have created impact amongst all, in various aspects of day-to-day life. One of such technological innovations that is presently oft-spoken, deliberated and executed in several fields perhaps capable of revolutionizing the world, is, Artificial Intelligence (AI). AI is a computer-system which can think intelligently, resembling how an intelligent human thinks. Some of the studies undertaken have revealed that AI is organised into four categories, namely, it is a system that thinks like a human being, thinks rationally, acts like a human being, acts rationally. AI is getting integrated into most of the business functions but getting dovetailed at a relatively faster pace into the Human Resource Management function of an organisation, be it in Hiring, Onboarding, Training besides other activities of HR. This does not sound like a panic bell to apprehend that AI will completely replace all HR initiatives, rather it will facilitate HR from getting bogged down into repetitive tasks to strategic roles and value-added duties. This paper, descriptive in its nature, will delve into a qualitative study as to how AI has been dovetailed into various sub-systems or mechanisms of HR and its plausible impact on organisations, HR department and employees at large.

Keywords: Human Resource Management, Artificial Intelligence, Hiring, Onboarding, Training.

Introduction

The buzzword of today in various conferences, seminars and articles is Artificial Intelligence (AI), which has made significant inroads across multifarious areas. Tasks which are trivial and hackneyed as such, hitherto done manually, are now being performed by software systems and automated machines. a technology that allows computers to learn from and make or recommend actions based on previously collected data. Synonymously termed computational intelligence, Artificial Intelligence is akin to human intelligence. It is not merely a machine with minds but fraught with many more attributes. In a more florid style, sensing, thinking, doing, and correcting are the hallmarks of Artificial Intelligence. Robotics, Machine Learning and Deep Learning are intertwined with AI. In terms of human resources management, artificial intelligence can be applied in many different ways to streamline processes and improve efficiency.

Literature Review

McCarthy (1956) coined the term "artificial intelligence" to describe "the science and engineering of creating intelligent machines." Progressive advancements brought cybernetics, automation theory, information processing, and cognitive problem-solving under the purview of AI (McCarthy, 1959, Marr, 2018, Copeland, 2018, Rayome, 2018). Accounting and finance,

healthcare, human resources, manufacturing, retail, and sports transportation are all using AI in their daily operations.

Yawalkar (2019) conducted research to understand the challenges associated with using artificial intelligence in the human resources department and to analyze how it functions there. The use of artificial intelligence (AI) by the human resources department for a variety of tasks was discovered to be growing. Robotics companies were able to handle tasks like hiring, data analysis, and collection, as well as reducing workplace workload and improving workplace performance. The usage of AI and its impact on HRM as a result of technological advancement was investigated by Bhardwaj et al. (2020) through an empirical study including 115 HR professionals working in the IT industry in the Delhi/NCR region. Finding out if the use and innovation of HR functions moderate this link was the goal of the study. An increased use of AI in the workplace enhances HR functional effectiveness, as evidenced by the robust association between the two components discovered by multiple regression-based hypotheses. Because AI has a significant correlation with both innovation and usability, it influences HR in terms of both. This research will offer insights into artificial intelligence, which is triggering a new round of industrial revolutions.

An emerging body of research has been studying the real and possible consequences of artificial intelligence (AI) applications in businesses in the workplace (e.g., Strohmeier & Piazza, 2015). According to Ibarra et al. (2018) and Müller et al. (2020), academics are beginning to recognize the advantages and disadvantages of using artificial intelligence (AI) in the workplace as well as the potential benefits of smart computer-based technologies for both individuals and businesses. The literature is getting more and more dispersed even yet research on how AI affects employment outcomes is just beginning to show up.

An organization can gain additional benefits by integrating artificial intelligence with human resource management (Minbaeva, 2020). These benefits include better managerial decisions (Liboni, Cezarino, Jabbour, Oliveira, & Stefanelli, 2019), faster and more efficient hiring processes (Reilly, 2018), better learning at work (Hamilton & Sodeman, 2020), employee engagement (Tripathi, Ranjan, & Pandeya, 2012), and employee retention (Samarasinghe & Medis, 2020).

In their 2022 study, Arslan et al. focused on the challenges that HRM executives and departments face in their organizations due to the cooperation between artificial intelligence (AI) robots and human workers on a team basis. Using a combination of multiple literature streams, this study investigates the relationship between AI (particularly robots) and HRM in contemporary businesses. The findings demonstrated the importance of organizational support mechanisms, such as opportunities for training, a supportive work environment, and guarantees of a practical technological competency level, prior to placing human workers in teams with robots.

The purpose of Kambur and Akar's (2022) study was to develop a reliable and accurate scale, learn how HR staff members view AI, and evaluate the improvements AI has made to the HR department. An example of 821 HR managers and employees was given by the biggest company in Turkey. It was determined that managers and HR employees thought technology would free them from repetitive work, reduce the stress of trying to identify competent candidates, and provide them with access to a wider range of opportunities.

Artificial Intelligence in Marketing / sales management

AI is being utilized advantageously in some businesses, including as banks and insurance companies, for tasks like credit loan grading,

expense reporting, and billing. AI is capable of tracking events and patterns in bond and stock prices. The primary metrics used by AI are the user's financial objectives and portfolio. At that point, it can suggest stocks and bonds to purchase or sell. Known by the popular term "Robo-Advisors," these technologies are becoming more and more ubiquitous in both fintech startups and well-established financial institutions.

Risk management: Risk assessment is an extremely important and complicated procedure for financial institutions when they are making loans. Through its analysis of pertinent borrower data, AI can streamline most procedures. When evaluating data pertaining to recent transactions, artificial intelligence (AI) is crucial.

It does, however, highlight the possible dangers associated with lending. Effectively, it simplifies risk management for companies.

Customer data management: The success of a firm depends on effective data management. Information may be reliably and efficiently retrieved from business documents with the use of technologies like text analytics, data mining, and natural language processing (NLP).

Marketing professionals and salespeople may deliver extremely tailored customer experiences by integrating artificial intelligence into corporate management. In comparison to conventional high-budget campaigns, it also costs less. The relationship between a product or service and the consumer is the primary factor that determines future optimization.

Here are a few creative ways that marketers can include AI in their campaigns:

Lead time of scores: Machine learning-generated propensity models can be developed to score leads according to specific parameters. It assists the sales team in determining how "hot" a certain lead is and if it is worthwhile to spend time with them. Making contact with the most qualified leads will save a significant amount of time. Additionally, they can focus their efforts where they will have the biggest impact.

Digital advertising strategies can be optimized by using machine learning algorithms that analyze vast volumes of historical data. to ascertain which advertisements work best for whom and at what point in the purchasing process. They are able to provide them with the most relevant content at the ideal moment thanks to this data.

Propensity modeling is a tool in predictive analytics that may be used to estimate the chance that a specific consumer would convert. It can even forecast which client will make more purchases or at what price a customer is most likely to convert. This will assist the management in devising innovative approaches to promote less well-liked products.

Artificial Intelligence in Healthcare

Medical personnel can swiftly uncover disease signs and trends that they might have missed otherwise thanks to artificial intelligence (AI) in healthcare. AI can examine large amounts of clinical material. From predicting outcomes from electronic health data to analyzing radiological images for early detection, artificial intelligence has a wide range of potential uses in the healthcare industry. Healthcare systems may become smarter, faster, and more effective in providing treatment to millions of people worldwide by utilizing artificial intelligence in hospital and clinic settings. The use of artificial intelligence in healthcare is really shaping the field's future, as it will improve patient outcomes, reduce costs for providers, and change the way patients receive high-quality treatment. Medical personnel can save time and money by making better judgments based on more accurate information when artificial intelligence is used in healthcare. AI in Healthcare has great promise for revolutionizing patient experiences and accelerating the development of high-quality, timely, and accurate treatment for patients. AI will likely be a game changer in this regard.

Artificial intelligence is widely employed in tasks including drug research, automated prescription, individualized medication and care, and patient care (Alriza, 2018).

Artificial Intelligence in Retail

A few of the numerous retail operations where AI has been usefully applied are online shopping, invoice creation, and payment processing. By offering tailored suggestions and enhancing inventory control, artificial intelligence can assist merchants in enhancing the consumer experience. Automating processes like demand forecasting and supply chain management can also assist merchants in cutting expenses and improving their pricing strategies. In the retail industry, it can be utilized to stop losses and identify fraud.

Artificial Intelligence in Transportation

Since AI technology was introduced to the transportation industry, a lot of things have gradually changed. AI has improved a lot. Numerous businesses are using AI to forecast crashes based on environmental and other factors. The use of AI in electric car technology is another fantastic advancement. Because they emit fewer emissions, electric vehicles significantly contribute to the decrease of environmental pollution. One excellent illustration of this is Connect Transit, which makes use of AI-integrated electric buses.

Additionally, it has ushered in the creation of traffic-sensing autonomous vehicles. Because self-driving cars use AI to recognize cyclists and pedestrians, fewer traffic incidents will occur.

It can be used to lessen traffic congestion on the roads, resulting in smooth traffic flow. Many smart cities throughout the world use AI traffic management systems to control traffic flow. Additionally, with the help of AI, drivers can receive warnings about potentially dangerous areas on a particular road or route. Artificial Intelligence can also forecast potential security risks and unanticipated traffic events.

While the application of AI in transportation is still in its infancy, it has the potential to completely transform the industry. The rate of AI adoption in this field has been influenced by trust. In the transportation industry, the absence of appropriate regulation, certification, and standardization of AI technologies exacerbates the already existing lack of trust. AI will be adopted in transportation, though, once public policy on the subject has completely developed as safety will be guaranteed and confidence will subsequently be restored.

Role of AI in Human Resource Management

AI is becoming a vital component of human resource management in today's business environment. Organizations are utilizing AI-powered solutions to optimize their resources and streamline operations in an effort to stay efficient and competitive. AI is transforming HR departments worldwide, from automated recruitment tools that find top talent to complex training programs that offer individualized information.

In the quickly evolving corporate world of today, companies may stay ahead of the competition by implementing more efficient HR processes made possible by utilizing cutting edge technology like machine learning and natural language processing.

Streamlining recruitment and selection

AI has the potential to simplify the human resources management recruitment and selection process. AI solutions are employed to promptly detect possible applicants possessing the qualifications and expertise required for a position. By eliminating any applications who don't fit specific parameters, it can also be used to ensure that employers select the best qualified applicant. This guarantees that only the top candidates are hired for each post while also saving time and money.

Advanced algorithms and machine learning skills enable artificial intelligence to assess

candidate data fast and precisely. This makes it quicker than recruiters to discover the best prospects. With the use of elements like language analysis, tone of voice, and facial expressions—things that a traditional recruiter might miss on a CV—AI can offer insightful information about a candidate's working behavior and personality.

Recruiters can also use AI to analyze the labor needs of the future while taking organizational strategy, performance data, and market trends into account. AI can help create accurate and realistic job descriptions by helping to identify the behaviors and competencies needed for each position.

Onboarding

AI can automate laborious, manual processes to speed up the onboarding of new employees. Technology that automates tasks gives onboarding teams more time to concentrate on the interpersonal aspects of onboarding new members. Tasks related to onboarding automation include training program implementation, database updates, and FAQ reduction.

AI can help expedite the onboarding process by automating administrative tasks like creating accounts, filling out paperwork, and providing training. This frees up HR staff to concentrate on more strategic aspects of the onboarding process, like building rapport and integrating new hires into the company culture.

Learning and Development (L&D)

AI is a key component in enabling businesses to continuously train their staff members new abilities and information. AI has the potential to assist in identifying optimal learning and comprehension strategies and to propose personalized learning activities. Employees benefit from being informed about the constantly evolving business environment.

L&D practitioners can provide better, more interesting learning experiences with the use

of artificial intelligence, which is completely changing the learning and development process. Employers can ensure the best possible learning results for their staff while saving time and money with AI.

Employees can receive automatically tailored learning experiences from learning and development solutions driven by AI. Using data, AI-driven algorithms may evaluate each employee's knowledge, abilities, and work history in addition to providing customized learning materials based on their preferences, needs, and learning preferences. Employees can swiftly and effectively develop their talents as a result. Enhancing learning outcomes and boosting staff engagement and retention are two benefits of this customized strategy.

By examining their performance data and offering customized comments, AI may also offer employees individualized coaching. An AI-led learning and development program, for instance, can assess each worker's performance and recommend details for development as well as practical guidance.

Strengthening performance management

Every employee has to attend the performance evaluation meeting, which takes place in a conference room. An effective performance management system is essential for any organization. Workers' contributions at work can be measured with a sound performance management system. The impact of the organization's training can also be monitored with this approach in place. Employee performance will be more in line with company aims and objectives with the help of this framework.

All of the time-consuming steps in traditional performance management, however, include setting the goal, completing a self-evaluation, getting feedback from supervisors, having a discussion, and signing off. In this instance, artificial intelligence (AI) can help with the real-

time goal monitoring and provide feedback on what has been accomplished and what needs to be completed.

AI also contributes to the removal of prejudices in employee performance comparisons. Setting specific, quantifiable goals will help achieve this. AI can also assist in setting the right goals for underperforming workers so they can improve their performance.

Moreover, it can help by offering insights into potential and forecasting which employees will perform well or poorly, all of which can be extremely helpful data for HR professionals in succession planning.

Employee engagement

AI has the potential to enhance communications between employers and workers. Intelligent surveys, real-time feedback, awards and recognition, and other employee engagement chores may all be accomplished with AI.

Here are some examples of the role that AI plays in employee engagement:

Personalization: By tailoring HR procedures and learning and development initiatives to each employee's unique requirements and preferences, AI-powered solutions may enhance the workplace experience. This has the potential to boost worker engagement and satisfaction.

Response: Artificial intelligence (AI)-driven chatbots and virtual assistants can help employees 24/7 by swiftly responding to their questions and offering feedback. By creating a supportive and accommodating work environment, this can lead to increased employee engagement.

Data-driven insights: HR specialists can assess employee data, including performance measurements and engagement surveys, with the aid of artificial intelligence (AI). They can then utilize this information to learn more about the workforce and spot any possible problems. The results can be utilized to create initiatives and programs for targeted employee engagement that addresses their unique needs and concerns.

Employee retention

One of the biggest issues facing the worldwide sector is retaining personnel. To retain its staff for as long as possible, organizations are continuously experimenting with new approaches and techniques.

Human resource specialists are generally in charge of employee retention. It might be difficult for HR professionals to retain their staff in this cutthroat market. HR has implemented multiple strategies throughout the organization in an effort to tackle this problem. AI can therefore assist in career advancement planning by keeping an eye on and assessing worker performance to spot any indications of depression or stagnation.

Findings

Research indicates that artificial intelligence can be applied to a wide range of HR operations, including recruitment, onboarding, training and development, performance management, employee engagement and employee retention. Beyond this, AI has been used to many more business domains.

Implications of the Study

Although sporadic mention of AI is found in several sources, detailed research into this field so far has been scanty. So, this paper will go into the making of building theory with regard to AI and its application in a structured form of study.

Conclusion

It can be inferred that AI is taking over many functions of HR and has been impacting several multidimensional disciplines. However, this should not raise an alarm that AI will replace manpower in totality. Instead, AI will sharpen the functioning of different aspects of business provided it is harnessed in the right way with authentic, quality data and done with the right sanctity.

References

- Alriza.(2018) 15 AI Applications. Use cases in Healthcare (2018 update)

- Bharadwaj,R(2018). AI in Transportation.-Current and Future Business-Use. Applications.

- Copeland,J(2018). Artificial Intelligence

- Marr,B(2018).The Key Definitions of Artificial Intelligence (AI) that explains its importance.

- McCarthy,J (1959).Programs with Common Sense at the Way back Machine .

- Rayonne,A(2018).The 10 IT jobs that will be most in-demand in 2020.

- https://www.researchgate.net/publication/370658730_IMPACT_OF_ARTIFICIAL_INTELLIGENCE_ON_HUMAN_RESOURCE_MANAGEMENT_A_REVIEW_OF_LITERATURE

From Normative to 'AI First' Finance: A Conceptual Review

Dr. Mahuya Basu

Faculty, Globsyn Business School, Kolkata

Prof. Kaushik Ghosh

Faculty, Globsyn Business School, Kolkata

Abstract

Since the development of modern finance, use and analysis of data had always been an integral part of financial study. With the increase in availability of the types, volume and frequency of data and introduction of advanced computation techniques, financial decision-making procedure had moved from assumption based normative models to theory free Artificial Intelligence (AI) enabled process. The primary objective of this study was to explore this evolution. The study was based on secondary data and primarily exploratory. It had also discussed how AI based techniques had influenced both academic research as well as the industry use. The study concluded that although the use of AI became an irreversible inclusion in the field of finance, the governance issues were still to be addressed to ensure financial services to be discrimination free and guarantee of investors' protection.

Introduction

The transition from normative finance to 'AI-first' finance marked the most discussed paradigm shift in the financial industry in recent times. Normative finance, rooted in conventional models and assumption-based processes, was substituted by artificial intelligence (AI) based decision making where information was directly derived from data without fitting a parametric model of finance. This transformation was primarily driven by the exponential growth in computing power, the availability of vast amounts of data – both structured and unstructured, and breakthroughs in machine learning algorithms. In this dynamic landscape, financial institutions have been increasingly embracing AI as a core component of their operations, leveraging its capabilities to enhance decision-making, risk management, and customer interactions. The shift signified not only a technological evolution but also a redefinition of how financial services were conceptualised, delivered, and optimised in the recent time.

In finance, 'Normative Theory' primarily refers to a framework that explains how financial markets, institutions and practices should operate. Hilpisch (2020) defined normative theories in Finance as the one that was based on assumptions and axioms and derived insights and results from those sets of relevant assumptions, whereas a positive theory relied on observations, experiments, data, relationships, and similar elements. It elucidated phenomena by leveraging insights derived from existing information and the resultant findings. The normative finance included models like 'discounted cash flows', 'capital asset pricing' or 'option pricing', theories like 'modern portfolio theory', laws like the law of 'no arbitrage' and hypotheses like 'efficient market hypothesis'. According to Peón & Antelob (2012), normative theories attempt to set rules about the optimal behaviour of the individual decision maker.

Descriptive finance on the other hand focused on data based empirical testing and validity of the theoretical models developed as a part of normative finance, hence they focused on how an economic agent actually behaved under certain circumstances. McGoun & Zielonka (2006) stated that in normative finance, a hypothesis was true if it corresponded to what people should rationally be doing. He defined it in sharp contradiction to positive finance where a hypothesis was true if it corresponded to what people were doing. According to this definition, models were conceptualized as normative ideals, aimed to depict actions based on rationality, with the underlying notion that rationality served as the central building block of financial markets in coherence.

Rationality stood as the core essence of financial markets, implying that models and hypotheses aligned with reality only when they hinged upon rationality as a fundamental assumption. Miller (1999) used the term 'micro normative finance' to describe the core economic problem where an individual or manager of an organisation aimed to maximize an objective function - utility, profit or shareholders' value. At the center of this idea there lied an economic agent whose decision-making process was strictly rational and based on the sole objective of utility maximization.

This concept of 'rational, selfish and sufficiently informed' economic agent at the core of all economic activities had been challenged by several alternative schools of thoughts. A number of these studies raised questions about the meaning of rationality and the ability of the human mind to process all available information. The basis of such oppositions on one hand explored the impact of psychological heuristics and biases of human mind on his decision-making process and on the other hand focused on analysing the actual behaviour of individuals and markets. A financial model should have been considered to be realistic when it demonstrated the ability to explain and

forecast the actions of individuals or market variables under examination. This notion, fueled by the exponential growth in the availability and processing power of data through computation led the path for data driven finance. The emergence and growth of data driven finance were based on three primary questions – firstly, how did the investors make their financial decisions, secondly, did these decisions reflect the guidelines and recommendations provided by modern financial theories and models or did they reflect some biases and thirdly if existed, did these biases were systematic and thus needed further modeling (Peon & Antelob, 2012).

Data driven finance mostly applied the statistical and econometric methods to rigorously test the normative theories and models. Hence, the significance lied not only in the existence of available data but also in how it could be accessed and processed. Till then, financial economists mostly used traditional sources such as newspapers, magazines, and financial reports. The volume and diversity of data furnished by data terminals like Refinitiv or Bloomberg posed a challenge for systematic consumption by individual users. Hilpisch (2020) suggested that the pivotal advancement in data-driven finance stemmed from the programmatic accessibility of data through application programming interfaces (APIs). These APIs enabled the utilization of computer code to systematically choose, retrieve, and process diverse and extensive datasets.

The new wave of fourth industrial revolution based on digital transformation and the application of Artificial Intelligence (AI) in several sectors including finance, healthcare, and education brought a new breakthrough. AI had been defined as the discipline focused on enabling computers and their systems to execute intricate operations typically associated with human intelligence (Tatsat et al., 2020). Lakhchini et al (2022) defined AI as the field of study by which a computer, and its systems,

developed the ability to carry out complicated operations that normally involve human intelligence.

AI's integration in to the field of finance has a long history and mirrored the intricate evolution of the AI discipline itself. During the 1950s and 1960s, application of AI in finance was not a major focus particularly in scholarly investigations. Subsequently, attention turned towards developing AI applications for finance, ranging from the recognition of Machine Learning (ML) and Artificial Neural Networks (ANN) to the emergence of Neural Network models based on Bayesian statistics. These developments became integral in extensive research applications also, particularly in audits, stock market forecasting, personal financial planning techniques and many more. The 1980s witnessed a substantial resurgence of AI techniques in finance with the emphasis on the use of fuzzy logic across diverse domains of financial research, such as pattern recognition, control, use of unstructured and alternative data, and decision processes. In the late 80's a prototype for automated trading was introduced, based on automatic adjustment of crucial parameters in response to market conditions. The use of mathematics in finance was also on rise, paving the way for complex statistical modeling and the incorporation of AI. Such operations started including a broad spectrum of tasks which were unconventional in previous financial research and applications including speech recognition, visual perception, and language translation. Therefore, in the contemporary era, AI serves as a powerful and efficient tool for addressing challenges and accelerating growth and success while saving both time and resources.

Transitioning from the normative financial theories to utilization of AI demanded thoughtful examination and a perspective analysis of potential outcomes, along with beneficial reflections on its impact on humanity. The primary objective of this paper was to explore this paradigm shift that had taken place in the study of finance since the development of modern finance. Specifically, this paper will try to explain the need for such transformation and the role that availability of data and digitalization has played in the process. It would also try to understand to what extent this transformation enhanced the quality of economic decision-making process and helped in achieving the basic objective of financial economics. The rest of the paper is divided as follows: Section 2 discusses the development of the major normative financial models whereas section 3 discusses the introduction and growth of data-driven financial models. Finally, section 4 captures the applications of artificial intelligence in the financial decision-making process both in practice and research. Section 5 highlighted the risk embedded in the application of AI and threw light on the problems of over digitization in financial decision making. Finally, section 6 concluded the discussion.

Major Normative Models in Finance: A Brief Review

The development of modern financial theories could be traced back to several key milestones, but a pivotal starting point was often identified with the emergence of the Modern Portfolio Theory (MPT), Efficient Market Hypothesis (EMH) and Capital Asset Pricing Model (CAPM).

In 1952, Harry Markowitz introduced the groundbreaking Modern Portfolio Theory (MPT), revolutionizing finance by providing a quantitative framework for portfolio management. This approach allowed investors to optimize their asset portfolios while balancing the trade-off between return and risk (Markowitz, 1952). Markowitz argued that to effectively mitigate risk, investors should avoid investing solely in one security and instead developed a diversified portfolio. He also emphasized on the degree of diversification necessary for constructing an efficient portfolio and stated that the key for creating the optimal combination of

assets was determined by covariance effects of the asset allocation and not merely by adding more assets to the portfolio.

In subsequent years, William Sharpe contended that a relatively small number of variables could yield results comparable to the Markowitz model (Sharpe, 1963). The introduction of market models simplified the mean-variance optimization process by including the concept of security beta in portfolio construction. Over the time period several researchers had added several more elements to MPT like skewness or log-normal return distribution but the pioneering work was still considered one of the most important contributions is modern finance.

The concept of Efficient market hypothesis was first formalized by Fama's contribution (1965,1970). Fama argued that financial markets were efficient in reflecting available information, and prices adjusted rapidly to new information. EMH primarily stated that a market was efficient when prices fully reflected all information available at any moment. Statman (1999) emphasized that the term 'efficiency' carried dual meanings when applied to financial markets. Firstly, it suggested that investors couldn't consistently outperform the market. Secondly, it implied that security prices were rational, indicating they were influenced solely by fundamental characteristics namely risk and expected return.

One of the most celebrated normative theories of finance emerged from the theory of no-arbitrage pricing used in valuing financial derivatives. This formula had profoundly influenced financial markets and served as a fundamental element in option pricing theory. The Black-Scholes formula calculated the theoretical price of call or put options, factoring in variables such as the current stock price, option strike price, time until expiration, volatility, and risk-free interest rates. Renowned for its simplicity and effectiveness, though the formula provided a concise means of estimating option prices, like other normative

theories, was also developed based on several restrictive assumptions namely efficient market, lognormal return distribution and some liquidity at every stage of the transaction.

The criticism against normative finance primarily emerged from two sources – The emergence of Behavioural Finance which laid its groundwork based on investors' biases and heuristics and extensive empirical works that statistically tested these models. Historically, all of these theories underwent rigorous testing against empirical data, a process that occurred long after their initial publication.

This delay in empirical validation could be attributed primarily to advancements in data availability and computational capabilities over time. This field that resided at the intersection of mathematics, statistics, and finance, employing these methods on financial market data, became commonly referred to as financial econometrics which became the core building block of data driven finance.

The Emergence of Data Driven Finance

Financial econometrics mainly relied on statistical techniques, including regression and stochastic time series analysis and was closely tied to the accessibility of financial data. Before the year 2000, both theoretical and empirical financial research predominantly utilized relatively small datasets primarily composed of low frequency structured data captured from financial statements and daily market prices.

However, over the past decades, there has been a transformative shift in data availability, with a notable increase in the types of financial and other data accessible, characterized by enhanced granularity, quantity, and velocity.

Soon, data under analysis extended from structured price data to unstructured data like analysts' recommendations, news and text content and again to alternative data like social media posting and satellite images.

Table I briefed the different types of data that became available now for financial analysis.

Fundamental Data	Market Data	Analytics	Alternative Data
Balance Sheet	Price/Yield/implied volatility	Analysts' recommendation	Images
Income Statement	Volume	Credit Rating	Google searches
Macro Variable	Dividend/Coupon	Earning Expectations	Twitter/chats
	Open interest quotes/cancellation	News Sentiments	Metadata

Source: Weiß (2021)

The volume, variety and velocity of the data became very high because of the variety of sources they were coming from (balance sheet, financial statements, Twitter, financial apps etc.) and also the variety of formats they were available in (structured, semi-structured, unstructured) and because of the high frequency nature, the data needed to be prepared well before they were being used.

A few of the problems that data driven financial analysis had to confront are i) incomplete, ii) noisy, containing impossible values or outlier and iii) inconsistent which contained discrepancies in codes or names. Hence, data preparation was one of the most important steps in developing econometric or machine learning models. Data preprocessing involved several steps of preparing a dataset for statistical analysis and involved substantial costs. The fundamental steps of data preprocessing were:

i. **Describing the data:** This step described the data mainly using descriptive statistics. Data could be described by the number of observations under all variables (features), understanding the meaning of variables they represented, the type of values each variable held, getting the summary statistics of the data etc.

ii. **Exploring the data:** In this step, data were explored to determine the sparseness, and identify missing values, which in turn helped to identify the appropriate learning method for the model.

iii. **Verifying the data quality:** This step was critical where the researcher tried to understand that who had collected the data, and from where the data were collected, which helped to identify the incomplete or erroneous data. Verifying the data quality was important it might include structural break or change in source character in the data.

iv. **Cleaning the data:** While combining data from multiple sources, there could be chances that data were duplicated or mislabeled. Data cleaning was a process of fixing or removing erroneous, corrupted, duplicate or incorrect data. This was also an important step in data preprocessing as erroneous data might train the model incorrectly leading to incorrect outcomes.

v. **Constructing the data:** In this step, the observed data points were transformed into aggregate or abstract variables thus reducing the number of variables in the dataset.

vi. **Integrating the data:** This step involved merging data from various sources (structured, semi-structured or unstructured) without losing any valuable information that the data might contain.

vii. **Formatting the data:** It was the process of transforming data into a common format which helped the user to perform comparisons.

All the normative models were extensively tested for validity including the core assumptions of

investors' rationality and the linear relationship between variables like expected return and systematic risk of equities. The widespread and extensive accessibility of financial data had prompted a shift from a theory-first approach to finance that prioritized data-driven methodologies. Numerous instances, drawn from actual financial data, highlighted the inability of several widely accepted financial models and theories to withstand scrutiny when confronted with the realities of financial markets. Despite their elegance, these models might prove overly simplistic, failing to encapsulate the intricate dynamics, evolving nature, and nonlinearities inherent in financial markets. This had led the path of 'theory free' totally data driven analysis of financial data without any assumptions of how market participants might behave, where practitioners and researchers both moved away from closed solution models and only relied on historical data to extract inference.

The Role of AI in Finance

Financial decisions like granting a loan, rating a bond or investing in securities, required quick and fact-based judgment calls. These decisions necessarily involved facts like balance sheet and income statement data, analysists' forecast which can easily be taught to a machine and subsequently the machine could make financial decisions with an increased speed of decision-making process. Hence, the entire financial decision-making process like granting loans, rating bonds, buying or selling stocks, could be automated using AI based ML algorithms. As the machines were trained with fact-based data, they would also comply with existing relevant regulations thus reducing the human errors. Moreover, the trained machines did not require any economic theory rather only relied on the data and patterns in the historical data, the decisions would always be tested in real-time.

The ease and efficiency of algorithmic finance caught instant attraction from both practitioners

and researchers. Cao (2018), through a Google trend analysis, identified that the search terms 'AI in finance' and 'data analysis in finance' have been consistently maintaining their popularity since 2004. In the years 2004 and 2005, there was a sudden surge in search interest for terms like 'neural network in finance' and 'data mining in finance'. The keywords 'data science in finance' began capturing significant attention in late 2004 and early 2005, while 'machine learning in finance' gained recognition around the middle of 2006. Strikingly, the term 'AI in FinTech' started gaining attraction from February 2016. Lastly, over the past five years, there had been a substantial increase in the combined topics of AI, data science, machine learning, data analytics, FinTech, finance, and economics on Google Trends. It reflected an emerging but critical role for AI and data science in the field of finance. Murugesan & Manohar (2019) suggested that AI applications and tools were widely accepted and used across banks, insurance companies and capital markets that automate, analyse and help in decision-making processes thereby created new business models and opportunities.

In order to explore the role of AI in finance, this study centered around the discussion from two broad perspectives, a brief review of the financial research output focusing on the use of AI in finance and the industry application of AI techniques in the field of finance. Table 2 summarized few of the diverse research studies conducted in recent years on the role and application of AI in Finance.

Industry had started using AI based techniques even before it caught academia's interest. Organisations like J P Morgan & Chase had reportedly incorporated it in various operations, including fraud detection, risk management, and customer service. Goldman Sachs had shown interest in using AI for trading strategies and risk management. BlackRock, one of the pioneers in using AI application in finance, had been using it for risk assessment and portfolio

management. Morgan Stanley had reportedly explored the use of natural language processing (NLP) to analyze financial news and reports for market insights. UBS has integrated AI into its wealth management services and even for financial compliances and many more. Cao (2020) had broadly grouped the AI applications in the field of Finance into i) modeling economic-financial system mechanisms; ii) financial market analysis and forecasting; iii) agent-based economics and finance; iv) smart investment, optimization and management; v) smart credit, loan and risk management; and vi) smart marketing analysis, campaign and customer care. He also summarised the finance problem areas and mapped them with typical AI application domains. Table 3 reflected the mapped AI application domain with Finance problem domain.

			Time 2: Selected Research Studies Based on Application of AI in Finance		
Sl. No	**Author (year of publication)**	**Application**	**Objective**	**Methodology**	**Findings**
1	Ghosh et al (2021)	Use of random forest and long-short term memory network to predict directional movement of stock price	The objective of the study is to predict the market movement factoring the closing and opening price and predicting the probability of outperforming markets in intra-day trading	The study divided the sample in several periods with each period had an in-sample and out-of-sample part, the features and targets are set for each part and finally random forest and long-short term memory is applied to it to predict market movement.	The study calculated the probability for each stock to outperform the median intraday market performance. The study took a long position with high probability stocks and shoer position to low probability stock. The strategy consistently outperformed the market return.
2	Acheampong & Elshandidy (2021)	Use of machine learning algorithms to model language in the narrative sections of annual reports of European banks to identify credit risk.	The study aimed to employ a machine learning algorithm which extracted content capable of explaining credit risk from narrative part and corporate disclosures of annual report of European Union banks	The study considered 145 Banks across 19 European Union countries over a period of 2005 to 2017 and used Supervised Latent Dirichlet Allocation (LDA) model to map the language in the annual report to the non-performing loans variable.	The study found that the text-based credit risk (soft) measure explains a substantial portion of the variation in NPLs, O-score, Z-score, and credit rating downgrades.
3	Chen & Ge (2020)	Use of Neural Network model in optimal portfolio selection problem	The study used a neural network-based model in portfolio selection problem	Hamilton-Jacobi-Bellman (H-J-B) dynamic programming approach was used to frame the problem of portfolio selection as a differential equation form. Based on this, the study proposed an optimisation objective and Neural Network was used to solve the problem.	The study checked the empirical performance of the proposed model and select the optimum portfolio.
4	Tang (2020)	Use of dada mining technique for predicting Financial Crisis	The study aimed to propose a AI based single classifier financial crisis prediction approach	it used two sets of companies as test group and control group and analysed various financial and non-financial indicators which were consistent and significantly different between these two groups. The study then used a decision tree induced learning method and mined the classified prediction knowledge of early warnings of financial crisis.	The methods used a dynamic training decision tree rather than a static input attribute set to model the decision tree. The resultant output improved the generalisation performance, reduced overfitting phenomena and improved the prediction ability.
5	Bedoya, Granados & Burgos (2020)	The use of graph analysis techniques to detect money laundering and financial fraud	The objective of this study was to develop a multidisciplinary approach using economic, legal and social data and use graph analysis to identify pattern which indicated money laundering and terrorism finance	Graph analysis was used to represent and analyse complex transactions and networks among entities. The data were represented as a graph, where nodes represented entities (individuals, companies, accounts) and edges represented transactions or relationships between entities. This graph structure allowed to visualize and analyse the flow of money and connections between different entities. Features might include unusual transaction patterns, frequent large transactions, multiple connections to high-risk entities, or sudden changes in transaction behaviour.	This paper introduced a technical and empirical evidence supporting an Anti-Money Laundering framework using AI and network science. The proposed software aimed to bridge the gap between the dynamic nature of Machine Learning and the existing tools to prevent that. Unlike certain tools that relied on static analysis conducted days or months after financial transactions have occurred, this approach provided a more real-time and proactive solution.

Sl. No	Author (year of publication)	Application	Objective	Methodology	Findings
				Table 2: Selected Research Studies Based on Application of AI in Finance…(cont.)	
6	Martínez, Román & Casado (2018)	Use of big data to understand investors' mood	The primary objective of this study was to assess the efficacy of big data algorithmic trading systems based on market mood and judged their performance against traditional methodologies.	It developed an automated trading algorithm based on the assessment of investors' risk tolerance by leveraging vast amounts of data gathered from social networks like Twitter and digital media sources, outreach articles, radio, and television news. Utilizing NLP techniques, predictive models were then created to forecast the market direction. This study has developed an algorithmic trading system that issued market orders, both long and short, solely relying on the measurement of investors' sentiment through a big data process.	The observed performance of these systems indicated that investors' mood demonstrated predictive capability over market evolution which challenged the efficient market hypothesis. It also indicated that big data algorithmic trading system had the potential to outperform the market, delivering positive returns in both bullish and bearish market conditions. Hence big data trading systems grounded in investors' mood represented a novel alternative approach to "traditional" trading systems based on charts.
7	Bhatia, Chandani and Chhateja (2020)	Employment of robo-advisors - An algorithms that adapts the investors' goals and risk tolerance in portfolio formation and provide automated financial advice	The study focused on the application of Robo advisory in removing behavioural biases from financial consultant.	The study used a semi-structured interview methods with snowball sampling techniques to collect data from the experts in the field of BFSI, IT, FINTECH and NBFCs companies	Investors are increasingly embracing Robo-advisors; ZERODHA, an Indian stock broking firm had developed a set of algorithm-dependent stock portfolios with dynamic adjustments in the background. Also, this system would prompt users to reconsider their portfolio configuration if any predefined rules are breached. These portfolios encompass aggressive stocks, very aggressive stocks, and mid-term stocks. The study also suggested that in the next five years, a fully automated Robo-advisory system was expected to be available in the market to make real-time decisions for the investors once provided with the relevant details.

Source: Authors' Compilation

Industry had started using AI based techniques even before it caught academia's interest. Organizations like J P Morgan & Chase had reportedly incorporated it in various operations, including fraud detection, risk management, and customer service.

Goldman Sachs had shown interest in using AI for trading strategies and risk management. BlackRock, one of the pioneers in using AI applications in finance, had been using it for risk assessment and portfolio management. Morgan Stanley had reportedly explored the use of natural language processing (NLP) to analyze financial news and reports for market insights.

UBS has integrated AI into its wealth management services and even for financial compliances and many more. Cao (2020) had broadly grouped the AI applications in the field of Finance into -

i) modeling economic-financial system mechanisms;

ii) financial market analysis and forecasting;

iii) agent-based economics and finance;

iv) smart investment, optimization and management;

v) smart credit, loan and risk management; and

vi) smart marketing analysis, campaign and customer care. He also summarised the finance problem areas and mapped them with typical AI application domains.

Table 3 reflected the mapped AI application domain with the Finance problem domain.

Table 3: The Applications of Artificial Intelligence in Finance

AI areas	Financial areas	Typical financial problems	Typical AI methods
Modeling economic financial mechanisms	Understanding financial systems	Modeling market ecosystem, pricing, hypotheses, relations, interactions, trading, movement, and marketing mechanisms, processes, and effect, etc.	Mathematical modeling, statistical modeling, quantitative analysis, game theories, theories of complex systems, simulation, machine learning, etc.
	Artificial financial markets	Simulating and testing market mechanisms, models, policies, new products and services, trading rules, regulation, stakeholder relations and interactions, etc.	Computer simulation, agent-based modeling, game theories, theories of complex systems, human machine interaction, optimization methods, reinforcement learning, etc.
Financial market analysis and forecasting	Market complexities and dynamics	Modeling financial system characteristics; macro, meso and micro indicators and variables; interactions, information and influence propagation and effect; etc.	Quantitative and quantitative modeling, complex systems, information theory, network theories, data analytics, machine learning, etc.
	Financial time series analysis	Modeling and predicting market movement, trend, volatility dynamics, exceptions, events, etc.	Time-series analysis, sequence analysis, pattern mining, dynamic process and programming, machine learning, and deep models, etc.
	Trading design and optimization	Discover and optimize strategies, signals and movements for pricing, trading, portfolio, and risk management, etc.	Quantitative analysis, data mining, machine learning, behavior analysis, risk analytics, and optimization methods, etc.
	Financial relation and interactions	Characterizing and analyzing diversified, hierarchical and multidimensional relations and interactions in financial variables and participants, etc.	Mathematical modeling, statistical modeling, relation learning, interaction learning, network theories, graph theories, etc.
	Market anomaly analysis	Recognize and predict abnormal movements, trends, behaviors, events inside/outside markets and of participants, etc.	Outlier detection, novelty/exception/change detection, behavior analytics, pattern mining, event modeling, probabilistic modeling, clustering, and classification, etc.
Agent-based economics and finance	Agent-based modeling	Modeling and simulating markets, supply and demand, participant behaviors and relations, mechanisms, policies, strategies, emergence and effect, etc.	Multiagent systems, simulation theories, human computer interaction, user modeling, behavior modeling, visualization, etc.
	Agent-based economics	Simulating macro/micro-economic hypotheses, policies, protocols, mechanisms and their effect in multiagent systems, etc.	Multiagent systems, computational economics and finance, and computational experiments, etc.

AI areas	Financial areas	Typical financial problems	Typical AI methods
Intelligent investment, optimization and management	Automated and smart investment	Developing and optimizing intelligent investment models, algorithms, platforms and services with market forecasting and risk-averse management, etc.	Market representation, forecasting, portfolio optimization, learn to rank, reinforcement learning, recommender systems, behavior analysis, deep models, game theories, optimization methods, etc.
	Online and offline portfolio optimization	Selecting, optimizing and managing online or offline diversified forms and products of portfolios with market prediction and risk management, etc.	Market representation, prediction, learn to rank, game theories, reinforcement learning, recommender systems, behavior analysis, deep models, portfolio optimization, optimization methods, etc.
Intelligent credit, loan and risk management	Credit management	Estimating, predicting and optimizing credit rating, limit, valuation, scheduling, and risk and fraud management, etc.	Profiling, forecasting, prediction, sequential and recurrent modeling, game theory, reinforcement learning, behavior analytics, risk analytics, optimization, etc.
	Loan management	Estimating, predicting and optimizing loan value, default, refund, repayment, refinance, risk and fraud management, etc.	Profiling, forecasting, prediction, behavior informatics, sequence analysis and modeling, game theory, reinforcement learning, risk analytics, and optimization, etc.
	Risk management	Modeling, predicting and managing risk factors, effect and its severity, fraud, crime, security-related events and money laundering associated with diversified financial products, mechanisms, markets and participants, etc.	risk analytics, probabilistic modeling, classification, clustering, semi-supervised learning, behavior modeling, sequential modeling, event analysis, deep neural models and reinforcement learning, etc.
Intelligent marketing	Marketing analysis and campaign	Analyzing marketing performance, product/company competitiveness, campaign effect, competitor advantage and strategies, market share change, recommending and optimizing marketing campaign strategies, actions, and target, etc.	Numerical modeling, econometrics, forecasting, prediction, event analysis, behavior analysis, interaction analysis, game theories, reinforcement learning, recommender systems, optimization methods, etc.
	Customer management	Understanding and predicting customer needs, sentiment, satisfaction, concerns, complaints, circumstance change, new demand, potential churning, mitigation strategies, etc.	Profiling, prediction, interaction modeling, behavior analytics, change analysis, social media analysis, text analysis, and recommender systems, etc.

Source: Cao (2020)

'AI-First Finance' – The Ethical Issues

Finance was one of the pioneering sectors that embraced artificial-intelligence based techniques. However, the role of AI in finance was far from noncontroversial and the nature of criticism had been far more intense than the probable risk of losing jobs. Financial Stability Board in their report (2017) mentioned two types of risks in AI first finance – micro-financial and macro-financial risk.

Micro financial risk included i) financial market risk, ii) risk for financial institutions and iii) risk for investors' privacy. The stability of financial markets faced potential threats when a significant number of market participants simultaneously used AI technology. If machine learning-based traders outshined their counterparts, there would be the risk of a domino effect where more traders adopted similar machine learning strategies, potentially escalating the volatility of the market. Secondly, The AI decision-making process often appeared as a "black box" to most individuals. This lack of transparency posed challenges for regulators and investors in identifying potential misuse of the system. Particularly, with inadequate governance structure related to AI applications in financial institutions, there would be a tendency to underestimate risks. Thirdly, the risk of data breach and protection of investors' privacy have been a challenge in the financial world. Establishing robust policies to safeguard consumer privacy and ensure data security would be imperative in addressing these concerns.

The macro-financial risk included i) market concentration risk, ii) market loophole risk, iii) market connection risk and iv) technological risk. The concentration of AI technologies in the hands of a limited few could lead to the concentration of specific functions within the financial system. If only larger enterprises could afford cutting-edge technologies due to substantial R&D costs, this might elevate their market position, resulting in increased market concentration. Widespread use of AI in high-frequency trading could generate a high volume of simultaneous transactions introducing more uncertainty, escalated leveraging thereby related risk factors. Moreover, when numerous financial institutions rely on the same data or algorithms from a specific segment, problems in one area might disseminate throughout the entire market. Therefore, the collective adoption of AI tools would give rise to connection risks. Last but not least, inadequate training of the AI model or insufficient feedback, such as lack of stress testing, might impede users from timely detection of potential technical risks. This would be especially true when users did not fully comprehend the nature and limitations of AI.

However, the major concern that was being raised about AI dependency was the potential discrimination embedded in the system. The bias present in the training data forming the foundation of these algorithms could yield significant repercussions in financial services. For example, if historical training data contained biases against certain demographic groups, it might lead to specific individuals or communities being unfairly denied access to credit or offered less favorable lending terms. These biases often mirrored existing societal inequalities, causing the AI model to learn and perpetuate discriminatory outcomes. Decisions made by these algorithms would have the power to impact individuals' access to credit, investment opportunities, and overall financial well-being.

According to the Boston Group study by He et al. (2018) there had been a remarkable progress in using AI applications in financial sector. They projected that in The Republic of China by 2027, 23 percent of financial job market would be changed as AI promised to augment efficacy and automation. This called for upskilling of labours at mass scale as many conventional job opportunities would seize and it would impact

the emerging economies like India more as their contribution had been substantial in labour intensive parts of global supply value chain.

Conclusions

Artificial Intelligence and its application in various fields including finance was a reality and would continue to enhance as time passed. As far as financial markets, instruments and trading activities were concerned, it might actually lead to a more efficient market with very little scope for imperfect price discovery and hence arbitrage profit. However, the role of finance had not been limited in markets and trading activities, rather it had a larger role to play in ensuring access to funds, credit and investors protection for small and retail investors. The governance related to AI issues was yet to emerge. On October 23rd,2023 US President had issued a landmark executive order (source: White House Briefing Room statement dated 30th October, 2023) aimed to establish new standards for AI safety and security while promoting equity and civil rights. According to the order, "Irresponsible uses of AI can lead to and deepen discrimination, bias, and other abuses in justice, healthcare, and housing." Consequently, one of the President's directives in the order was to "offer clear guidance to landlords, Federal benefits programs, and federal contractors to prevent AI algorithms from exacerbating discrimination." This declaration indicated that governance related to AI applications was yet to take the desired shape. The inclusion of AI was a reality, governance needed to draw level.

References

- Acheampong, A., & Elshandidy, T. (2021). Does soft information determine credit risk? Text-based evidence from European banks. Journal of international financial markets, institutions and money, 75, 101303.

- Bhatia, A., Chandani, A., & Chhateja, J. (2020). Robo advisory and its potential in addressing the behavioral biases of investors—A qualitative study in Indian context. Journal of Behavioral and Experimental Finance, 25, 100281.

- Black, F., & Scholes, M. (1973). The pricing of options and corporate liabilities. Journal of political economy, 81(3), 637-654.

- Board, F. F. S. (2017). Artificial intelligence and machine learning in financial services: Market developments and financial stability implications. Financial Stability Board.

- Cao, L. (2020). AI in finance: A review. Available at SSRN 3647625.

- Chen, S., & Ge, L. (2021). A learning-based strategy for portfolio selection. International Review of Economics & Finance, 71, 936-942.

- Fama, E. F. (1965). The behavior of stock-market prices. The journal of Business, 38(1), 34-105.

- Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The journal of Finance, 25(2), 383-417.

- Garcia-Bedoya, O., Granados, O., & Cardozo Burgos, J. (2021). AI against money laundering networks: the Colombian case. Journal of Money Laundering Control, 24(1), 49-62.

- Ghosh, P., Neufeld, A., & Sahoo, J. K. (2022). Forecasting directional movements of stock prices for intraday trading using LSTM and random forests. Finance Research Letters, 46, 102280.

- Gómez Martínez, R., Prado Román, M., & Plaza Casado, P. (2019). Big data algorithmic trading systems based on investors' mood. Journal of Behavioral Finance, 20(2), 227-238.

- He, D., Guo, M., Zhou, J., & Guo, V. (2018). The Impact of Artificial Intelligence (AI) on the Financial Job Market. Boston Consulting Group.

- Hilpisch, Y. (2020). Artificial Intelligence in Finance. O'Reilly Media.

- Lakhchini, W., Wahabi, R., El Kabbouri, M., Bp, C., & Hassan, S. (2022). Artificial Intelligence & Machine Learning in Finance: A literature review. International Journal of Accounting, Finance, Auditing, Management and Economics.

- Markowitz, H. (1952). The utility of wealth. Journal of political Economy, 60(2), 151-158.

- McGoun, E. G., & Zielonka, P. (2006). The platonic foundations of finance and the interpretation of finance models. The Journal of Behavioral Finance, 7(1), 43-57.

- Miller, M. H. (1999). The history of finance. The Journal of Portfolio Management, 25(4), 95-101.

- Murugesan, R., & Manohar, V. (2019). AI in Financial Sector–A Driver to Financial Literacy. Shanlax International Journal of Commerce, 7(3), 66-70.

- Peón, D., & Antelo, M. (2012). Are normative models in Finance realistic?. Cuadernos de economía, 35(98), 89-99.

- Sharpe, W. F. (1963). A simplified model for portfolio analysis. Management science, 9(2), 277-293.

- Statman, M. (1999). Behaviorial finance: Past battles and future engagements. Financial analysts journal, 55(6), 18-27.

- Tang, J. (2020, February). A short-term prediction approach of financial crisis based on artificial intelligence classification. In 2020 12th International Conference on Measuring Technology and Mechatronics Automation (ICMTMA) (pp. 990-994). IEEE.

- Tatsat, H., Puri, S., & Lookabaugh, B. (2020). Machine Learning and Data Science Blueprints for Finance. O'Reilly Media.

- Website of White House available at https://www.whitehouse.gov/briefing-room/ statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence/.

- WeiB, G.(2021). 'Artificial Intelligence & Machine Learning in Finance'. Lecture 3 available at https://www.youtube.com/h?v=573lcx41NNQ&list=PL4i4aZbplv9KZzkgz2U3RYObCcmXSHwOc&index=3; accessed on 23rd Dec, 2023.

Artificial Intelligence in Medical Education: Present Situation and Prospects for the Future

Avishek Ganguly

Additional Registrar, Department of Academics, IQCMC & H, Durgapur

Anik Ghosh

Assistant Professor, Department of Management, Brainware University

Dr.(Prof.) Debaprasad Chattopadhyay

Faculty, Globsyn Business School, Kolkata

Introduction

Learning about medicine is a lifelong process that includes undergraduate, graduate, specialist training, and other courses. It also holds true for a variety of healthcare workers, such as physicians, nurses, and other allied health professionals. In light of this, it is imperative that we recognize the enormous contribution that artificial intelligence makes to medical education in this day of rapidly advancing technology.

Methods

Included were high-quality data that satisfied the study's goals. Furthermore, thorough analyses of publications found in reliable databases including PubMed, Research Gate, PubMed central, Web of Science, and Google Scholar were taken into account for the literature review.

Findings

Over the past ten years, artificial intelligence has resolved a number of problems in education, including language processing, reasoning, planning, and cognitive modelling.

In conclusion, the following applications of it in medical education are possible: Medical Distance Learning and Management, Virtual Inquiry System, and Medical School Teaching Video Recording. It may also increase the significance of medicine's non-analytical, humanistic features. This review article's objective was to discuss the current and future implications of AI in medical education.

Keywords: *Medical education; Artificial intelligence; Machine learning; Digital technology*

Introduction

The study of artificial intelligence (AI) is a relatively recent area that emerged in the middle of the 20th century. It's a technology that mimics human thought processes mostly through computer systems. Although computer science is usually linked with artificial intelligence (AI), other disciplines such as languages, psychology, philosophy, and mathematics are also included. AI was first developed in 1955, and since then, its uses have expanded in a rapidly evolving digital environment where social media, business executives, and healthcare professionals are contributing to the rise in public expectations. Over the past ten years, artificial intelligence has helped to resolve a number of problems in education, including language processing, reasoning, planning, and cognitive modeling (1). A rising amount of interest was found in the topic when one searched for AI in medical

education in the Web of Science. An increase in the overall quantity of publications and the frequency of citations for those articles shows a recent increase in the use of AI in research and development for medical education within the past 20 years (2). The following applications for medical education can make use of it: medical distance learning and administration, virtual inquiry systems, and video instruction recording in medical schools (1).

A lifetime of learning is required for medical education, which includes undergraduate, graduate, specialty, and additional training. It also holds true for a variety of healthcare workers, such as physicians, nurses, and other allied health professionals. Consequently, in light of the current era of fast evolving technology, it is imperative to acknowledge that new works must be constructed upon the existing materials in order to progress the subject of AI in medical education (2).

AI has the potential to improve the value of medicine's non-analytical, humanistic components. In an era where medical knowledge is expanding exponentially, a healthcare professional must be abstract and make sense of the information while making a medical decision from a profusion of choices. Artificial intelligence will lessen doctors' attempts to comprehend digital data, enhancing their capacity for diagnosis and problem-solving (3).

The learners of today are not the learners of yesterday. They are growing up in a digital age and place a great importance on social interactions. This generation of learners prefers to collaborate in groups and use various software programs to discuss the specifics of their work with other learners. They require one-on-one intellectual support and like the compliments on their achievements.

To capture and maintain students' interest, teachers must identify and implement effective teaching strategies. In order to integrate a core set of competencies into health professional education, for instance, the Institute of Medicine (US) organized a multidisciplinary summit and proposed a variety of strategies involving oversight procedures, training settings, research, public reporting, and leadership (4). "Training Tomorrow's Doctors" included recommendations for public policy, accrediting bodies, healthcare facilities, and other similar organizations in addition to illuminating the challenges facing the educational mission (5).

In a world where everything is connected, medical education needs to adapt to the new healthcare landscape, which includes digitization and a younger student body (3).

Artificial Intelligence (AI) has applications in learning, assessment, and curriculum building and analysis. AI can reduce the amount of time needed to evaluate different curricula, handle multidimensional issues, increase the precision of categorization, and show how the parameters in curriculum assessment relate to one another. AI, for instance, is able to evaluate medical students' "overall happiness" and "effectiveness of curriculum," which are important aspects of training future physicians. AI can help students learn by providing them with personalized, adaptive content that is modified by their input. This will enable students to identify areas in which they lack knowledge and take the right action. Additionally, AI can expedite, speed up, and lower the cost of the evaluation process while effectively producing detailed, personalized feedback (6).

According to Wartman et al., improving patient safety, risk management, cooperation, and communication are all important but insufficient ways to change the medical school system. They come to the conclusion that the following adjustments are necessary in order to teach students "medical practice" in an AI-revolutionized society (7). In addition to the traditional methods of fact-based memorizing and clinical internships, authorities should

place an emphasis on creation and research. Educational institutions should also place an emphasis on abilities like compassion and statistical knowledge. Future medical students will need to adjust to a new kind of instruction built around quickly advancing technology like artificial intelligence and machine learning. In the future, medical students will have to adjust to a value-based payment model, in which consumers of healthcare services will be able to hold the system responsible for both price and quality.

The purpose of this essay was to draw attention to how AI technology must be used in medical education in order to meet learners' evolving expectations and the demands of the growing digital ecosystem. It also highlights the benefits AI may offer medical education, such as enhancing diagnostic and problem-solving abilities, enhancing curriculum development and analysis, facilitating individualized learning, and accelerating assessment processes. The paper also highlights the need of prioritizing research, teaching skills other than memorization, and adopting a value-based approach to medical practice. It also highlights the importance of preparing the next generation of healthcare professionals to deal with advances in artificial intelligence and machine learning. This review's objective was to further AI integration in medical education as a means of addressing the challenges and opportunities presented by the digital era and ensuring the delivery of high-quality healthcare services.

Methods

This review article's objective was to outline the significance of artificial intelligence (AI) in medical education throughout the last 20 years, as well as its current state and potential future uses. As a result, only excellent data that matched the goals of the study were included. Comprehensive analyses of publications found in reliable databases including Google Scholar, PubMed, ResearchGate, PubMed Central, Web

of Science, and PubMed were also taken into consideration for the literature study.

Artificial intelligence, healthcare and AI, AI and medical education, AI in medical research, doctors and AI, new dimensions in medical education, medical doctors, postgraduate medical courses, and AI were the main index words or phrases utilized throughout the literature search.

Scientific papers written in English that addressed the study's aims met the inclusion criteria.

Studies written in languages other than English, works that didn't discuss the use of AI in medical education, and works published before 2002 were all excluded.

Artificial Intelligence in the Current Medical Education Environment

The American Medical Association (AMA) approved its first augmented intelligence policy during its 2018 annual conference. It backed up research that showed how AI ought to be used in medical education. At the Duke Institute for Health Innovation, medical students collaborate with data scientists to create technologies that improve physician care. In a similar vein, graduate and postgraduate students at Stanford University's Center for AI in Medicine and Imaging work with machine learning to address challenges in healthcare. The University of Florida radiology residents worked with a technology company to create computer-aided detection for mammography. To learn about emerging technology, Carle Illinois College of Medicine offers a course given by an engineer, clinical scientist, and scientist.

Furthermore, medical students can enroll in a course on cutting-edge healthcare technology offered by the Sharon Lund Medical Intelligence and Innovation Institute. Medical students are placed in engineering labs by the University Of Virginia Center for Engineering in Medicine to create novel healthcare solutions (8).

AI can educate doctors on clinical difficulties as they arise, sparing them time from having to rehash prior knowledge or quickly scan material that isn't pertinent to their practice. In a similar vein, informatics instruction at Johns Hopkins University School of Medicine is customized to the curriculum and methods of instruction (9).

The Human Diagnosis Project, or simply "Human Dx," is another example of a cutting-edge AI-enabled healthcare system. "Human Dx" seeks to combine machine learning and the pooled knowledge of doctors to deliver more accessible, affordable, accurate, and better treatment for everybody. Research on its application in clinical decision-making is currently being conducted in association with some of the best medical schools in the world, such as Yale, Stanford, Harvard, and other stakeholders (10, 11).

Comparably, innovations such as the MedAware system, which was created in partnership with Harvard University, analyze massive amounts of data from electronic medical records (EMRs) using big data analytics and machine learning algorithms to comprehend how doctors treat patients in practical situations. A clinician is prompted to double-check for potential errors when a prescription they write deviates from a typical treatment plan; this is recorded as a potential error (12).

A MedEye prototype was developed by MIT researchers, who believe it can eradicate medication errors. To scan and identify other medicines, it makes use of cameras. MedEye uses image recognition and machine learning to verify the accuracy of medication by comparing it to the hospital information system (13). The University of Missouri worked with PerceptiMed, a business that develops safety medications, to create and test MedPassTM, a personalized and safe medication system for long-term care institutions. It is an automated drug dispensing system that checks each pill and guards against prescription mistakes (14).
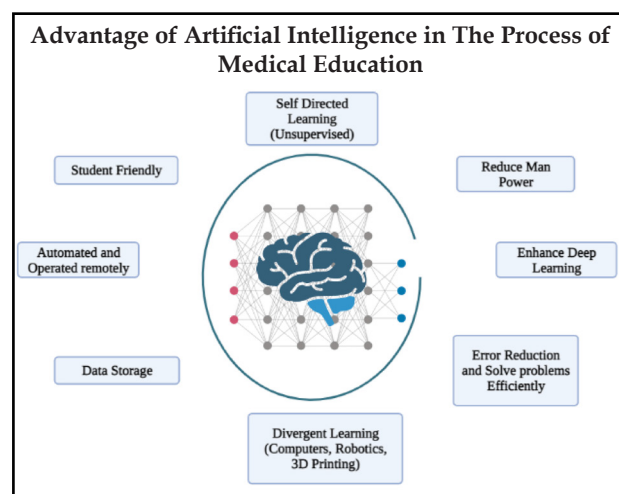
Figure No.: 01

Western Michigan University's Homer Stryker M.D. School of Medicine has constructed a state-of-the-art simulation center. In order to help second-year medical students practice clinical skills, the medical school is piloting a program created by the UK-based start-up "Resource Medical" that uses chat robots with artificial intelligence to simulate patient interactions. Furthermore, users can interact with the robot to simulate a patient visit. For example, they can ask the robot why it requires medical attention and find out about its symptoms and past medical history (15). While there are a number of surgical simulation software available, such as Buckingham Virtual Tympanum and Touch Surgery, that teach students about the anatomical aspects of surgical procedures, they are in no way equivalent to training conducted on human patients (16, 17).

Because it is not limited by time or location, distance education is a more effective kind of instruction. Peer-to-peer or student-faculty contact can be fostered and students' knowledge can be supplemented by using readily available technology, mobile learning, and online learning (3).

The potential impact of artificial intelligence (AI) on various industries is significant, with healthcare being only one of them. Artificial Intelligence (AI) holds great promise for

enhancing medical education, improving diagnosis accuracy, and shaping the future of healthcare careers. When looking ahead, there are many different perspectives and challenges to consider (19).

AI's potential to tailor and adjust the learning experience is one of the most important developments for medical education going forward. Given their varied tastes and learning styles, today's digital learners have unique demands that AI can help with. Through data analysis and machine learning algorithms, artificial intelligence (AI) can provide adaptive instructional content that is tailored to individual students' knowledge gaps and learning styles. This customized strategy boosts engagement and promotes a deeper understanding of intricate medical concepts (20).

If AI is to be effectively implemented in medical education, challenges must be addressed in spite of its immense potential. One of these concerns is the ethical application of AI; as this technology develops, concerns about algorithmic bias, security, and data privacy become more prevalent. To ensure that AI algorithms make decisions that are fair, impartial, and transparent, it is imperative to establish robust ethical frameworks. The requirement for educators and medical personnel to update their knowledge and obtain the required training presents another difficulty. Teachers need to be prepared with the skills necessary to use AI in both teaching and assessment in order to successfully integrate AI into medical education. Despite AI's enormous promise, there are obstacles that need to be overcome if it is to be used in medical education. The ethical use of AI is one of these worries; as this technology advances, worries about algorithmic bias, security, and data privacy become more common. Strong ethical frameworks are necessary to guarantee that AI algorithms make decisions that are impartial, transparent, and fair. Another challenge is that educators and medical professionals need

to keep up with the latest developments and receive the necessary training. To successfully integrate AI into medical education, teachers must be equipped with the abilities required to apply AI in both teaching and assessment. AI in medical education requires a lot of infrastructure and technology assistance. To get the most out of artificial intelligence (AI), healthcare and educational institutions need to invest in secure networks, data storage, and state-of-the-art computing gear. If AI is to be applied effectively and successfully in medical education, coordination between academics, corporations, and regulatory organizations is necessary to set universal standards, frameworks, and norms. AI offers a bright future for medical education by facilitating more convenient curriculum development and execution, improving diagnostic capabilities, and enabling tailored learning experiences. To fully achieve the promise of AI in medical education, it is imperative to address the issues of infrastructure, training, and ethics. Medical education can stay up with the quickly changing healthcare landscape and equip aspiring medical professionals with the information and abilities they need to provide superior patient care by integrating AI technology effectively (22).

AI's limitations when used in educational technologies

An effective analysis tool that teachers can utilize to help them analyze their students' behavior and modify their courses depending on assessment results is a virtual inquiry system such as "DxR Clinician." Students can quickly acquire the skills needed to tackle clinical challenges. By interacting with the examples, they can get a great deal of knowledge regarding critical illness diagnosis. In addition, the system can perform deep learning and analysis, identify mistakes committed by students during the case study, and help students fix these problems. Like DxR Clinician, "Intelligent Tutor Systems" can identify false beliefs by tracking the learner's

"psychological processes" as they solve problems. It assesses the comprehension level of the students as well. It can also encourage students to engage in self-regulation, self-monitoring, and self-explanation by giving them prompt support, counsel, and clarifications (1).

Digital learning with enhanced technology has many technical benefits, but computer-based learning and artificial intelligence algorithms can be trained to be prejudiced toward any goal or against any group. As a result, we need to handle moral and ethical matters with caution. Above all, future medical professionals should emphasize a humanistic approach to managing patients' bio-psychosocial complexity, which is difficult for machines to comprehend. As a result, scheduling mutually convenient times for participation is essential, particularly while learning remotely. Online peer tutoring is beneficial when students feel connected to and a part of others, even though they are geographically separated from teachers and fellow students. However, as the structure of the course affects students' motivation and involvement and should be designed to encourage them to work on projects and participate in discussions, it does not only mean transferring traditional lectures to online collaborative learning (3).

Robotics' use in the medical sciences and its constraints

Although surgical robot technology is still in its infancy and is largely managed by humans, the technology has already demonstrated encouraging outcomes. Surgical robots will have a hugely positive direct impact on healthcare since they are very precise in managing the direction, depth, and speed of their movements. Especially when working with delicate tissues like the eyes, surgeons need exceptionally stable hands. In studies, AI technology is successful in eliminating the blood beneath the retina or the membranes from patients' eyes that are caused by age-related macular degeneration.

In several cases, doing surgery with robotic equipment proved to be more efficient than doing it by hand (23). Because they never fatigue, they are especially well adapted to tasks requiring constant, repetitive motions. Robots can also travel to places that traditional tools cannot and maintain their position for a longer amount of time. AI, for instance, can spot patterns in surgical techniques to enhance best practices and raise the precision of surgical robot accuracy. Artificial intelligence software can be used to design intelligent robots, and eventually these robots will be able to do surgery without the assistance of humans. Medical schools that do not teach robotic surgery will be at a loss because these surgical procedures will soon become commonplace (24–26).

The importance of artificial intelligence in the work life of physicians, hospital managers, and patients has diminished. Healthcare: Data-driven AI systems that carry out duties more precisely and affordably include Human Dx, MedAware, MedEye, MedPassTM, and others. With machine learning technology, artificial intelligence will continue to benefit the healthcare system more effectively because it is automatically trained to learn from experience and get better at it without explicit programming. Everything has two sides, always. While there are many benefits to deploying robots for healthcare activities, there is also a chance that they could make mistakes or malfunction. With these strong robots, human error or mechanical failure is always possible. A single mechanical malfunction has the potential to be serious or even deadly. The price is yet another big drawback. Surgical robots are limited to modern hospitals, research institutes, and industrialized nations. In certain cases, patients and certain educational institutions may discover that robotic surgery is financially unaffordable.

The workforce's longevity is at risk, so the healthcare provider must also spend a large sum of money and time educating the staff to

operate robots. Therefore, until the expense of technology decreases over time, the possibility of error and the high cost for educational institutions may prevent the widespread adoption of robotic surgery.

Ideal Instruction for Using AI in Medical Education

Before AI to be fully utilized in a healthcare system, it needs to be sufficiently and appropriately trained. In this case, the role of physicians and other healthcare workers is vital. The most frequent risk is that AI systems will sometimes make mistakes that harm patients or cause other problems in the healthcare system.

A patient may suffer, for instance, if an AI system gives the incorrect prescription, misses a tumor on a radiological examination, or gives one patient a hospital bed over another. Though many injuries happen in medical settings even when artificial intelligence isn't used, one could argue that AI errors are theoretically different because, should AI systems become more widely used, a single flaw could cause harm to thousands of patients as opposed to the small number of patients harmed by the error of a single provider. To extract reliable patient data and integrate it into AI systems, physicians require extensive training. Lessons on medical AI systems that failed for a variety of unanticipated reasons—including inadequate training, as demonstrated by IBM's Watson—have already been covered (27).

The greatest instruction must fully realize the application of AI in medical education. It demands the application of a multidisciplinary strategy integrating knowledge from the domains of ethics, education, medical, and computer technology (27). Developing skills in data analytics, AI algorithms, and ethical issues related to AI use should be prioritized in training programs. For curriculum development, instructional delivery, and assessment methods to effectively use AI technology, educators

and healthcare professionals must possess the requisite competencies. Medical schools that offer targeted "faculty development programs" can improve faculty readiness. Furthermore, in order to stay up to date with the fast evolving field of artificial intelligence in medical education, ongoing learning and cooperation among academic institutions, businesses, and regulatory bodies are imperative (8).

Artificial Intelligence: Ethical Concerns

Applications of artificial intelligence extend into the real world, such as manual labor help, robotic prostheses, and smartphone apps that enable online medical care. The privacy, safety, and preferences of patients may be compromised by this potent technology. It presents a fresh set of moral problems that need to be recognized and resolved (28). As will be discussed below, Gerke et al. identify four major ethical issues with AI in healthcare (21).

- **Consent to use:** Health AI applications like imaging, diagnosis, and surgery will change patient-physician interactions. However, there are numerous obstacles in the way of professionals' obligations to inform patients about the intricacies of artificial intelligence. Because AI employs "black-box" methodologies, doctors may occasionally struggle to understand and use a range of machine-learning strategies, which can occasionally result in a lack of transparency. Increased attention to this area is necessary to make the results increasingly predictable.

- **Safety and openness:** One of the biggest obstacles facing AI in healthcare is safety. One of the most prominent examples of a major issue with healthcare analytics is the use of IBM Watson for cancer treatment. It has recently come under fire for supposedly suggesting "unsafe and incorrect" cancer treatment options. This real-life incident has drawn unwanted attention to the field. It also highlights how important it is for AIs

to be dependable and effective. However, how can we ensure that AI keeps its promise? To truly realize the potential of AI, stakeholders—especially AI developers—must guarantee two essential elements: the reliability and authenticity of the datasets and openness.

- **Algorithmic fairness and biases:** Any machine learning (ML) system or algorithm that is trained by humans is only as trustworthy, efficient, and equitable as the data that it was trained on. The possibility of biases should be taken into consideration when selecting the ML technologies/ procedures that they want to use to train the algorithms and what datasets (including assessing their quality and diversity) they would like to utilize for the programming. Additionally prone to bias and consequent discrimination is AI. Numerous real-world examples have demonstrated how biased algorithms can be, leading to discrimination on the basis of gender, race, or ethnic origin.

- **Data privacy:** Patients shared test results with «Streams» an app designed to detect and diagnose acute renal impairment in order to do clinical safety testing, but they were not fully informed about how the test results would be processed. Although the "Streams" app does not employ artificial intelligence, this real-world example has highlighted the possibility of privacy violations when developing technological solutions (21).

Conclusion

Since 2018, there has been a rise in the application of AI in educational institutions. While academic institutions collaborate closely with IT companies to create innovative technologies such as personalized medication dispensing, prescription error detection, and individualized learning, full-scale and error-free artificial intelligence and machine learning technologies

are still a ways off.

AI-driven technologies will essentially run medical education in the future, helping teachers better understand their students and facilitating individual student learning according to learning styles. This will free up educational institutions to concentrate more on teaching morality, ethics, and communication. Even though these AI-driven educational frameworks still carry some bias risk, additional research will assist to shed more light on this matter.

We are still in the early stages of using AI robots in surgery. Progress in this area is expected to be slow because it entails reducing the risk to the patient's life and saving money. As time goes on and costs come down, these surgical procedures will become standard, and medical schools that do not provide robotic surgery will soon fall behind. AI will someday need to be included into medical education in order for it to remain relevant. But almost as important is teaching the "AI Systems" appropriately. Finally, developing a healthcare system that will be distinct from the way medicine is currently performed would need teaching upcoming medical professionals about AI technology and its ethical concerns, morals, and ethics. Finally, developing a healthcare system that will be distinct from the way medicine is currently performed would need teaching upcoming medical professionals about AI technology and its ethical concerns.

Ethics approval: Not applicable.

Conflicts of Interest: None declared.

References

- Zhao H, Li G, Feng W. Research on application of artificial intelligence in medical education. Proc- Int Conf Eng Simul Intell Control ESAIC, Hunan, China; 2018 Nov 9; pp. 340–2.

- Chan KS, Zary N. Applications and Challenges of Implementing Artificial Intelligence in Medical Education:

Integrative Review. JMIR Med Educ. 2019;5(1):e13930.

● Han ER, Yeo S, Kim MJ, Lee YH, Park KH, Roh H. Medical education trends for future physicians in the era of advanced technology and artificial intelligence: An integrative review. BMC Med Educ. 2019;19(1):1–15.

● Greiner AC, Knebel E. Health Professions Education: A Bridge to Quality. Washington (DC): National Academies Press (US); 2003.

● Blumenthal D. Training tomorrow's doctors: the medical education mission of academic health centers: a report of the Commonwealth Fund Task Force on Academic Health Centers. New York: Commonwealth Fund; 2002.

● Garg T. Artificial Intelligence in Medical Education. Am J Med. 2020;133(2):e68.

● Wartman SA, Combs CD. Medical education must move from the information age to the age of artificial intelligence. Acad Med. 2018;93(8):1107–9.

● Paranjape K, Schinkel M, Panday RN, Car J, Nanayakkara P. Introducing artificial intelligence training in medical education. JMIR Med Educ. 2019;5(2):e16048.

● Robeznieks A. 3 ways medical AI can improve workflow for physicians [Internet]. American Medical Association. 2023 [Cited 2023 Jan 06]. Available from: https://www.ama-assn.org/practice-management/digital/3-ways-medical-ai-can-improve-workflow- physicians.

● Zimmerschied C. AI, teamed with phy-sicians' intelligence, could improve care American Medical Association [Internet]. American Medical Association. 2023 [Cited 2023 Jan 6]. Available from: https://www-ama-assn-org.libproxy1.nus.edu.sg/ prac-tice-management/digital/ai-teamed-physi-cians-intelligence-could-improve-care.

● Smith MT. Project crowdsources specialists' diagnoses for safety-net care [Internet]. American Medical Association. 2023 [Cited 2023 Jan 6]. Available from: https://www.ama-assn.org/practice-management/digital/project-crowdsources-specialists-diagnoses- safety-net-care.

● Kohn LT, Corrigan JM, Donaldson MS. To Err is Human: Building a Safer Health System. Washington (DC): National Academies Press (US); 2000.

● Ducharme J. MIT Alumni Created Drug Safety Technology [Internet]. 2014 [cited 2023 Jan 8]. Available from: https://www.bostonmagazine.com/ health/2014/09/09/medeye-drug-errors/.

● MedAware. Providing A Safety Layer Within Health Data Systems [Internet]. MedAware. 2023 [Cited 2023 Jan 10]. Available from: https://www.medaware.com/.

● Simulation Center. WMed [Internet]. 2023 [Cited 2023 Jan 10]. Available from: https://wmed.edu/ simulationcenter.

● Samra S, Wu A, Redleaf M. Interactive iPhone/iPad App for Increased Tympanic Membrane Familiarity. Ann Otol Rhinol Laryngol. 2016;125(12):997–1000.

● Mandler AG. Touch Surgery: A Twenty-First Century Platform for Surgical Training. J Digit Imaging. 2018;31(5):585-90.

● Wang W. Medical education in china: progress in the past 70 years and a vision for the future. BMC Medical Education. 2021;21(1):453.

● Davenport T, Kalakota R. The potential for artificial intelligence in healthcare. Future Healthc J. 2019;6(2):94-8.

● Bhutoria A. Personalized education and Artificial Intelligence in the United States, China, and India: A systematic review using

a Human-In-The-Loop model. Computers and Education; Artificial Intelligence. 2022;3:100068.

- Gerke S, Minssen T, Cohen G. Ethical and legal challenges of artificial intelligence-driven healthcare. Artificial Intelligence in Healthcare. USA: EY; Building a Better Working World. 2020. pp. 295-336.

- Bajwa J, Munir U, Nori A, Williams B. Artificial intelligence in healthcare: transforming the practice of medicine. Future Healthc J. 2021;8(2):e188-94.

- Edwards TL, Xue K, Meenink HCM, Beelen MJ, Naus GJL, Simunovic MP, et al. First-in-human study of the safety and viability of intraocular robotic surgery. Nat Biomed Eng. 2018;2(9):649.

- Nag HH, Sisodia K, Sheetal P, Govind H, Chandra S. Laparoscopic excision of the choledochal cyst in adult patients: An experience. J Minim Access Surg. 2017;13(4):261.

- Schroerlucke SR, Wang MY, Cannestra AF, Good CR, Lim J, Hsu VW, et al. Complication Rate in Robotic- Guided vs Fluoro-Guided Minimally Invasive Spinal Fusion Surgery: Report from MIS Refresh Prospective Comparative Study. Spine J. 2017;17(10):S254-5.

- Porpiglia F, Checcucci E, Amparore D, Autorino R, Piana A, Bellin A, et al. Augmented-reality robot- assisted radical prostatectomy using hyper-accuracy three-dimensional reconstruction (HA3DTM) technology: a radiological and pathological study. BJU Int. 2019;123(5):834–45.

- Masters K. Artificial intelligence in medical education. Med Teach. 2019;41(9):976–80.

- Rigby MJ. Ethical dimensions of using artificial intelligence in health care. AMA J Ethics. 2019;21(2):121–4.

Augmenting Human Resource Management through Artificial Emotional Intelligence:
A Comprehensive Exploration of Implementation, Ethical Considerations, and Future Horizons

Dr. Vishal Verma

Head-HR, Alumnus Software Limited

Abstract

This research paper explains the concept of Artificial Emotional Intelligence (AEI) and explores how Artificial Emotional Intelligence can assist in Human Resource Management (HRM). It examines the theoretical foundations, technological underpinnings, ethical consi-derations, and practical applications to illuminate how AEI can assist in HRM. This comprehensive examination aims to provide a detailed understanding of how AEI is redefining HRM practices and shaping the workplace of the future.

Key Words: *Artificial Emotional Intelligence, Human Resource Management, Emotional Intelligence, Artificial Intelligence*

Introduction

Artificial Emotional Intelligence (AEI) operates at the convergence of computer science, psychology, and cognitive science, with the goal of furnishing machines with the capacity to recognize, interpret, and react to human emotions. This progressive discipline employs sophisticated algorithms and machine learning methodologies to scrutinize facial expressions, voice tones, and other non-verbal signals, empowering machines to grasp the different aspects of human emotional conditions (Picard, 1997; Ekman, 1993).

In the domain of human-computer interaction, AEI improves user engagement by allowing systems to adjust to the emotional states of users.

Substantial investigations conducted by scholars like Picard (1997) have paved the way for emotion-aware computing, enabling machines to dynamically respond to the emotional cues of users and thereby fostering more intuitive and individualized interactions.

Artificial emotional intelligence systems use computer vision, sensors, cameras, and real-world data to gather information. They employ speech science and deep learning algorithms to process and compare this data, pinpointing key emotions like fear and joy. The machine interprets the identified emotions, improving its ability to recognize the subtleties of human communication as the emotion database expands.

By integrating emotional intelligence in AI algorithms, organizations can elevate employee engagement, streamline conflict resolution processes, and ultimately cultivate a more satisfying workplace environment. Through insightful case studies, we witness the tangible impact of empathetic AI in HR, showcasing its transformative capacity to enhance the overall dynamics of human-AI interactions and contribute to the positive evolution of workplace satisfaction.

Goleman's model, rooted in competencies like self-awareness, self-regulation, motivation, empathy, and social skills, forms the bedrock of emotional intelligence. AEI builds upon these

competencies, employing machine learning algorithms and facial recognition technologies to analyze, interpret, and respond to emotional cues exhibited by employees.

Background and Literature review

Emotional intelligence, a term introduced by Michael Beldoch in 1964, is primarily characterized by the ability to recognize emotions in oneself and others, generate and adapt emotions, and utilize emotional information in achieving goals and solving problems. A prerequisite for these skills is the capacity to distinguish between different emotions.

The term "affective computing," coined by Rosalind W. Picard of MIT Media Lab in 1995, traces its roots back to earlier instances, such as the first patent for automatic speech emotion recognition filed by John D. Williamson in 1978.

Janet E. Cahn, from MIT Media Lab, explored "the generation of affect in synthesized speech" in 1989, and in 1992, Hiroshi Kobayashi and Fumio Hara presented their work on neural networks automatically recognizing the six basic facial expressions.

Building Blocks of AEI

The primary emphasis of AEI research has been on the automated identification of human emotions and the generation of emotions for conversational agents and robots. AEI research has predominantly concentrated on the automated identification of human emotions and the creation of emotions for conversational agents and robots. Figure 1 illustrates the key components of AEI, including emotion recognition, emotion generation, and emotion augmentation.
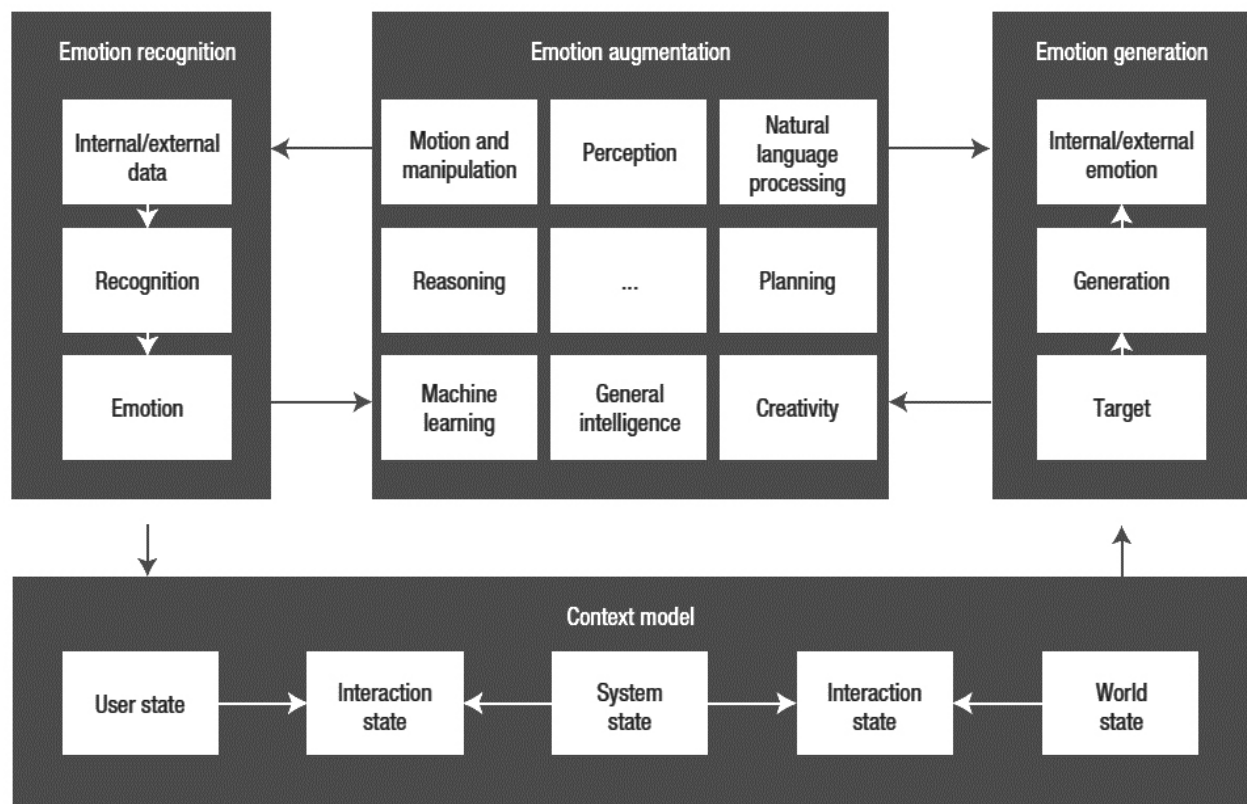
Figure 1: Building block of AEI, Schuller, Dagmar & Schuller, Björn. (2018). The Age of Artificial Emotional Intelligence.

Emotion recognition is the ability to precisely infer human emotions from numerous sources and modalities using questionnaires, physical signals, and physiological signals. The predominant methods for analysing emotions include acoustic speech and spoken (or written) language content, facial expressions, body posture, movement, and physiological measurements like heart rate, skin conductance, and even brain activity.

Similar to the emotional analysis aspect, the emotion generation particularly concerns emotional speech and facial expression synthesis. AI can generate emotionally appropriate responses, using knowledge about human emotions and social cues. This helps create more natural and engaging interactions.

Compared to recognizing and creating emotions, not much attention has been given to adding emotions to AI for tasks like planning and reasoning. Most emotion addition happens in emotion-augmented machine learning (EML), inspired by biology. Bringing in principles from the amygdala follows the trend of mimicking mammalian neural networks. Even though we're still figuring out how to model and create artificial emotions, there's potential in using emotional principles to improve learning efficiency, like faster learning or lower costs. Integrating emotions into machine learning can lead to better solutions, and an algorithm's confidence can be influenced by its emotional state.

Application of AEI in HR

Emotion Recognition in Employee Engagement

AEI extends the concept of artificial intelligence to include the capacity to perceive and interpret human emotions, providing a more comprehensive understanding of employee well-being and engagement. Facial expression analysis, as studied by McDuff et al. (2015), offers insights into the emotional states of employees during various work-related interactions. Beyond traditional survey methods, AEI incorporates biometric data to capture physiological indicators like heart rate and skin conductance, offering a more holistic view of emotional responses. AEI enables a more personalized approach to employee engagement by tailoring interactions, feedback, and support mechanisms based on individual emotional profiles. AEI can play a crucial role in proactively identifying signs of stress or burnout, prompting organizations to implement targeted well-being initiatives and support systems. Understanding the emotional dynamics within teams helps organizations optimize team structures, enhance communication, and foster a positive collaborative environment. This capability proves invaluable in gauging employee engagement, job satisfaction, and well-being. AEI can leverage predictive analytics to forecast trends in employee engagement and productivity, allowing organizations to proactively address potential issues before they impact performance. AEI systems can continuously learn and adapt to changes in employee behavior and emotional patterns, ensuring the technology remains effective and relevant over time.

Natural Language Processing for Employee Feedback

Natural Language Processing (NLP) in AEI provides HR professionals with powerful tools for analysing employee feedback. It involves the use of computational techniques to interpret and derive meaning from human language. In the context of employee feedback, NLP can be employed to automate the analysis of large volumes of feedback data, identify patterns, sentiment, and key topics, and provide valuable insights to organizations. By analyzing feedback collected over several months, NLP can reveal if there's an increasing trend in comments related to a specific issue, helping organizations address concerns proactively. NLP can flag unexpected increases in negative

sentiment or a sudden surge in mentions of a specific issue, helping organizations address potential problems swiftly. OpenAI's Chat GPT, renowned for its contextual understanding, can be harnessed to interpret the emotional nuances in written or spoken feedback, facilitating more comprehensive performance evaluations and personalized development plans. The work of Hirschberg and Manning further delves into sentiment analysis, shedding light on the NLP techniques that can enhance emotion-aware HR systems.

Affective Computing in HR Interaction

Affective computing transforms HR interactions, fostering a more empathetic and responsive environment. Chatbots and virtual assistants, infused with Emotion AI, adapt their responses based on employees' emotional cues. Affectiva's contributions to affective computing demonstrate how HR interactions can become more personalized, leading to improved employee satisfaction and retention.

Mental Health Support in the Workplace

Emotion AI finds applications in employee mental health support, a critical aspect of HRM. Technologies like Emotiv and NeuroSky, as explored by Majumder et al. (2020), utilize brain-computer interfaces to detect and analyse emotional states, offering insights into stress levels and potential well-being interventions. The work of Wang and Zhang on "Emotion Recognition and Regulation" provides valuable insights into the intersection of emotion AI and mental health support.

Ethical Considerations in HRM with Emotion AI

The integration of Emotion AI in HRM necessitates a careful examination of ethical considerations. Privacy concerns, consent issues, and biases in emotion recognition algorithms demand thoughtful implementation and adherence to ethical guidelines. The ethical AI practices outlined by organizations like the Partnership on AI serve as crucial references for responsible deployment in HRM contexts. The paper by Mittelstadt et al., "The Ethics of Algorithms: Mapping the Debate," provides a nuanced understanding of ethical considerations in AI applications, including HRM. Privacy, data security, and the potential manipulation of emotions are paramount considerations (Holzinger et al., 2017). Striking a delicate balance between enhancing user experience and safeguarding individual privacy remains an ongoing challenge.

Bias in emotion recognition algorithms is another critical issue. Research by Caliskan et al. (2017) emphasizes the importance of addressing biases in training data to ensure fair and unbiased outcomes in AEI applications. Ethical considerations demand continual efforts to mitigate biases and ensure the responsible development and deployment of AEI systems.

To further enhance the field, the integration of explainable AI is imperative (Adadi & Berrada, 2018). Providing transparency in how AEI systems make emotional assessments fosters user trust and facilitates ethical deployment.

Conclusion

As organizations look to the future, AEI holds the promise of predicting and preventing employee burnout through early identification of signs and workload balancing. Professional development and training programs stand to benefit from AEI, providing personalized learning experiences tailored to individual emotional intelligence needs. However, these advancements come with challenges, demanding the development of robust ethical guidelines to navigate the evolving landscape responsibly. The dynamic interplay of technology and human emotion requires continual adaptation and a proactive approach to address potential pitfalls.

Embracing an interdisciplinary approach, HRM draws on psychology, neuroscience, and

computer science to unlock the full potential of AEI. Ongoing research, as reflected in the works of scholars like Picard, underscores the importance of collaboration to refine emotion recognition and deepen the understanding of human emotions in the workplace. The book "Emotion AI: Emotion Recognition and Affective Computing" by Peter J. Cowling provides an in-depth exploration of the interdisciplinary aspects of emotion AI, with relevance to HRM.

The integration of Artificial Emotional Intelligence into Human Resource Management marks a transformative juncture in organizational practices. Embracing AEI responsibly ensures that HRM not only adapts to the digital age but leads the charge in fostering workplaces that are not just efficient but empathetic, responsive, and human-centric. The journey ahead requires a delicate balance between technological innovation and ethical considerations, making AEI a cornerstone in the evolution of HRM practices for the 21st century. The onus is on organizations to embrace this technological evolution responsibly, ensuring that AI augments human potential without compromising fundamental ethical principles.

References

- Adadi, A., & Berrada, M. (2018). Peeking inside the black-box: A survey on Explainable Artificial Intelligence (XAI). IEEE Access, 6, 52138-52160.

- Beldoch, M. (1973). 8 Michael Beldoch Sensitivity to Expression of Emotional Meaning in Three Modes of Communication M. Beldoch,'Sensitivity to expression of emotional meaning in three modes of communication', in JR Davitz et al., The Communication of Emotional. Social Encounters: Readings in Social Interaction, 121.

- Caliskan, A., et al. (2017). Semantics derived automatically from language corpora contain human-like biases. Science, 356(6334), 183-186.

- Ekman, P. (1993). FacIal ExpressIon and EmotIon. AmerIcan PsychologIst, Journal of PersonalIty and SocIal Psychology, 48, 384-392. http://dx.doI.org/10.1037/0003-066X.48.4.384

- Goleman, D. (1995). Emotional Intelligence: Why It Can Matter More Than IQ. Bantam Books.

- Holzinger, A., et al. (2017). Towards Integrating Artificial Intelligence and Computer Science Curricula. In Information Technology-New Generations (pp. 3-17).

- J.D. Williamson (1978), Speech Analyzer for Analyzing Pitch or Frequency Perturbations in Individual Speech Pattern to Determine the Emotional State of the Person, US Patent 4,093,821.

- J.E. Cahn, (1989) Generation of Affect in Synthesized Speech, MIT Media Lab, www.media.mit.edu/publications/generation-of-affect-in-synthesized-speech-2.

- Majumder, A., Aung, Z., Imtiaz, S. A., & Peek, N. (2020). Health informatics in the big data era: A roadmap for research on emotion-aware telehealthcare. Journal of Medical Internet Research, 22(6), e17149.

- McDuff, D., El Kaliouby, R., & Picard, R. (2015). Crowdsourcing facial responses to online videos. In Proceedings of the 2015 ACM on International Conference on Multimodal Interaction (pp. 467-474).

- Picard, R. W. (1997). Affective Computing. MIT Press.

- Salovey, P., & Mayer, J. D. (1990). Emotional Intelligence. Imagination, Cognition and Personality, 9(3), 185–211.

- Schuller, Dagmar & Schuller, Björn. (2018). The Age of Artificial Emotional Intelligence. Computer. 51. 38-46. 10.1109/MC.2018.3620963.

Artificial Intelligence (AI) in Human Resource Management (HRM): A Conceptual Review of Applications, Challenges and Future Prospects

Jahir Rayhan

Assistant Professor, Dept. of Business Administration,
Ishakha International University, Bangladesh

Abstract

This paper aims to convey an extensive examination of artificial intelligence, recent trends and future prospects with collaborations regarding HRM, and how the implementation of emerging AI-based technologies strengthens the functions of HR generally to impart strategic benefits are expected to be the smart systems of the future. They are also transforming HR policies and practices by increasing the importance and place on the latest advances in technology. AI is a breakthrough that has the potential to substantially transform a number of areas of HRM. It is becoming immersed and increasingly interconnected with HRM and is presently regarded as essential for carrying out functional duties. The present scenario of AI in HRM is explores how AI instruments and structures are used throughout different HR operations. The research has used a descriptive design. The research relies solely on secondary data that was obtained from a variety of sources. The learners acquire knowledge about AI in the area of every stage devoted to HR practices. This study has concluded an exhaustive evaluation of the current situation of circumstances, difficulties and opportunities of AI in HRM. The overview extends to a larger range of HR functions that robotics companies can handle, involving hiring, recruiting, data analysis, data collection, and reduction of workplace workloads while enhancing workplace efficiency. It analyzes existing data, highlights areas in need of further study, and offers academics and practitioners new viewpoints on the way, AI will drastically change HRM activities in the future.

Introduction

As a cutting-edge technology of the modern era, AI has been successfully used over the years in a variety of fields. Currently, AI is becoming an increasingly important component of managerial procedures, with businesses adopting AI technologies in a growing number of cases. Although the application, adoption, impact and the role of AI in HRM are very essential and the AI technologies have arranged to improve the quality of life, tasks, working structures, working systems, styles and working conditions and environment, the originality of AI has come from the results of the intellectual human intelligence, research and development and their thought. AI is the application of technology to perform tasks requiring a suitable degree of cognitive ability. AI has lately been acknowledged as being crucial for carrying out operational activities, especially in the discipline of HR analytics. Organizations are applying AI technologies to better and more efficiently manage and coordinate the management of HR. AI has a great deal to make available to HR professionals. Perhaps it's boosting organizational outcomes through digitalized HR practices in many global economic sectors, automating and computing for improving employee morale, or speeding up the processes

through data-driven HR options in the future. Affective computing and robotic automation of processes are two less commonly recognized disciplines that are taken into consideration by this comprehensive mappings of AI areas associated with HR, in combination with the more widely recognized fields of AI and the use of natural language processing.

HRM and technology innovations have been working together to increase output, change the way services are rendered, simplify processes, fortify the leadership group, and alter HR roles. HRM methods have been transformed by the introduction of e-recruitment, e-training, and incompetence management functions brought about by the change in HR technology. AI in HR systems has the potential to boost efficiency and productivity, yielding cost savings and more accurate decision-making based on information. As a result, academics and professionals are becoming increasingly interested in AI. The way AI is affecting HRM has made a thorough analysis of this important field's research environment necessary. The research literature suggests that although there is a growing focus on AI applications in HRM, many related and pertinent topics are yet unexplored. The current review has endeavored to present insights on the subsequent research concerns: (a) in light of worldwide business operations in the HRM sector, how are artificial intelligence (AI) and intelligence-based technologies increasingly perceived? (b) How can artificial intelligence be applied to smart and effective HRM practices to deliver better and quick services through digital involves? (c) What are the challenges in combining AI and humans, and what are the possible future opportunities to think about? There are six sections in this study. This is the arrangement for the remaining part of the paper: An overview of AI and HRM is given in section 2 along with a review of relevant literature; section 3 contains the study's methodology; section 4 gives a thorough explanation of the applications, challenges, future opportunities

and collaborative relations of AI for current HRM practices; section 5 presents the study's findings and recommendations; and section 6 covers conclusions.

Objectives of the Study

The main objective of the study is to examine the view of the current applications of AI in relation to rapidly evolving discipline of HRM in the business context. The several objectives are:

a) To determine the key challenges for applying the use and future prospects of AI in HRM;

b) To explore the supports that HR relationship management and chances of collaboration enjoy as a result of AI merging into the job; and

c) To provide the suggestions regarding the details of AI in HR to sustain itself going forward.

This study will employ the theoretical framework in order to reach its desired objectives. Since the application of AI in HR is still relatively new, scholars and professionals continue to evaluate its benefits and drawbacks in relation to efficiency and value. For emerging domains like these, conceptual is helpful. This study uses it to assess the current status of AI systems in the hiring process, examine the difficulties facing HRM techniques, and provide the benefits and drawbacks of using AI in HRM in order to arrive at an objective conclusion. The paper provides a springboard for other research projects that fill in the knowledge gaps and improve the field as it relates to new workplace circumstances.

Backdrop Theory and Literature Review

Historical Background of Artificial Intelligence

The 1950s witnessed the beginning of the drive to develop AI systems. Along with the initiative's introduction, many questions regarding its application and use have also surfaced. In 1956, John McCarthy, an emeritus professor of Computer Science at Stanford University,

established the area of "artificial intelligence." At Dartmouth College in Hanover, he arranged the renowned Dartmouth conference, which launched the field of AI. He thought that human-order intelligence will eventually arise through systems. Schein and Coles predicted in 1973 an ensemble of twenty-one potential goods that by the 1990s could result from the advancements in artificial AI. Therefore, skepticism has contributed to the so-called AI winter, which has significantly slowed down the rapid pace at which AI is being developed. AI is evolving in sync with developments in computer science and technology. AI was applied in the multimedia game business in the years 1990.

Thereby, artificial intelligence uses to any method that enables computers to simulate human behavior and was developed between 1950 and 1980. In contrast to machine learning, AI in this notion dates back to the 1980s and refers to computational technology that gives computers the capacity to learn without explicit programming. Deep learning is the newest iteration of the idea. As of 2022, deep learning is a branch of machine learning that paves the way for the computing of multi-layer neural networks. The realization that AI chess software has demonstrated that it can drive out humans in the game of chess makes this year significant for AI as well as its continuing rise in popularity. AI showed tremendous promise since being used in the gaming business and it provides the framework for the proper operation of many other technical breakthroughs, including robots and all other automated systems. AI is being applied more and more in many scientific fields where the ability to analyze a huge number of data serves as the foundation for decision-making owing to its growing popularity.

Conceptual View of Artificial Intelligence

The term "artificial intelligence" is frequently used to describe the branch of study that aims to give robots the ability to do tasks like thinking and acting, planning, logic, understanding, and

acquisition of knowledge. AI, also referred to as machine intelligence, is an interdisciplinary discipline that imitates the cognitive processes and capacities of humans. It is a process that stimulates human awareness and thought processes. It can swiftly access databases, extract information, effectively address our questions, and give the best response in a straightforward and logical manner. The development of machines that are capable of thinking like humans that is, learning, planning, solving problems, reasoning, socializing, creativity, and self-correction is the focus of AI (Kok et al., n.d.). AI and digital platforms have unrestricted potential for strengthening and broadening the workplace. AI also contains a wide range of technologies that enable a computer to carry out activities that typically require human cognition, such as making adjustments to decisions (Tambe et al., 2019, p. 16).

A new technology that shows promise in a variety of fields and businesses is AI (O'Connor, 2020). It has gained prominence and is opening the door for new business dynamics. Although AI is still in its infancy, given its enormous potential, it should provide substantial returns on investment. Having been in business for more than 50 years, Shell Oman Marketing Company is one of the top petroleum merchants in the nation (Shell Oman, 2021). A recent research found that 62% of businesses plan to implement AI very soon, while 38% of corporations are currently using it at work. The study of AI focuses on creating intelligent algorithms and technological advances that enable human intelligence to be applied in a variety of operations. In order to improve productivity and operational efficiency, this strategy uses machine learning and data analytics to replicate current human activities Using machine learning and data analytics, this method attempts to replicate current human activities in order to improve productivity. To gather, analyze and manage vital healthcare and medical data, AI is employed all across the healthcare sector. (Giriraj Kiradoo, 2018).

Artificial Intelligence in HRM

HRM is going through a significant shift as a result of the use of AI technology. AI as a discipline of computer science that makes it possible for algorithms to perform tasks that usually need human brains, has the potential to fundamentally transform the way HRM functions by automating repetitive tasks improving decision-making, and providing valuable information (Hossin M. et. al, 2021). The term HRM refers to a broad category of activities related to the human element in businesses. It includes a range of methods for managing human abilities and competences, such as hiring talent, supervising staff, and maximizing output (Bhardwaj et al., 2020; Soni et al., 2019).

AI technologies may assist HR departments with these tasks in order to improve employee experience, strengthen teams, and lower staff turnover (Danysz et al., 2019). Management of performance, planning the workforce, workforce analysis, automated assistants for self-service/HR providing services, succession installing patches, leadership, and coaching are among of the HRM practice areas where AI has produced the best results (Berhil et al., 2020).

Cobbe J, Singh J. (2021), in the growth of technology across a number of industries, particularly HR, and the application of AI has grown in importance. Employers are starting to use AI in HR management to improve productivity and effectiveness in areas including hiring, training, performance reviews, and employees' data management in recent years.

Pallathadka H. et. al, (2021), the enormous potential of AI in the HR field has been demonstrated by earlier research. For instance, it has been discovered that applying AI to the hiring and selection process may enhance both the effectiveness and quality of the hiring procedure. When AI is used in performance management, it has been discovered that this technology may improve employee performance assessment accuracy, objectivity, and transparency (Pantano E, et. al, 2020).

In a research by Jia et al. (2018), a conceptual framework of AI in HRM is put out. It includes relevant AI technology applications together with HRM components such as recruitment, training, HR strategy, performance management, remuneration, and employee engagement. By removing prejudice, AI improves HRM's capacity to recognize real achievers and potential leaders (Buck and Morrow, 2018). HR departments may gain an advantage in strategy by using AI technologies to help managers analyze, predicted, and evaluate talent more accurately (Nicastro, 2020).

Bondarouk et al., (2017) and Connelly et al., (2020), technological improvements are causing a fast transformation of the HR function and the work environment. Employee up-skilling must be ongoing due to innovation and the ensuing disruptions in corporate operations. HR has to rethink how work has to be managed differently in order to take use of AI and associated technologies. There are other names for this process of digitizing HR: digital HRM, online HRM, and E-HRM (Crawshaw et al., 2020).

Tambe et al. (2019) highlight several obstacles to AI adoption in HR, including the constraints placed by tiny data sets, the complexity of HR phenomena, issues of justice, and legal, ethical, and accounting considerations. Application of AI in HRM is accompanied by a number of hurdles, from conceptual to empirical (Kaur et al., 2021). Jain, D. S. (2018) in the study article, the function of AI in HRM was identified. According to the report, the majority of businesses have been implementing contemporary technology in a variety of HR processes, such as hiring, performance reviews, and cloud-based HR systems.

Jarrahi, M. H. (2018), AI and the Coming Future of Work: Human-AI Symbiotic interaction in

Administrative Decision Making is the title of his research paper. The study articles discussed how AI may benefit humans. AI has been useful in supporting decision-makers in organizations, dealing with uncertainty and, in especially, ambiguity in their decisions. Technology needs to depend on humans when making subconscious assessment and decisions that analyze and optimize decision results.

	Artificial Intelligence	**Humans Mind**
Complexity	Collect data, put in, analyze, and evaluate data.	Determine the area to search and collect information; Select an option with comparable data coverage.
Ambiguity	Examine sentiments while presenting a variety of different perspectives.	Open communication, establish consensus, and rally support.
Uncertainty	Allow individuals to access information in "real time."	Quickly and intuitively makes decisions when faced with uncertainty.

Source: (Jarrahi, M. H. 2018)

Buzko, et al., (2016), AI Techniques in HR Development is the title of the study. The authors of a study on the challenges posed by AI in the field of HR pointed out that AI is unable to determine the ROI of training expenditures. The authors of the research article observed that artificial intelligence technologies help humans analyze data more quickly. In general, AI has reshaped how businesses manage their workforce, plan HR schedules, assess productivity, increase efficiency, provide prompt feedback, and enhance employee engagement levels as well. These essential concerns are covered in greater detail in the subsections that follow.

Research Methodology

A descriptive design was used in the investigation. Consequently, it is exploratory in manner, drawing from a thorough analysis of pertinent past research and a discussion of comparative views of the many facets of AI, its applications, challenges and future amenities in HRM to reach final conclusions. The study is primarily a thorough analysis of relevant literature based on substantial efforts. Thus, As a result, the exploratory nature stems from a thorough analysis of pertinent past research, and in order to reach conclusions, a comparison of the many facets of AI and HR management has been explored. The study is primarily a comprehensive review of relevant literature based on very hard labor and effective to achieve the goals. As a result, it is a descriptive or perspective paper that has been assembled using scholarly or opinion study that based on secondary data that was gathered from publications, journals, the internet, etc.

Data Presentation, Results And Discussions

Applications of Artificial Intelligence in HRM

The applications of AI in the management of global efficiency and excellent services worldwide are fruitful. By providing better services and very effective technology that

help HR departments in accomplishing the necessary HRM duties, it improves the lifestyles of individuals. AI is a ubiquitous tool utilized in HRM practices across all industries for gathering, analyzing, presenting, and managing important HR and HR-related data.

AI-applied in HR for Getting Smarter and Growing More Informed

The era of work has arrived. HR department can now analyze recruiting choices, individual growth, and team atmosphere to assess things like efficacy, effectiveness and efficiency and employee experience as a result to new technologies. AI is currently employed in specific HR departments' decision-making processes, but a great deal more has to be done to fully develop the technology. As a result, workforces are becoming smarter with working procedures. They keep themselves up-to-date with connecting the most important information.

AI-driven in Road-mapping and planning of HR

The foundation of HRM is planing for the future. AI has great potential for HR planning as well. AI technology is applied by managers as an emergency use decision-making system that can complete strategic planning in a more comprehensive way. AI also plays an immense role in HR departments since it makes HR more efficient and helps to simplify procedures. To free up HR managers' productive time, they may utilize it by automating all the time-consuming and monotonous procedures, such payroll and attendance. Massive volumes of staff data may be crunched by analytics tools with AI capabilities to identify patterns, forecast attrition, and point out possible skill shortages.

AI-Driven in the Practices of Talent Acquisition and Recruitment

Talent acquisition is a critical function of the HR department as it may benefit the company by drawing in and integrating talented individuals. The HR function that may apply AI the most

frequently is talent acquisition. The application assessment procedure remains the most time-consuming task for any HR department during the recruiting process. The hardest part of hiring is finding the ideal applicant with the necessary skills and background from among hundreds of resumes. AI is transforming recruiting practices. Algorithms based on machine learning (ML) may be used to automatically filter resumes, and the computer system is able to shortlist the resumes that are the most relevant to each vacancy. AI evaluates applicants through video interviews as well, evaluating their eligibility using speech and face recognition. This improves the caliber of talent acquisition while also speeding up hiring. So, AI-powered job posting platforms can assist HR in identifying qualified candidates.

AI in Onboarding and Offboarding for New Workers

As any individual who has handled a program for onboarding can attest, adjusting and inducting new hires is usually a tedious and repeated procedure. The HR department may automate and design an onboarding process with AI to make it more streamlined, effective, and customized. Effective onboarding of new hires may increase retention by 82%. AI can automate many of the repetitive tasks involved in onboarding new personnel, minimizing the need for human interaction while yet providing a customized experience. These procedures also consist of gap analysis, skill evaluation, induction training, document verification, etc. Offboarding is not an exception. An AI-powered solution may, for instance, send out emails to terminate an employee's access to various systems, documentation pertaining to the return of corporate assets, and departure surveys when an employee departs the firm.

AI highly Customized Workplace and Employee Experiences

AI has the capacity to get better at customizing the work experience for employees. As a result, workers get more individualized training,

chances for growth, and support, which boosts their job happiness and productivity. AI is capable of providing real-time feedback and continually monitoring employee performance. Employees get feedback that specifically tackles their areas of strength and growth rather than general performance reports.

AI Improved Chatbots and Automation

AI-driven chatbots are becoming more and more popular for answering standard HR questions and duties. With speedier and more effective services, these machines are starting to interact more like humans. AI-powered chatbots can respond to employee questions about HR right away. The ability of these bots to identify individual requirements and provide tailored solutions makes it simpler for staff members to get the information and assistance they need, when they need it.

AI in Employee Engagement and Setting-Up

The success of a firm is largely dependent on employee engagement and sitting-up. AI systems assess employee sentiment and well-being by analyzing data from performance assessments, feedback, and employee surveys. In order to raise employee happiness and lower attrition rates, predictive analytics may assist detect possible problems and offer solutions.

AI-driven Force in Training and Development

With the help of AI-based training and development programs, staff members may improve their knowledge on their own. Educating staff members about emerging technology can have several advantages. By assessing the employee's current skill set, AI-based application software may identify and assign the proper training to them. AI-based application software may evaluate the employees' historical data for the current employee development program and recommend the necessary training so that the employees can receive it when it's needed. To stay up with the rapid advancement of technology, training is very important. In

this regard, AI can be useful in the planning, organizing, and scheduling of remote learning environments, including online courses. AI can be more involved in matching employees to customized training programs based on their individual requirements than just these administrative duties.

AI in Individual Skills and Performance Enhancement

When it comes to enhancing employees' unique talents and performance, machine learning has shown to be quite powerful. Although there is always room for development, the tool already frees up HR professionals' time so they can concentrate on other tasks while it offers the essential actionable information. Because it is not scalable, this type of technology still has to be improved. It struggles to interpret all the variables and handle massive amounts of data when utilized in large organizations.

AI-driven Employee Performance Management

There is a need for improved methods of tracking and managing employee performance in a world where most employers now allow remote work. Performance management systems with AI capabilities can help with this as they monitor worker behavior, performance, and possible roadblocks. But that is just the leading edge of the iceberg; AI systems can also evaluate performance data and offer meaningful, real-time insights to the HR staff, enabling them to make more informed choices. AI decision-making system makes it possible to employ various scientific assessment techniques like 360-degree performance evaluation techniques more automatically and rapidly. With AI's aid, decision-makers may assess each indicator's performance, suggest improvements for the indications that didn't work create and apply workable new indicators, and suggest upgrade strategies. Forecasting the future trend may also be used to create the performance goals for the future.

AI-applied in Compensation Management

The pay package management, also known as compensation management, is a dynamic management process that, under the direction of organizational growth objectives, establishes, allocates, and modifies employee compensation principles, methods, levels, structures, and elements in detail. Applications of AI can help to make compensation policies more equitable. AI system based on biological processes, neurology, psychology, and statistics is called a BP neural network. It can create a standard computational model, merge several neural network nodes, and mimic the nervous system of the human brain. Using big data as input, a BP neural network system may be utilized to create a smart decision-support system that forms a fair compensation appraisal system.

AI improved Employee Recognition and Acknowledgment

To improve their efficacy and enhance the employee experience, organizations have recently embraced AI-related solutions more and more in their employee recognition and rewards programs. By analyzing employee performance data, AI algorithms incorporated into recognition systems can provide appropriate methods for acknowledging an employee's work and significant accomplishments. HR administrators may also build individualized recognition to improve the work experience with the use of AI-powered recognition technologies. Not only that, but AI enables businesses to instantly identify and honor their workforce.

AI-automated in the Tasks of Administration

Automating tasks like benefit administration, candidate prescreening, interview scheduling, and more is possible with smart technology. While all of these roles are critical to an organization's success overall, completing the tasks associated with these procedures takes time, and as a result, HR professionals frequently find themselves with less time to serve their employees more effectively. This load can be reduced by using AI technologies to automate administrative chores. HR professionals may focus more of their work on strategic planning with the time saved.

Challenges and Complications Linked to AI in HRM

There are a few challenges that AI in the HR field must address in order to be highly accurate and effective. It's up to talk about the challenges of AI in HR in this section.

Lack of Creative, Out-of-Box Thinking and Human Judgment

Routine work is not the foundation for all HR procedures and ongoing initiatives. In order to create writing, AI systems rely on similarities and pre existing data, which leads to repetive material devoid of novel insights. AI is limited in its ability to generate novel ideas and thoughts since it is lacking the capacity to think creatively. It has trouble understanding complicated emotions, which makes it challenging to add authentic human feeling to articles or establish an empathic connection with people. AI lacks the ability to apply human judgment and critical thinking skills, resulting in potential errors in the analysis and interpretation of data.

Possible Discriminatory and Biased Systems of Algorithms

The possibility of discrimination and bias in algorithms is one of the greatest issues linked to AI and automation in HR. This might happen if the variables utilized in the algorithms are intrinsically discriminating, or if the computer algorithms are trained on biased data.

Possibility of Unemployment and Employees Displacement

A possible challenge for AI and automation in HR might be the possibility of loss of employment and human displacement. It is likely the particular positions may become outdated or that individuals will be eliminated

from their existing duties when more HR functions are automated.

Threat to Data Safety and Security of Employees

There is a chance that employee data security and privacy may be violated as more HR functions become digital and automated. Consider the possibility of data breaches and the loss of confidential data if private employee information is collected and preserved in a relational database that is open to hackers or cyber attacks. HR specialists need to use caution to guarantee that the privacy of employees is maintained and that those devices are deployed comfortably.

Inability to Human Contact and Emotional Intelligence

The lack of these two factors in HR is another issue with AI. AI can increase productivity and speed up operations, but it cannot take the place of the human aspect, which is frequently required for HR duties like performance evaluation and dispute settlement. HR managers must apply caution when integrating automation with interpersonal interaction and empathetic feelings to make sure that workers feel acknowledged and supported. AI may provide answers that are technically correct but lack logical reasoning or common sense, leading to inaccurate or nonsensical outputs.

Lack of Ability to Identify High-Risk Erroneous

This is a usual challenge when applying AI in HR, especially in the hiring process. HR managers face the risk of overlooking applicants who might not fit every one of an organization's strict hiring criteria but who could nevertheless be exceptional individuals who can make a big difference to the company. These attributes and potential may not always be evident in a resume. If companies just utilize AI-driven tools, they may lose out on these people since the AI systems that scanned resumes would not identify them as suitable candidates.

Lack of Trust in Artificial Intelligence

An important issue with the application of AI in HR is the absence of trust in the machine learning algorithms. Some HR specialists may find it challenging to use the technology since they have doubts about the accuracy and reliability of AI-powered solutions. To get over this issue, organizations need to teach HR staff members about the ability of AI and how to apply it to improve HR practices. However AI is an advance in technology that can support human judgment and decision-making. HR managers need to be aware that AI should not take their position altogether.

Managing Employee Diversity and Inclusion

Managing staff diversity and inclusion is one of the HR manager's biggest challenges. Organizations must make sure that every employee is handled fairly and with respect in light of the growing diversity of the workforce. This entails addressing bias and discrimination, fostering an inclusive culture, and offering instruction and training.

Not all of the Time Capable to be implemented AI in HR

Similar to HR department employees who are not prepared to advance their careers, organizations believe AI is not yet ready to be implemented in their daily operations. More attention and financial backing are needed for any type of significant modifications, which certain organizations just cannot afford. In light of this, it is unlikely that AI technologies will see widespread adoption very soon. It could take decades before all companies, large and small, decide to use AI in their hiring procedures or even begin using it in other areas of their workplace. Ultimately, change is a process that takes time.

Finally, it might be challenging for the employees to become adapted to or learn how to use artificial intelligence devices. The HR department of any industry may find it challenging to select the

most suitable applicant to manage or handle these applications (Yawalkar, 2019).

Artificial Intelligence in Human Resources: Future Prospects

Not only does AI in HR have a bright future, but it will also revolutionize the HR industry. HR managers will need to acquire new skills in order to stay relevant and generate value for the company as AI continues to transform how they work. AI will eventually be capable of fully handling several jobs and responsibilities. This will have an effect on future job design and the way HR creates capacity planning.

"Artificial intelligence will reach human levels by around 2029. Follow that out further to, say, 2045; we will have multiplied the intelligence, the human biological machine intelligence of our civilization a billion-fold." -Ray Kurzweil

AI in HR has a bright future ahead of it that will change the HR industry as a whole. It will be essential for HR professionals to acquire new skills in order to stay relevant and generate corporate value as AI continues to transform the way they work. There are some of the most important responsibilities that HR professionals will have to fill, along with their effects on the HR industry.

a) HR leaders will need to acquire distinctive, superior skills as AI becomes more and more popular. AI will boost productivity and efficiency in staff management. Attrition will decrease as a result of the use of AI in HR. AI-driven recruiting will grow into the default mode of recruitment. Employee initiation procedures will be primarily automated. AI will be integrated into T&D platforms. Employee recommendations will become more accurate and predictable.

b) The workforce that HR has to oversee will embrace AI, which will not only affect every aspect of the employee lifecycle. There are several types' people who are in the workforce at the moment: employees,

temporary workers, providers, and regular staff. Future HR management responsibilities will include monitoring robots that assist workers in completing tasks.

c) AI-consolidated technologies will make it easier for new employees to comprehend the organization's values, culture, and other important data. AI will help in automating management duties such as designing logins and finishing up paperwork.

d) AI will assist in carrying out a variety of employee engagement activities and initiatives, such as employee recognition systems, real-time feedback, personalized feedback surveys, etc. HR is now more prepared than ever to assess the involvement and contentment of team members. Additionally, it will support the HR team in proactively implementing retention initiatives, which will ultimately reduce attrition.

e) AI will be a more versatile and adaptive type of application that can learn and change as time passes, making it ideal for challenging tasks and decision-making. By automating processes like screening resumes and candidate communication, AI will assist HR departments in finding and vetting new recruits more quickly. HR staff will be able to concentrate on the most eligible applicants while saving time and resources thanks to this issue.

f) HR departments will be able to assess employee satisfaction and engagement through the use of AI-powered tools that analyze data from social media posts, performance indicators, and survey answers. By examining unique learning preferences, styles, and performance information, AI will be utilized to customize staff training and development initiatives.

g) AI-based solutions will handle a lot of these duties automatically, allowing HR

departments to concentrate on more important projects. HR departments will be able to concentrate on important projects and enhance the employee experience as a result of AI's ability to make operations easier, based on data, and personalized.

h) As AI technology grows, we expect to see more automation, personalization, and data-driven decision-making in HR practices. AI will help to improve HR practices, such as job posting, candidate screening, and employee performance management. AI will also help HR professionals to make more informed decisions by providing real-time data and insights..

i) HRIS will be more helpful and effective in the future. AI and data management systems have a dynamic interaction that has important ramifications for large-scale HRIS installations. AI integration within the data management application may improve the accuracy and efficiency of database queries while also optimizing HR managers' labor allocation. One of the main advantages of artificial intelligence for human resources is this.

j) As more businesses move toward a remote workforce, remote HR will gain acceptance in the upcoming years. The HR office of the future will be an automated remote one, powered by AI, offering rapid solutions and smooth bureaucratic.

Opportunities for Collaboration and HR Relationship Management between AI and HRM

Experts in AI and HR can collaborate together, combining their mutual strengths to generate materials that have greater implications. Through collectively, they can take advantages of human intuition and creativity along with AI's boost and data analysis abilities to increase the efficacy and quality of written assignments. It is imperative that we maintain a balance and

work jointly effectively with human creative individuals and AI. The figure shows the collaboration between AI and HR.
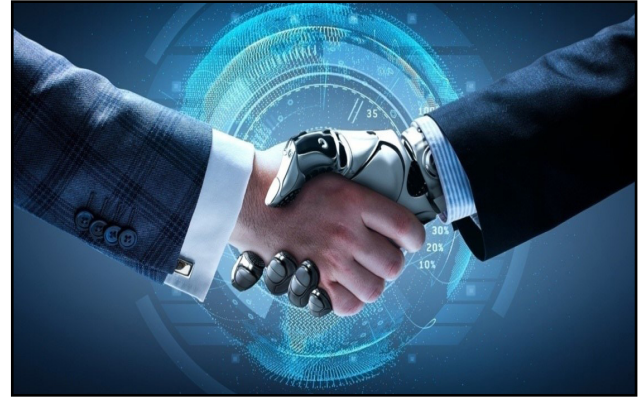
Although AI can create objects quickly, it lacks creativity and the human touch. Inversely, HR managers are able to relate to their audience and bring feeling into their work. By merging the advantages of both of them, we can produce excellent material that connects to and interests users. As humans may modify and add their own perspectives, AI systems can help by producing outlines or recommending subject matters. Adopting this cooperative strategy assures that we produce stimulating content that combines the highest quality aspects of each discipline.

Employee relations and corporate culture are included in employee relationship management, which coordinates the connection between employers and employees. AI may be employed as a support system in human relations management as well as communication management to handle management activities, solve multiple complicated procedures stereotypes, and serve as performers, helpers, and advisors. The manager's assistant helps him and his staff mostly with tasks like scheduling, reporting, recording, and scorecard maintenance.

The figure indicates the strong relations that one's creative power work together with another's automated power and machine learning.
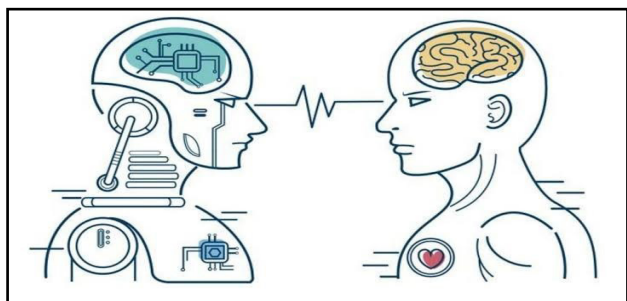
Applications of AI in this field include the "Virtual reality Assistant System," which sets up meetings by creating and reading emails, scheduling attendees, and keeping track of calendars. As a result of taking in information from both themselves and their peers, these intelligent devices will gradually increase pertinent knowledge and broaden their service areas. These technologies become what are known as an "advisor system" by expanding the concept of AI in the workplace.

If AI and HR positively collaborate and HR maintains proper and positive use of AI, Positively, working together with AI can be advantageous for a number of reasons.

a. automating HR procedures and strengthening employee-HR collaboration,

b. applying workplace and communication technology that are already installed and set up correctly,

c. ensuring smooth interactions between HR and different divisions of work can help in decision-making and improves results for businesses for organizations,

d. using AI tools like advanced analytics and automated HR workflows, HR departments can gain valuable knowledge about workplace dynamics,

e. enhancing the efficiency and consistency of HR procedures and creating a collaborative and team-oriented workplace.

Through AI's lightning-fast speed and precision, large-scale information analysis can reduce human workload overload and free up time for more significant and creative activities. However, employing human knowledge and skills in leadership, collaboration, creativity, and social skills, people can train and counsel AI on how to analyze data and come up with answers. Thus, it makes sense to think that good performance results from human and AI cooperation that understand and assist one another.

Findings and Recommendations of the Study

Major Findings of the Study

In this survey study, we investigated the current applications of AI, its challenges, and its prospective executes in HRM. Hiring and retention, wellness programs for workers, diversity in culture, HR planning, evaluations of performance, the employee experience, communication, HR data analysis, and other HRM-related disciplines were among the many that we discussed and where AI is making a significant impact. We found that AI has the potential to revolutionize HRM by supporting decision-making through data-driven insights, automating administrative operations, providing objective performance assessments, enabling personalized experiences, and raising overall efficiency and effectiveness. Nevertheless, we also discovered a number of challenges that are related to the application of AI in HRM, such as bias and equal treatment, data security and privacy, openness, reliability, responsibility, and managing modifications that are connected with the deployment of AI in HRM.

The primary objective's inputs indicated that AI has significant potential in the HR domain. It simplifies the workload for HR staff members while also enabling them to contribute value in many capacities. In this way, it also improves the employees' entire experience, which will eventually help the HR department's reliability. The data provided for the following objective: suggest that HR staff members are aware of

the extent to which AI can address challenges in organizations by providing a high-level overview of how value addition might be accomplished.

Recommendations of the Study

There is ample opportunity of effectiveness for future AI applies in HRM. I suggest that the following recommendations for how that will optimize the positive effects of AI in HR and address its limitations:

- Organizations must concentrate on developing a culture of collaboration between employees and AI technologies in HRM. This means supporting an HRM approach that is human-centric, emphasizing the importance of human judgments in making decisions, and improving HR practitioners' capacities to work effectively with AI technology.

- Increased accuracy, decreased bias, and moral use all have to be necessary for AI systems to get better. This includes looking into explainable AI approaches, examining frameworks for implementing explainable AI, and sponsoring research to remove bias in AI systems. It would be feasible to manage and apply other algorithms by using the same AI methods.

- The study advises HR managers to investigate the moral ramifications of implementing AI in HRM, including hiring and selecting technologies and also HR departments to look into how AI should affect the capabilities needed for effectively managing emerging technologies in HRM and the skills required by HR personnel.

- AI systems should be regularly monitored, evaluated, and audited in order to identify and address biases, ensure adherence to legal and ethical obligations, and maintain transparency and accountability. To gather input from employees and address any concerns or issues they may have with

the use of AI, organizations should set to establish feedback channels.

- The study suggests examining the HR department's duties in managing the move to modern technology, including the creation of initiatives for training and development in order to facilitate employee reskilling and upskilling.

- The same methodologies should be used to do research on more AI applications in the future like technological design specifications and validation, technology application analysis, and risk and problem analysis.

Finally, organizations should focus on learning employees on AI technology, including its pros and cons, challenges, and implications and future prospects for HRM practices. Employee trust may be increased and their participation in the AI implementation process can be facilitated by establishing open channels of communication.

Limitations and Future Directions of the Study

There aren't multiple studies on AI technology and its applications in HRM because it's still relatively new. As far as we are aware, no academic work has addressed the challenges faced in applying AI technology to the HR field through a methodical analysis that addresses the whole range of its meaning as this paper does. There might be limitations on the study, too. Consequently, it is possible that certain articles that delve into the assigned subject matter were excluded from the search specifications the authors used. Potential employees' ability to game the system or respond harshly to algorithm-based conclusions is an important limitation of AI as it is currently applied in HRM.

To develop ethical guidelines and legal frameworks that are particularly appropriate for the application of AI in HRM, HR experts, researchers, legislators, and corporate executives should collaborate. These guidelines should include responsibility, fairness, privacy,

openness, and the responsible application of AI technology. Since these methods yield highly effective and promising outcomes, more research can be done in this field. AI has yet to attain its full potential and capabilities, but in the years coming up, its applications and technologies will undoubtedly have a significant impact on human life. In addition, researchers can use quantitative research in the future to ascertain how HR staff members and organizations perceive the use of AI in HRM procedures. When performing exploratory research, authors must to pay close attention to control factors. Future research endeavors may also consider granting tools human-like emotional capabilities. Research on AI's contribution to green HRM is also possible in the future.

Conclusions

Based on this study, I may conclude that the applications of AI in HR improves reliability, facilitates resource analysis, and saves time for the HR department because AI can complete most tasks. The efficient application of AI encourages employees to participate more in their work. AI is an essential driver in hiring, training, development, promoting, performance data collection, and employee performance evaluation. Applying a review of prior data, the aim of this paper is to provide the theoretical framework for discussing AI in HRM practices. Possible applications of AI, as well as its challenges have been discussed, along with their potential future prospects. HR is one area where AI application is expanding quickly. A recent poll by Eightfold AI, which involved over 250 HR experts, revealed that 92% of the participants anticipated increasing their use of AI in some capacity. AI is changing HR procedures in a variety of ways, including bias reduction, personalization, and automation. The advantages of AI in HR are obvious, despite certain drawbacks to take into account, such as prejudice and a lack of transparency. AI will have a significant impact on how HR operates in the future and how we manage our workforce. HR specialists must thus adopt this technology in order to deliver the most results and remain competitive. The researcher will learn about the use of AI tools used in HR procedures and investigate the technicalities, potential, and obstacles of AI in HRM as well as its potential in the future.

References

- AI and Automation in HR: Impact, Adoption and Future Workforce https://www.digitalhrtech.com/ai-in-hr-impact-adoption-automation

- Ameen N. (2021). Customer experiences in the age of artificial intelligence. Comput Human Behav.;114:106548.

- Berhil, S., Benlahmar, H., & Labani, N. (2020). A review paper on artificial intelligence at the service of human resources management. Indonesian Journal of Electrical Engineering and Computer Science, 18(1), 32-40.

- Bhardwaj, G., Singh, S.V., & Kumar, V. (2020): An empirical study of artificial intelligence and its impact on human resource functions. In 2020 International Conference on Computation, Automation and Knowledge Management (ICCAKM) (pp. 47–51). IEEE.

- Buck, B. & Morrow, J. (2018). AI, performance management and engagement: keeping your best their best. Strategic HR Review, 17 (5), 261-262.

- Buzko, I., Dyachenko, Y., Petrova, M., Nenkov, N., Tuleninova, D., & Koeva, K. (2016): Artificial Intelligence technologies in human resource development. Computer Modelling & New Technologies, 26-29.

- Cobbe J, Singh J. (2021 Sep.) Artificial intelligence as a service: legal responsibilities, liabilities, and policy challenges. Comput Law Secur Rep.;42:105573.

- Danysz, K., Cicirello, S., Mingle, E., Assuncao, B., Tetarenko, N., Mockute, R., & Desai, S. (2019). Artificial intelligence and the future of the drug safety professional. Drug safety, 42(4), 491-497.

- Giriraj Kiradoo (2018): "Role of Application of Artificial Intelligence (AI) and its Importance in the Healthcare Industry, International Journal of Advanced Research in Engineering and Technology, 9(2), pp 104–107.

- Hossin MS, Ulfy MA, Karim MW (2021): Challenges in adopting artificial intelligence (AI) in HRM practices: A study on Bangladesh perspective. International Fellowship Journal of Interdisciplinary Research Volume-1

- Jain, D. S. (2018, March): Human Resource Management and Artificial Intelligence. International Journal of Management and Social Sciences Research (IJMSSR), 7(3), 56-59.

- Jarrahi, M. H. (2018): Artificial Intelligence and the Future of Work: Human-AI Symbiosis in Organizational Decision Making. Business Horizons, 61(4), 1-10. doi:10.1016/j.bushor.2018.03.007

- Jia, Q., Guo, Y., Li, R., Li, Y., & Chen, Y (2018): A conceptual artificial intelligence application framework in human resource management. In Proceedings of the International Conference onElectronic Business, 106-114.

- Kok, J.N.; Boers, E.J.W.; Kosters, W.A. & Putton, P.V. (n.d.): Artificial intelligence: Definitions, trends, techniques, and cases. Encyclopedia of Life Support System.

- Lv X. et. al, (2022). Artificial intelligence service recovery: the role of empathic response in hospitality customers' continuous usage intention. Comput Human Behav.;126:106993.

- McCarthy, John, Minsky ML, Rochester N, Shannon CE (2006) "A proposal for the Dartmouth summer research project on artificial intelligence, august 31, 1955." AI magazine 27(4): 12-12. [14] Firschein, Oscar, Fischler, M. A., Coles, L. S., & Tenenbaum, J. M. (1973) "Forecasting and assessing the impact of artificial intelligence on society." IJCAI 5:105-120.

- Meijerink, J., Boons, M., Keegan, A., Marler, J. (2021): Algorithmic human resource management: synthesizing developments and cross-disciplinary insights on digital HRM. Int. J. Hum. Resour. Manag. 32(12), 2545–2562. https://doi.org/10.1080/09585192.2021.1925326

- Nicastro, D. (2020): Ways Artificial Intelligence is Reinventing Human Resources. Retrieved December 18, 2020, from https://www.cmswire. Com/digital-workplace/7-ways-artificial-intelligenceis-reinventing-human-resources.

- O'Connor, S. W. (2020, January 2): Northeastern University. Retrieved from Northeastern University:https://www.northeastern.edu/graduate/blog/artificial-intelligence-in-human-resource-management/

- Pallathadka H. (2021): Applications of artificial intelligence in business management, e-commerce and finance. Mater Today Proc.;(Jul): https://doi.org/10.1016/j.matpr.2021.06.419.

- Pantano E, et. al, (2020).Forecasting artificial intelligence on online customer assistance: evidence from chatbot patents analysis. J Retailing Consum Serv.;55:102096.

- Rodgers, W., Murray, J.M., Stefanidis, A., Degbey, W.Y., Tarba, S.Y. (2023): An artifcial intelligence algorithmic approach to ethical decision-making in human resource management processes. Hum. Resour. Manag. Rev. https://doi.org/10.1016/j.hrmr.2022.100925

- Shell Oman. (2021, November): Shell Oman. Retrieved from Shell Oman: https://www. shelloman.com.om/ en_om/about-us.html

- Soni, N., Sharma, E.K., Singh, N., & Kapoor, A. (2019): Impact of artificial intelligence on businesses: From research, innovation, market deployment to future shifts in business models.

- Tambe, P., Cappelli, P., & Yakubovich, V. (2019): Artificial intelligence in human resources management: Challenges and a path forward. California Management Review, 61(4), 15–42. https://doi. org/10.1177/0008125619867910

- Yawalkar, M. V. V. (2019): A Study of Artificial Intelligence and its role in Human Resource Management. International Journal of Research and Analytical Reviews (IJRAR), 20-24.

Blending of AI in Financial Sector with Special Reference to the Banking Sector

Dr. Akinchan Buddhodev Sinha

Deputy Director, The Institute of Company Secretaries of India (ICSI), Noida

Prof. Arindam Sinha

Academician and Researcher, Kolkata

Abstract

The world of finance has emerged as an obvious laboratory of AI because information processing is the key function of financial sector. In view of this, it has been observed that financial institutions of all forms invest heavily in technology and data well ahead of other industries in order to vanquish competition.

The financial sector is closely linked to the growing digital world. Whether it is banks, insurance companies, stock markets etc. digitalization has become an indispensable element. Moreover soaring business volumes, rising cut-throat competition and to stay alive and thrive in the competition, meeting customer / investor requirements, efficient management of business operations, effective strategic management etc. has created mammoth scope for Artificial Intelligence (AI). In view of the mentioned facts, it creates paramount academic and research interests to delve into usage of AI in financial sector. In this article application of AI in banking sector will be undertaken to comprehend how AI has acted as a game changer in the global as well as Indian banking industry in terms of enhancement in revenue, loans management, overall productivity of the branches, expansion of business etc.

Keywords: *AI in Financial Sector; AI in Banking Sector; Global Banking Sector; Indian Banking Sector.*

Introduction

Artificial Intelligence is gaining steam in the financial sector at an astounding pace. It is assisting financial sector in many ways such as AI it is playing a crucial role in tackling frauds more efficiently, optimization of customer experience, proper risk management, automation of operations thereby reducing costs, fostering transparency in business transactions and so on and so forth.

The activities which previously consumed substantial time can now be carried out within few minutes or even within seconds. For instance, previously to open a bank account, say a savings bank account a customer who was not aware of the account opening process has to go from one window to another window of the bank to comprehend the mentioned process but today with the help of various AI applications a customer can easily understand the process and open a bank account or carry out any financial transactions.

According to a survey by NTT Data Services in 2021, 83 percent of financial services executives agreed that AI is giving birth to new approaches of product differentiation and expand customer base by getting access to unique data sets, and 81 percent of the respondents said that AI is vital in devising strategies to beguile customers and retain them.

Literature Review

According to OECD's Business and Finance Outlook 2021, the embracing of artificial intelligence (AI) systems and techniques has

enhanced prodigiously facilitated by availability of massive data and rise in the affordability of computing capacity. AI is increasingly being used by financial services providers across industries within the financial sector that is, in retail and corporate banking such as, tailored products, chat-bots for client service, credit scoring and credit underwriting decision-making, credit loss forecasting, anti-money laundering (AML), fraud monitoring and detection, customer service, natural language processing (NLP) for sentiment analysis) etc.

Singh and Pathak (2020) have given the definition of Artificial Intelligence, "as the ability of the machines to think on their own and do a task without the help of human beings."

Mhlana (2020) has studied the impact of Artificial Intelligence on the process of digital financial inclusion, while emphasising the significance of its key facets like, chatbots, fraud detection and cybersecurity with reference to the improvement in the quality of services to the customers.

Suma S.R. and Anupama S (2021) in their study observed that majority of respondents with whom detailed interviews were conducted stated that new advancements in AI are exciting. Further, the study revealed that Artificial Intelligence was found to be advantageous by 75 out of 100 banking respondents. With reference to cash deposits, 92 out of 100 clients used an automated financial consultant. 83 out of 100 respondents said that AI in banks has stoke up the pace of administrations and 84 out of 100 opined that AI can improve bank security in many ways.

Mehdiabadi et al. (2022) has opined that the concept of banking 5.0 is based on the framework of an industrial revolution created by artificial intelligence.

Shetty Sharan Kumar, Spulbar Cristi, Birau Ramona and Filip Robert Dorin (2022) have mentioned that artificial intelligence has ushered in a radical metamorphosis in the banking industry. It has been observed that banks have embraced numerous AI technologies in their activities like core banking, operational performance, customer support and analytics.

Noreen et al. (2023) has stated that the banking industry can embrace appropriate methods based on AI technology to enhance the quality of customer services as well as bank's performance indicators.

Stanly Milin (2023) has mentioned about customers expectation of certain level of customisation due to the onset of technology, thereby necessitating restructuring of conventional banking services and products to meet each customer's distinct needs.

Research Questions / Hypothesis

1. Whether there is a significant difference or not in the net profit / loss of the public and private sector banks using Artificial Intelligence, i.e., State Bank of India, Punjab National Bank, HDFC Bank and ICICI Bank considered for the research study?

Null Hypothesis (H0): There is no significant difference in the net profit / loss of the banks considered for the research study due to usage of Artificial Intelligence

Alternative Hypothesis (H1): There is a significant difference in the net profit / loss of the public and private sector banks considered for the research study due to usage of Artificial Intelligence.

2. Whether there is a significant difference or not in the Net Interest Income to Total Funds ratio of the public and private sector banks that have embraced Artificial Intelligence and have been considered for the research study?

Null Hypothesis (H0): There is no significant difference in the Net Interest Income to Total Funds Ratio of the banks considered for the research study due to usage of Artificial Intelligence.

Alternative Hypothesis (H1): There is a significant difference in the Net Interest Income to Total Funds Ratio of the banks considered for the research study due to usage of Artificial Intelligence.

3. Whether there is a positive impact or not on the profitability of the banks considered for the research study, i.e., State Bank of India, Punjab National Bank, HDFC Bank and ICICI Bank due to implementation of Artificial Intelligence?

Null Hypothesis (H0): There is a positive impact on the net profit / loss of the banks considered for the research study after implementation of Artificial Intelligence.

Alternative Hypothesis (H1): There is no positive impact on the net profit / loss of the banks considered for the research study before and after implementation of Artificial Intelligence.

Methodology and Data Collection

1.F-Test (One Factor Model): This statistical tool will assist in comprehending whether there exists a significant difference or not in the net profit / loss and Net Interest Income to Total Funds ratio of the public and private sector banks considered for the research study having implemented Artificial Intelligence in their operations.

2. Kruskal Wallis or H-Test: This statistical tool will help in understanding whether espousing

Artificial Intelligence have exerted a positive impact or not on the profitability of the banks considered for the research study.

Findings

Since majority of banks in India espoused Artificial Intelligence in the recent past, as mentioned in one of the literatures that numerous traditional banks since 2016 collaborated with fintech start-ups or devised solutions in-house to provide advanced banking solutions to their customers, in view of this, analysis of four Indian banks , i.e., two banks from public and private sectors each have been conducted .

The analysis of the following variables - net profit / loss, Net Interest to Tota Funds ratio and Return on Capital Employed ratio of the banks considered for the research study have been conducted to ascertain whether due to usage of Artificial Intelligence is there a significant difference or not in the mentioned variables of the banks.

Net Profit / Loss

The net profit / loss of public and private sector banks considered for the research study that is, State Bank of India (SBI), Punjab National Bank (PNB), HDFC Bank and ICICI Bank is provided in the table 1 below.

Table 1
Net Profit / Loss of the Public and Private Sector Banks

Years /Banks	State Bank of India	Punjab National Bank	HDFC Bank	ICICI Bank
2016	12743.29	-3663.27	12817.33	10926.89
2017	-390.67	901.13	15287.4	11340.33
2018	-4187.41	-12584.34	18560.84	9099.54
2019	3069.07	-10026.41	22445.61	5689.16
2020	18176.83	363.34	27296.27	11225.47
2021	24279.72	2152.43	31856.77	20363.97
2022	36356.17	3675.96	38150.9	25783.83
2023	56558.43	3069.34	46148.7	34463.03

Null Hypothesis (H0): There is no significant difference in the net profit / loss of the banks considered for the research study due to usage of Artificial Intelligence.

Alternative Hypothesis (H1): There is a significant difference in the net profit / loss of the public and private sector banks considered for the research study due to usage of Artificial Intelligence.

The analysis to ascertain whether the banks considered for the research study using artificial intelligence in their operations reveals a significant difference or not in their net profit / loss have been exhibited in table 2 and 3.

Table 2
Net Profit / Loss of the Public and Private Sector Banks

Years / Banks	State Bank of India	Punjab National Bank	HDFC Bank	ICICI Bank
2016	12743.29	-3663.27	12817.33	10926.89
2017	-390.67	901.13	15287.4	11340.33
2018	-4187.41	-12584.34	18560.84	9099.54
2019	3069.07	-10026.41	22445.61	5689.16
2020	18176.83	363.34	27296.27	11225.47
2021	24279.72	2152.43	31856.77	20363.97
2022	36356.17	3675.96	38150.9	25783.83
2023	56558.43	3069.34	46148.7	34463.03

Table 3
Analysis: Artificial Intelligence and Net Profit / Loss

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
12743.29	7	133862.1	19123.16286	484627961		
-3663.27	7	-12448.6	-1778.364286	44211165.01		
12817.33	7	199746.5	28535.21286	121223335.4		
10926.89	7	117965.3	16852.19	108167646.1		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3382962406	3	1127654135	5.948876	0.003498	3.008787
Within Groups	4549380645	24	189557526.9			
Total	7932343051	27				

Decision: The computed value of F = 5.948876 > Tabled value of F0.05 = 3.008787 => the null hypothesis is rejected H0 is rejected and alternative hypothesis H1 is accepted => There is a significant difference in the net profit / loss of the public and private sector banks considered for the research study due to usage of Artificial Intelligence.

Now to ascertain whether there exists a significant difference or not in the Net Interest Income to Total Funds Ratios of the public and private sector banks considered for the research study, F-Test (One Factor Model) have been applied. The period considered for the analysis is 2019-2023.

Null Hypothesis (H0): There is no significant difference in the Net Interest Income to Total Funds Ratio of the banks considered for the research study due to usage of Artificial Intelligence

Alternative Hypothesis (H1): There is a significant difference in the Net Interest Income to Total Funds Ratio of the banks considered for the research study due to usage of Artificial Intelligence.

The analysis to ascertain whether the banks considered for the research study using artificial intelligence in their operations reveals a significant difference or not in the Net Interest Income to Total Funds Ratio have been exhibited in table 3 and 4.

Table 3
Net Interest Income to Total Funds Ratios of the Banks

Years / Banks	State Bank of India	Punjab National Bank	HDFC Bank	ICICI Bank
2019	2.62	2.02	4.3	2.99
2020	2.71	2.24	4.18	3.5
2021	2.72	2.2	4.1	3.61
2022	2.64	2.93	3.95	3.78
2023	2.86	2.49	4	4.38

Table 4
Analysis: Artificial Intelligence and Net Interest Income to Total Funds Ratios

Anova: Single Factor						
SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
2.62	4	10.93	2.7325	0.008492		
2.02	4	9.86	2.465	0.112567		
4.3	4	16.23	4.0575	0.010558		
2.99	4	15.27	3.8175	0.153892		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.427319	3	2.475773	34.68582	3.4209123785	3.490295
Within Groups	0.856525	12	0.071377			
Total	8.283844	15				

Decision: The computed value of F = 34.68582 > Tabled value of F0.05 = 3.490295 => the null hypothesis is rejected H0 is rejected and alternative hypothesis H1 is accepted => There is a significant difference in the Net Interest Income to Total Funds Ratio of the banks considered for the research study due to usage of Artificial Intelligence.

To comprehend the efficacy of the Artificial Intelligence from the perspective of profitability before and after implementation of Artificial Intelligence by the banks considered for the research study, Kruskal Wallis Test (H-Test) have been applied on the net profit / loss. Since by perusing the literatures it is being observed that majority of the banks in India embraced Artificial Intelligence in 2016, in view of this, to observe the impact on the profitability of the banks the pre and post artificial intelligence years considered are 2015 and 2016 respectively.

Null Hypothesis (H0): There is a positive impact on the net profit / loss of the banks considered for the research study after implementation of Artificial Intelligence.

Alternative Hypothesis (H1): There is no positive impact on the net profit / loss of the banks considered for the research study after implementation of Artificial Intelligence.

The net profit / loss of the years 2015 and 2016 is provided in the table 5.

Table 5
Net Profit / loss of the Banks

Years / Banks Net Profit / Loss	SBI	PNB	HDFC	ICICI
2015	17517.37	3341.42	10700.05	12942.30
2016	12743.29	-3663.27	12817.33	10926.89

Since net profit / loss of two periods, i.e., 2015 and 2016 are provided and each year comprises of 4 net profit / loss values, so we have N1= N2 = 4, and N = N1 + N2 = 4 +4 = 8. Arranging all these net profit / loss values in increasing order of magnitude and assigning appropriate ranks, we get:

Banks Net Profit / Loss	-3663.27	3341.42	10700.05	10926.89	12743.29	12817.33	12942.30	17517.37
Ranks	1	2	3	4	5	6	7	8

The year wise ranks are provided in table 6.

Table 6
Rank Table

Net Profit / Loss of banks for 2015	2	3	7	8	20 = R_1
Net Profit / Loss of banks for 2016	1	4	5	6	16 = R_2

$$H = \frac{12}{N(N+1)} \ [R_1^2 / N_1 + R_2^2 / N_2] - 3(N + 1)$$

$$H = \frac{12}{72} \left[400 / 4 + 256 / 4 \right] - 3(8 + 1)$$

H = 27.33 – 27.0

H= 0.33

Here degrees of freedom = k -1 = 2 -1 = 1

Also level of significance: $\alpha = 0.05$

Therefore, $\chi 2$ (for 1 degree of freedom and $\alpha = 0.05$) = $\chi 2 0.05$ = 3.841

Decision: Fail to reject H0 if H < $\chi 2 0.05$

Now 0.33 < 3.841 => H < $\chi 2 0.05$

=> The null hypothesis H0 fails to be rejected and the alternative hypothesis H1 is rejected. It can be concluded that there is a positive impact on the net profit / loss of the banks considered for the research study after implementation of Artificial Intelligence.

Analysis and Discussion

From the above findings, it may be opined that the artificial intelligence has exerted varying degree of impact on the profitability of the banks considered for the research study that is different for public and private sector banks considered for the research study. This may be due to difference in the extent of usage of artificial intelligence by the banks or the usage may differ region / area wise, i.e., for operations in urban and semi-urban areas artificial intelligence may be used substantially and in case of operations in rural or far-flung areas artificial intelligence may not be used massively.

Similarly, on observing the outcomes of the analysis of Net Interest Income to Total Funds ratio of the banks, there exist a significant difference in the mentioned variable for the public and private sector banks considered for the research study i.e., artificial intelligence may not be able to generate similar results in terms of net interest income to total funds for the banks.

However, for both the aforesaid analysis, it may be stated that artificial intelligence has many

dimensions and almost all the banks in India are taking magnificent initiatives to make optimum utilisation of artificial intelligence to serve the customers both at national and global levels optimally.

Further, this article has focused on select variables only to comprehend the financial performance of the banks but in reality, there are numerous factors determining the financial performance of the banks like Return on Capital Employed, Earnings before Interest and Tax (EBIT), Non-Performing Assets (NPAs) etc. so even if the above mentioned analysis have revealed difference in the profitability and net interest income to total funds ratios, it may not be correct to infer that artificial intelligence is not creating optimism.

Finally, looking at the third analysis that deciphered whether there is a positive impact or not on the profitability of the banks considered for the research study by taking into account the pre and post implementation years of artificial intelligence, it is heartening to note that the serendipity of the banks have changed due to espousing artificial intelligence. As evident from the results of Kruskal Wallis or H-Test in this regard that banks have been benefitted massively post implementation of artificial intelligence.

Conclusion

Artificial Intelligence has gained strong footholds in the Indian banking sector and is playing a crucial role in creating ease of banking as well as enhancing the efficiency of banking operations. Further it also assist in expediting document management with OCR, classification and extraction; improvement in compliance and regulatory oversight; automation in decision making with respect to underwriting and credit analysis; management of STP (Straight-Through Processing) exceptions and other work drivers by projecting upstream and avoiding downstream and improvement in customer experience with personalised services and recommendations .

Thus, artificial intelligence has become an indispensable component of banking system. As ESTEMPLE (E-Economic, S-Social, T-Technological, E-Ecological, M-Media, P-Political, L-Legal and E-Ethical) factors exert a robust influence on the business environment and most of them are in constant flux, it becomes mandatory for business organisations to assimilate latest technologies meeting the business needs. In view of this, banks being the backbone of any economy and financial powerhouse also needs to update their technologies to serve the customers in best possible way as well as strengthening management control systems.

However, the banks also needs to focus on the challenges pertaining to artificial intelligence that is data privacy and security, ethical considerations, regulatory compliance and cybersecurity risks.

Limitations and Scope for future research

A) Limitations of the research study

1) This research study is based on secondary data.

2) Due to technical constraints other public and private sector commercial banks could not be studied.

3) Financial performance of the banks considered for the research study have not been gauged on other yardsticks like Return on Capital Employed, Earnings before Interest and Tax (EBIT), Earnings Per Share (EPS), Non-Performing Assets (NPAs) etc.

B. Scope for future research

1) Impact of artificial intelligence on CAMELS (Capital Adequacy, Asset Quality, Management, Earnings, Liquidity and Sensitivity) of Indian commercial banks may be studied.

2) Impact of artificial intelligence on the overall efficiency of Payment Banks and Small Finance Banks may be undertaken.

References

- https://www.ey.com/en_be/digital-transformation/how-ai-can-drive-productivity-and-value-in-the-financial-sector

- https://cloud.google.com/discover/finance-ai

- https://www.intel.com/content/www/us/en/financial-services-it/fintech/ai-in-financial-services.html

- https://www.oecdilibrary.org/sites/39b6299aen/index.html?itemId=/content/component/39b6299a-en

- Mehdiabadi, A., Shahabi, V., Shamsinejad, S., Amiri, M., Spulbar, C., Birau, R. (2022) Investigating Industry 5.0 and Its Impact on the Banking Industry: Requirements, Approaches and Communications, Applied Sciences, 12(10):5126. https://doi.org/10.3390/app12105126.

- Mhlanga, D. (2020) Industry 4.0 in Finance: The Impact of Artificial Intelligence (AI) on Digital Financial Inclusion International Journal of Financial Studies, 8(3):45. https://doi.org/10.3390/ijfs8030045.

- Noreen, U., Shafique, A., Ahmed, Z., Ashfaq, M. (2023) Banking 4.0: Artificial Intelligence (AI) in Banking Industry & Consumer's Perspective. Sustainability, 15(4):3682. https://doi.org/10.3390/su15043682.

- https://inc42.com/features/how-artificial-intelligence-algorithms-are-changing-indias-bankingindustry/#:~:text=AI%20In%20Banking%3A%20Definition%20And%20Use%2DCases&text=Since%202016%2C%20many%20traditional%20banks,banking%20solution%20to%20their%20customers.

- https://www.forbesindia.com/article/explainers/top-10-banks-india-by-market-cap/87913/1

- https://www.moneycontrol.com/stocks/company_info/print_main.php (State bank of India)

- https://www.moneycontrol.com/stocks/company_info/print_main.php (PNB)

- https://www.moneycontrol.com/stocks/company_info/print_main.php (HDFC Bank)

- https://www.moneycontrol.com/stocks/company_info/print_main.php (ICICI Bank)

- Singh, T., Pathak, N. (2020b) Emerging Role Of Artificial Intelligence In Indian Banking Sector, Journal Of Critical Reviews, ISSN-2394-5125, 7(16), 1370- 1373.

- https://www.researchgate.net/publication/368848498_Impact_of_Artificial_Intelligence_in_Banking_Sector_with_Reference_to_Private_Banks_in_India

- https://indiaai.gov.in/article/ai-is-changing-the-face-of-digital-banking-in-india

- https://www.mdim.ac.in/wp-backend/wp-content/uploads/2022/03/Suma%20S.R.,%20Anupama%20S_Page%2050-58.pdf

- https://hexaware.com/blogs/ai-in-banking-6-benefits-that-will-make-you-exclaim-bank-onit/#:~:text=Using%20AI%2C%20banks%20can%20ensure,to%20take%20corrective%20action%20quickly.

- https://www.linkedin.com/pulse/impact-artificial-intelligence-banking-opportunities-challenges#:~:text=monitoring%20market%20trends.-,Challenges%20of%20AI%20in%20Banking,and%20protecting%20customers'%20confidential%20information.

Predicting Financial Distress of Maharatna Companies: An Empirical Analysis

Anusree Bose

Assistant Professor, Dept. of Engg. Science & Humanities Academy of Technology, Adisaptagram

Abhijit Biswas

Faculty, Globsyn Business School, Kolkata

Abstract

The contribution of Central Public Sector Enterprises (CPSEs) towards the upgradation of the Indian economy can never be disregarded. Public sector enterprises or undertakings are the pivot of Indian economy since the hour of freedom.

But due to the reception of the LPG model of new monetary strategy in 1991, the Public Undertakings have been exposed to competition from homegrown as well as worldwide organizations. In this scenery the current review is fundamentally engaged to examine the situation of Indian Maharatna Organizations as far as their well-being, more explicitly enquiring the monetary strength of the organizations.

This review applied the Altman, and Zmijewski Model to investigate the monetary soundness of the organizations. Further to recognize the particular element influencing the strength of the organizations correlation analysis has been applied here.

Keywords: *Financial Distress Analysis Altman Z score; Zmijewski Model; Pearson Correlation, Independent t-test.*

Introduction

Since public enterprises (PEs) make up a vibrant and diverse industrial base in India, their importance to the country's economy cannot be understated (Sur & Chakraborty, 2015).

There were just five PSUs owned by the government in 1951, but once the Industrial (Development and Regulation) Act was passed in 1952, the government began to concentrate on promoting industrialization.

For this reason, in order to fulfil Nehru's national industrialization program, the expansion of public sector firms was prioritized in both India's second five-year plan (1956–60) and Industrial program Resolution (1956), successively the number of PSUs reached to 365 by March 2021.

PSUs fall into one of three formal categories:

- Central Public Sector Enterprises (CPSE)
- Public Sector Banks (PSB)
- State Level PublicEnterprises (SLPE)

Depending on their financial performance and progress, CPSEs are granted the status of Maharatna, Navaratna, and Miniratna (Category I and II) ("Public sector undertakings", 2023). The criteria for awarding the Ratna status to CPSEs are mentioned in Table 1.

In order to provide these PSUs more financial sovereignty and the ability to grow their businesses as global giant, the government established the Maharatna Category in 2009.

The term "Maharatna" means "a great jewel" in Hindi (Gahlot, 2019). Currently there are 13 CPSEs which have been regarded as "Maharatna Companies", the list of those companies are mentioned in Table 2.

Table 1

Category	Eligibility
Maharatna	Three years with an average annual net profit of over ₹2,500 crores, OR The average annual Net worth of ₹10,000 crores for 3 years, OR Average Annual Turnover of ₹20,000 crores for 3 years (against Rs 25,000 crore prescribed earlier) Must be listed on Indian stock exchange with minimum prescribed public shareholding under Securities and Exchange Board of India (SEBI) regulations
Navaratna	A score of 60 (out of 100), based on six parameters which include net profit, net worth, total manpower cost, the total cost of production, cost of services, PBDIT (Profit Before Depreciation, Interest, and Taxes), capital employed, etc., AND A PSU must first be a Miniratna and have 4 independent directors on its board before it can be made a Navratna.
Miniratna Category-I	Have made profits continuously for the last three years or earned a net profit of ₹30 crores or more in one of the three years
Miniratna Category-II	Have made profits continuously for the last three years and should have a positive net worth.

(Source: Wikipedia contributors. 2023. "Public sector undertakings" Last Modified)

Table 2

Company Name	Industry
Bharat Heavy Electricals Limited (BHEL)	Energy and infrastructure sectors
Bharat Petroleum Corporation Limited (BPCL)	Petroleum and Natural Gas
Coal India Limited (CIL)	Coal mining
Gas Authority of India Limited (GAIL)	Petroleum and Natural Gas
Hindustan Petroleum Corporation Limited (HPCL)	Petroleum and Natural Gas
Indian Oil Corporation Limited (IOCL)	Petroleum and Natural Gas
National Thermal Power Corporation (NTPC)	Energy and infrastructure sectors
Oil and natural gas corporation (ONGC)	Petroleum and Natural Gas
Power Grid Corporation of India (PGCIL)	Power sector
Steel Authority of India Limited (SAIL)	Manufacturing Sector
Rural Electrification Corporation Limited (RECL)	Power-Infrastructure sector
Power Finance Corporation (PFC)	Finance Sector
Oil India Limited (OIL)	Petroleum and Natural Gas

(Source: Wikipedia contributors. 2023. "Public sector undertakings" Last Modified)

Due to the rapidly changing economic scenario the industry's businesses compete fiercely with one another and affects their performance. With the economy's liberalization in 1991, the Indian government's policies for public sector firms underwent a paradigm shift. The government-guaranteed monopoly was lost by the businesses. This change in public sector policy brought about a number of changes, including the transition from a controlled to a market economy, complete government ownership to disinvestment, unlimited life to the threat of liquidation, creation of jobs to manpower rationalization, liberal budget support to removal of support, departmental boards to independent boards (Bose & Basu, 2020). That is why it become very crucial to monitor all the factors affecting company's financial condition to prevent the bankruptcy. But before facing this stage a company has to deal with financial distress. Financial distress is a situation where a company is unable to pay its outstanding current liabilities, which ultimately leads towards bankruptcy, if it is not controlled (Rahayuningtyas & Yanti,

2023). Several empirical investigations have been carried out to gauge a company's financial difficulty. The application of variety of models to assess a company's level of financial difficulty has also been investigated. Based on numerous research studies, the most significant financial distress prediction models are developed by Edward Altman and William Beaver (Beaver, 1968 and Altman, 1968). Beaver employed univariate analysis to forecast the companies' financial distress, whereas, Prof. Altman utilized a multivariate approach for the same (Maji & Sur, 2015). In addition to these models, experts in the past have employed a variety of models to forecast a company's financial situation. The Zmijewski Model, the Springate Model, and Ohlson, Fulmer, CA-Score, and other models. But among all of these models it has been discovered that Alatman Z- Score is the most accurate one (Primasari, 2017). In this backdrop present study is focused to assess the Maharatna firms' financial soundness in order to provide investors with a better understanding of the financial standing of the business.

Literature Review

The growth of Indian economy is deeply rooted with the contribution of CPSEs over the year. But after liberalisation this sector faced a steep competition from domestic as well as from global market (Sur & Chakraborty, 2015). Existing literatures state that during 2020 out of the ten Maharatna businesses, six—SAIL, IOCL, NTPC, BPCL, HPCL, and PGCIL—have a low liquidity position, while just two—BHEL and CIL—have a fairly favourable short-term solvency level. As for GAIL, its liquidity status is mediocre. Conversely, relating to solvency the performance of all the companies except SAIL & BHEL are in favourable situation. On top of that study indicate that three companies—SAIL, NTPC, and PGCIL—are mostly not in danger zone, while CIL, BPCL, and HPCL are in a safe zone. And the others—ONGC, IOCL, GAIL, and BHEL—are in the grey area (Bose & Basu, 2020). Even other study has also claimed that SAIL is in a financial hardship state and has been in the bankruptcy zone constantly from 2013–14 to 2018–19 (Anjum & Pervej, 2020) due to low liquidity positions, ineffective inventory management and ineffective accounts receivable management (Bhunia, 2007). Like SAIL, researcher found that NTPC is also in a state of crisis (Pardeshi & Thorat, 2015). Again, it has also been noticed that though the financial condition of ONGC during 2006 to 2014 the position strong enough in terms of liquidity, solvency, operating efficiency and profitability to play a dominant role in Indian oil exploration sector (Maji & Sur, 2015), but 2020 it was found that ONGC belong from grey zone as per Altman Z-score model (Bose & Basu, 2020). In its preview present study is mainly focused to analyse the financial health of the Mahartna sector of Indian Economy.

Objectives

- To measure the financial health of the company by using financial distress detection tools.

- To identify the Correlation between Explanatory Variables with Z Scores & X Scores.

Research Methodology

Data Source

The panel dataset of Maharatna Companies from the period of 2014 to 2023 were collected from the secondary data sources i.e., published financial reports of the companies and moneycontrol. com.

Measuring Financial Distress

Based on the existing literatures Altman Z-score model and Zmijewski Score Model were applied here to access the financial distress of the companies (Primasari, 2017). Altman (1968) employed a step-wise multivariate discriminant analysis (MDA) model, which is like logistic regression where the dependent variable is a qualitative element.

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

Where,

X_1 = Working Capital/ Total Asset

X_2 = Retained Earnings/ Total Asset

X_3 = EBIT/ Total Asset

X_4 = Market value of Equity/ Total Liabilities

X_5 = Sales/ Total Asset

Cutoff Criteria:

Score	Zone
Z-Score> 2.67	Green
2.67>Z- Score>1.81	Grey
Z-Score< 1.81	Red

On other side, Zmijewski developed a new model in 1984 to predict the bankruptcy by emphasising on firm's performance, liquidity and leverage. The ratios used in this model are determined by probit analysis-

$$X = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3$$

Where,

X_1 = Return on Asset

X_2 = Debt ratio

X_3 = Current ratio

According to Zmijewski (1984), Scores less than 0.5 potrays a higher probability of default.

Independent T-test statistic has been conducted at 5% level of significance to observe the significant difference if any, between the Z-score & X-score.
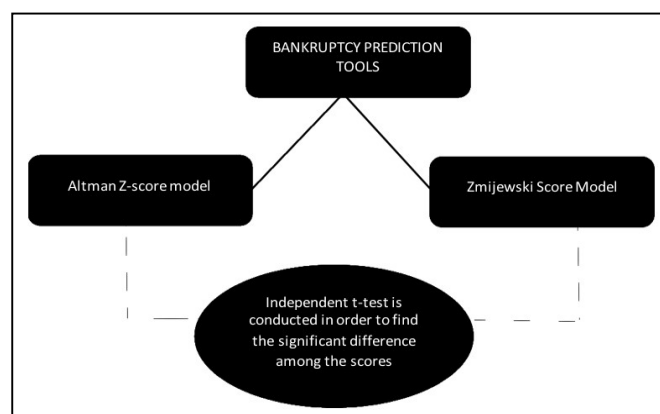
Measuring Financial Distress Scores and Explanatory Variables:

To identify the Correlation between Explanatory Variables with Z Scores & X Scores Pearson corelation has been applied in this study

Analysis & Discussions:

Table 1.1: Altman Z-Score values of Maharatna Companies

Co. Name	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	Avg.	Zone
BHEL	1.16	3.69	0.91	1.17	1.52	1.62	1.68	1.5	1.71	1.85	1.68	RED
BPCL	3.7	3.45	3.01	2.86	3.63	3.5	3.35	3.76	4.38	4.4	3.52	GREEN
CIL	3.08	2.63	2.15	2.76	2.7	2.4	3.47	3.66	3.35	3.21	2.91	GREEN
GAIL	2.46	2.46	1.88	2.26	2.55	2.13	2.05	1.91	2.04	2.24	2.2	GREY
HPCL	2.77	2.85	2.62	2.72	3.36	3.38	3.26	3.45	3.81	3.44	3.16	GREEN
IOCL	2.57	2.45	2.12	2.11	2.51	2.55	2.41	2.54	2.56	2.28	2.41	GREY
NTPC	1.13	0.98	0.89	0.91	0.89	0.96	1.00	1.03	1.13	1.39	1.03	RED
ONGC	1.97	1.69	1.23	1.45	1.65	1.42	1.73	1.85	1.84	1.96	1.68	RED
PGCIL	0.84	0.73	0.7	0.58	0.53	0.53	0.52	0.47	0.45	0.48	0.58	RED
SAIL	1.35	1.86	1.16	0.97	1.01	0.75	0.53	0.54	1.1	1.23	1.05	RED
RECL	1.12	1.24	1.18	1.18	1.44	1.52	0.49	0.48	0.38	0.39	0.94	RED
PFC	0.58	1.3	1.28	1.24	1.23	1.49	0.41	0.47	0.42	0.44	0.89	RED
OIL	1.91	1.47	0.94	1.33	1.51	1.49	1.55	1.79	1.76	1.66	1.54	RED

Source : Authors' own tabulation

Based on the computed Altman Z-Score, it can be observed that three of the 13 maharatna companies—BPCL, CIL and HPCL—belong in the safe zone, based on the Altman Z-Score model. The financial success of these three companies is fairly good, as seen by the fact that their Z-Scores for the last ten years have all been more than 1.81.

Of these three, BPCL has performed the best, with the highest Z-Score in almost each instance. On the other side, though it has been observed in previous literature that up to 2020, four out of ten maharatna companies, namely, BHEL, GAIL, IOCL & ONGC belong from the grey zone (Bose & Basu, 2020), but as per present analysis it can be clearly observed that only two companies belong from grey zone i.e., IOCL & GAIL, with average Z-Score values of 2.22 & 2.41. Though BHEL & ONGC were in the grey area until 2020 (Bose & Basu, 2020).

But as of right now, they headed into the red zone. So it must be taken into account that although IOCL & GAIL are not currently in danger, however they need to enhance their financial standing. Even the remaining maharatna companies i.e., NTPC, PGCIL, SAIL, RECL, PFC and OIL, are now considered to be in risk because their Z-Score is less than 1.21, which can be refer to them as ill company. The Z-Score value of PGCIL is the lowest among these sick companies, indicating that it has the highest risk among all maharatna companies to get bankrupt.

Table 1.2: Zmijewski Score values of Maharatna Companies

Co. Name	2023	2022	2021	2020	2019	2018	2017	2016	2015	2014	Avg.	Zone
BHEL	-6.49	-6.52	18.64	7.65	-12.26	-9.97	-7.9	0.56	-13.62	-25.22	-5.52	Sound
BPCL	-5.59	-27.75	-63.01	-7.29	-27.81	-36.31	-39.54	-45.46	-34.15	-23.63	-31.05	Sound
CIL	- 286.52	- 226.97	-155.33	- 229.29	-249.97	- 229.02	- 348.28	-352.37	-275.14	-273.06	- 262.59	Sound
GAIL	-27.62	-57.68	-33.63	-47.09	-46.27	-39.97	-32.33	-22.71	-28.54	-41.82	-37.76	Sound
HPCL	35.08	-17.04	-34.23	-7.12	-25.38	-32.57	-35.11	-24.46	-16.44	-2.20	-15.95	Sound
IOCL	-7.54	-27.51	-28.73	0.65	-23.99	-7.54	-27.51	-28.73	0.65	-23.99	-17.42	Sound
NTPC	-16.93	-17.15	-14.48	-10.13	-15.26	-15.73	-16.20	-21.39	-22.32	-27.64	-17.72	Sound
ONGC	-51.70	-57.91	-19.79	-24.29	-43.41	-34.34	-36.78	-37.02	-42.59	-54.16	-40.20	Sound
PGCIL	- 23.5727	- 25.2189	-14.6926	- 11.0828	-9.38448	- 8.7326	- 8.78952	- 5.8436	- 4.92244	- 5.62488	- 11.7865	Distress
SAIL	-8.22	-48.72	-14.39	-4.20	-6.51	4.31	13.78	18.49	-10.05	-13.83	-6.93	Sound
RECL	23.04	22.38	30.16	35.85	27.54	23.38	7.88	12.35	13.05	12.99	20.86	Distress
PFC	14.95	15.72	22.26	27.82	25.51	25.02	19.71	16.56	17.23	16.31	20.11	Distress
OIL	- 59.0485	-37.1823	-16.3638	- 29.3899	-27.3486	- 30.0504	- 17.8922	- 28.6313	- 33.2319	- 40.0568	- 31.9196	Sound

Source : Authors' own tabulation

According to the calculated X-Score of Zmijewski model, it can be clearly observed that out of total 13 Maharatna companies only 3 companies namely, PGCIL, RECL & PFC belong from distress category, whereas as per study the rest are in sound position. The position of RECL is worst among the distress companies according to this model.

Though as per Altman Z-score out of 13 companies 8 companies belong from red zone, still X-score revels that only 3 out of 13 belongs from the distress zone. The primary cases where the disparity is noticeable include BHEL, NTPC, ONGC, and OIL. Taking this into account, the study uses the Independent T-test to determine if there is a difference between the Z- and X- scores.

H0: There is no significant difference between Z-scores and X-scores

H1: There is a significant difference between Z- scores and X-scores

	z score	*x score*
Mean	1.815062077	-33.68347244
Variance	0.906456364	5096.680217
Observations	13	13
Hypothesized Mean Difference	0	
df	12	
t Stat	**1.792667691**	
P(T<=t) one-tail	0.049125643	
t Critical one-tail	1.782287556	
P(T<=t) two-tail	0.098251287	
t Critical two-tail	2.17881283	

Source : Authors' own tabulation

To investigate whether there is a significant difference between the Z- and X- scores, an independent sample t-test has been applied here. As per the outcome the null hypothesis has been accepted against the alternate one at the 0.05% level of significance based on the t-statistic value of 1.79, which reveals there is no such significant difference.

Table 1.3: Analysis of the Correlation between Z Scores and Explanatory Variables

Correlation between Z Scores and Explanatory Variables	**WC/TA & Z**	**RE/TA & Z**	**EBIT/TA & Z**	**MVE/TL & Z**	**S/TA & Z**
	-0.12	**0.16***	**0.39***	**0.22****	**0.75***

Source : Authors' own tabulation

*Statistically significant at 1% level | ** Statistically significant at 5% level |*** Statistically significant at 10% level

In Table 1.3, an effort was made to explore the association between the Z scores and the predictors used in this model.

The accompanying Table points out that a low degree of negative correlation was found between Z-score and working capital to total asset ratio, though this relationship was not statistically significant even at any level of significance.

But a very low degree of positive relationship can be observed between RE/TA and Z score, which is statistically significant at 10% level of significance. Again, A low to moderate degree of positive association of Z- score can be identified with BEP Ratio & MVE to Total Liabilities Ratio, which are also statistically significant at 1% and 5% level of significance respectively. Interestingly, the evidence showed a very strong and statistically significant positive association between Sales/TA & Z-score. Hence, it signifies that the greater the asset turnover ratio and basic earning power ratio, the higher will be the Z-Score, which leads the company towards the Green Zone.

Table 1.4: Zmijewski Score values of Maharatna Companies

Correlation between X Scores and Explanatory Variables	CR & X	ROTA & X	DER & X
	0.0085	-0.9871[*]	0.3999[*]

Source : Authors' own tabulation

*Statistically significant at 1% level | ** Statistically significant at 5% level |*** Statistically significant at 10% level

An attempt was made to look into the connection between the explanatory factors and the X scores in Table 1.4. The result shows that the relationship between the X-score and Return on Total Assets is highly significant and negative. It says that a higher ROTA will result in a lower X-score, which eventually moves the company in the favourable direction. On the other hand, there is a highly significant and moderately strong correlation between DER and X-Score, indicating that a greater Debt Equity Ratio corresponds to a higher X-score, which finally directs the company towards a disaster zone.

Conclusion

According to both models, even though these PSUs have the glitzy Maharatna title, some of these businesses are not in a good financial situation. Eight of the thirteen companies—BHEL, ONGC, NTPC, PGCIL, SAIL, RECL, PFC, and OIL—are projected to go insolvent in the next two years, according to the Altman model. However, according to the Zmijewski model's X-Score, just three companies—PGCIL, RECL, and PFC—fall into the distressed category. According to the correlation, to save themselves from going bankrupt, businesses should concentrate on improving their asset turnover ratio, basic earning power ratio, and return on total asset ratio. Companies should concentrate on reducing the debt-to-equity ratio at the same time. These safety measures can protect the business from facing financial distress, which ultimately enrich the market economy.

References

- Agarwal,V and Taffier, R (2007), Comparing the performance of market based and accounting based bankruptcy prediction models, available at:http://ssrn.com/abstract=968252.

- Bemmann, Martin, Improving the Comparability of Insolvency Predictions (2005). Dresden Economics Discussion Paper Series No. 08/2005. Available at SSRN:http://ssrn.com/abstract=731644

- Chiung-Ying Lee and Chia-Hua Chang (2010), Application of company financial crisis early warning model –Use of Financial Reference Database, International Journal of Business and Economic Sciences, 2(1), 40-45

- Chakraborty K. (2014). Linkage between Efficiency of Assets Management and Profitability during the Post- liberalisation Era: A Study on Select Companies of Indian Public Sector. J. Inst. Public Enterp, 37(3-4):1-17

- Datt R, Sundharam KPM (2002). Indian Economy, Mittal Publications, New Delhi pp. 99-127

- Goswami, D.,& Hazarika, p."Stages and Symptoms of Industrial Sickness- A Mathematical Model Applied to a Few Small Scale Industrial Units in NE Indian State of Assam", ISBN: 978-1-61804-098-5

- Gupta S, Jain PK, Yadav SS, Gupta VK (2011). Financial performance of Disinvested

Central Public Sector Enterprises in India: An Empirical Study on Select Dimensions. J. Appl. Fin. Bank. 1(4):57-106.

● Hui, H and Jhao, Jing- Jing (2008), Relationship between corporate governance and financial distress: An empirical analysis of the distressed companies in China, International Journal of Management, 25 32-28

● Jones, F.L (1987), Current techniques in bankruptcy prediction, Journal of Accounting Literature, 6 131-164

● Khan AQ (1990). Efficiency Profile of Public Enterprises in India, Vohra Publishers and Distributors, Allahabad pp. 30-43

● K.Srinivas and V.Apparao: "Sickness causes in cooperative sugar factories in Andhra Pradesh - a case study" www. elixirpublishers.com (Elixir International Journal), K.Srinivas et al./ Elixir Mgmt. Arts 43 (2012) 7033-7039 Mallik AK, Sur D (2004). Financial Performance of Indian Enterprises in the Post-Liberalisation Era : A Case Study of National Thermal Power Corporation Limited. Res. Bull. 25:59-69.

● Maitlo, M. G. "Sickness in Small-Scale Industries of Sindh: Causes & Remedies". A Case Study of Larkana Estate Area, Australian Journal of Basic and Applied Sciences, 1(4): 860-865, 2007, ISSN 1991-8178.

● Pursell,G. Industrial Sickness, Primary and Secondary: "The Effects of Exit Constraints on Industrial Performance", The World Bank Economic Review, Vol. 4, No. 1 (Jan., 1990), pp. 103-114, Oxford University Press Sur D, Panja R (2014). Profitability Trends in NTPC Ltd. during the Pre- and Post- liberalisation Periods: A Comparative Study. J. Inst. Public Enterp. 37(1&2):78-90.

● Sur D, Yadav SK (2014). Trends in Asset Management Efficiency in Maharatna Central Public Sector Enterprises: A Cross-Sectional Analysis. J. Inst. Public Enterp. 37(3 & 4):78-90.

● V.K. Joshi, "Management of Industrial Sickness" (Jaipur, 1987).pp.57-59

Innovative Economic Strategies for Financial Inclusion

Dr. Rupak Gupta

Globsyn Business School, Kolkata

Dr. Biswa Ranjan Mohanty & Dr. Gobinda Chandra Panda

Biju Patnaik Institute of Information Technology and Management Studies, Bhubaneswar

Abstract

''Financial inclusion'' describes the policy of providing equal access to banking and financial services for all residents of a community. The primary purpose of the initiative is to ensure that everyone, regardless of financial means, has access to basic financial services. The primary objective of financial inclusion is to guarantee low-income people have access to safe and sound financial services. At the Pittsburgh Summit in September 2009, G20 leaders committed to increasing poor people's access to financial services by facilitating the safe introduction of new approaches to reaching the unbanked with financial products and services. Roughly two billion adults worldwide have no access to formal financial services. They are the unbanked in a society where financial institutions are essential for survival. New methods for reaching low-income households with banking products have the potential to have a profound impact. Increasing people's access to credit, even if just enough to buy a sewing machine and launch a microbusiness, is known to have a major effect on economic growth. Low-income individuals can better raise or stabilize their income, build assets, and weather economic shocks if they have access to a wider variety of financial services. Having access to affordable insurance, domestic and international payment and money transfer services, domestic and international money transfer services, savings and credit products is essential. One billion people with mobile phones worldwide do not have access to formal financial services. With the continuing decline in the cost of connected devices, now is the time to employ technology to address financial discrimination. Technological progress has allowed banks to extend their clientele by providing more and better services to low-income people at cheaper prices.

Keywords: *Financial Inclusion, Economically Unprivileged Section, Financial Services, Technological Innovation.*

Introduction

What is financial inclusion?

Those who were previously excluded from the financial system are said to have been ''included'' when they have access to suitable financial services.

After the global financial crisis and economic depression, the G20 summits' main focus has been on restoring trust among economic actors, especially consumers, and restoring financial stability. The Pittsburgh Summit in September 2009 established the Financial Inclusion Experts Group (FIEG) and two subgroups on Small and Medium-sized Enterprise Finance and Access through Innovation to recognize the mutually reinforcing policy objectives of financial stability, financial inclusion, and consumer protection. G20 leaders have promised to expand the availability of financial services for the disadvantaged by promoting the safe spread of innovative delivery mechanisms. Nearly 90% of the world's population — more than two billion people — lives in Africa, Latin America, Asia, or the Middle East, where they lack access to formal or even semi-formal financial services. The Group of Twenty (G20) has committed to fixing this issue. The majority of people recognize

that expanding people's access to microfinance can greatly enhance their standard of living. More and more people are realizing that providing access to savings products, payment services (both domestically and internationally through remittances), and insurance (including microinsurance aimed at the needs of the poor) greatly improves the poor's ability to increase or stabilize their income, build assets, and become more resilient to economic shocks.

The availability of financial services for low-income persons is hampered by both regulatory restrictions (such as the requirement to provide identification documents) and product design flaws (such as minimum account balances). Organizations trying to develop services for people with low incomes typically encounter challenges such as the high cost of providing these services and the lack of regulatory room for innovation. The fees associated with a transaction have no correlation to the magnitude of the transaction. As a result, the low-value services provided to the poor by conventional retail banking and insurance cannot be maintained.

The Access Through Innovation Sub Group (ATISG) is interested in hearing from you if you have a creative proposal to increase people's access to financial services. One of the primary motivators of technological advancement is the possibility that technology may one day allow for the widespread availability of low-cost, long-term financial services.

The number of people with access to mobile devices is rapidly approaching three billion. As a result, the cost of various forms of media and information transfer has dropped significantly. Once in a generation, we have the chance to harness cutting-edge technology to end economic exclusion. Resources that were once unaffordable are now within reach due to technological advancements. Financial service providers can now access previously inaccessible demographics as a result of

technology developments. Policy and regulation in the financial sector are crucial for making the most of technology to increase access to financial services.

There has been a rise in support for ground-breaking legislative and regulatory reforms that pave the way for financial inclusion and the creative delivery of traditional financial services that goes along with it.

As a result, there are more convenient banking solutions available. Lack of practical competence with legislation, regulation, and oversight is a barrier to providing innovative financial services to the poor and excluded.

The private sector has historically been more innovative than government agencies. Governments must therefore devise policy and regulatory responses that are flexible enough to account for new developments and competing interests.

The G20 FIEG SubGroup on Access through innovation has investigated different legislative and regulatory frameworks with the intention of (i) lowering barriers to entry for high-quality, low-cost financial services that meet the needs of a diverse set of customers.

Why is inclusion important?

1. To smooth Income Trend.

2. To obtain financing to grow business.

3. To protect against natural and man-made disaster.

4. To save for family celebration and other life events (Births, Weddings and funerals

Why are they excluded?

1. Inadequate education

2. No valid identification

3. Geographic Challenges

4. Financial Product Too Expensive

5. No Credit History

Who are the financially excluded?

World's population =7.6b

Unbanked individuals = 1.6b

200+ million micro, small and medium enterprises without access to banking services.

Where are the financially excluded?

Developing countries are home to the vast majority of financially excluded MSMEs. More than 40% of micro, small, and medium-sized enterprises (MSMEs) in Least Developed Countries (LDCs) reported difficulties in securing finance, compared to 30% in Middle-Income Countries (MICs) and 15% in High-.

Figure 1. Seventy-five percent of the financially excluded individuals reside within 25 countries

Dark Coloured: Percentage of financially excluded individuals globally

The opportunity How much?

By catering to the needs of the underbanked and micro, small, and medium-sized enterprises (MSMEs) in 60 developing countries, EY predicts that banks could increase their annual income by US$200 billion. This is equal to twenty percent of EM banks' 2016 income.

Reducing the credit value gap (CVG) for MSMEs might provide US$176b in revenues, while effective inclusion of individuals could yield US$24b.

Figure 2. Potentially US$200b in additional annual revenue for banks in 60 Ems
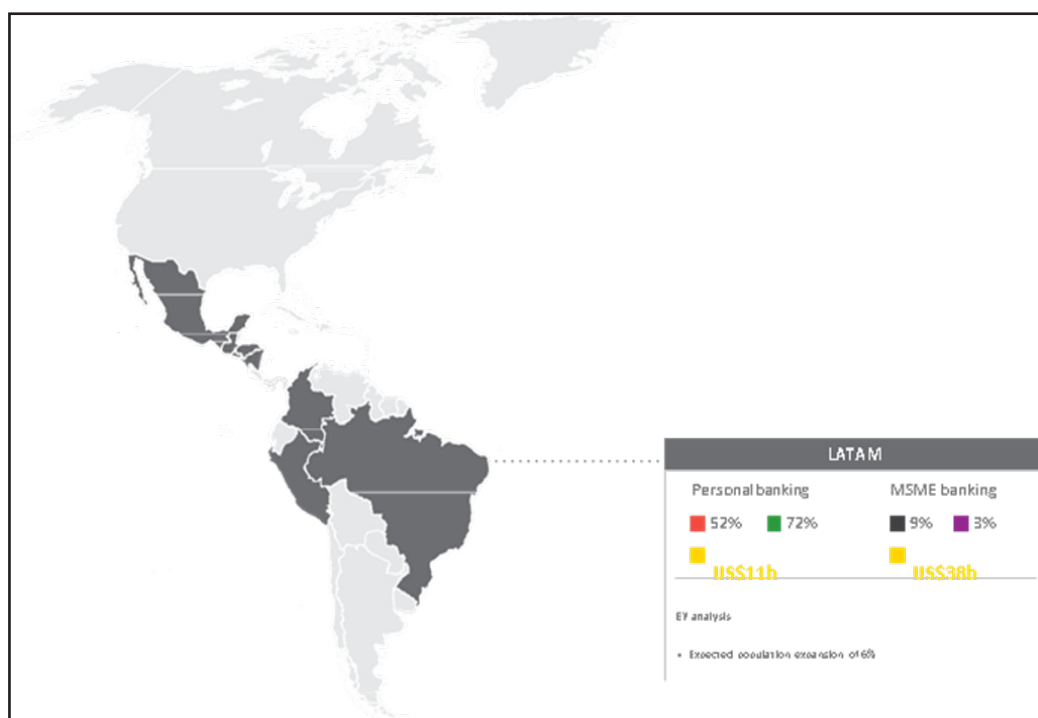
Technology and infrastructure drivers

High levels of mobile adoption and e-payments

As the cost of mobile devices decreases and network coverage increases, more low- and middle-income businesses (MSMEs) will be able to connect to the internet. The meteoric expansion of m-Pesa has dramatically increased the number of Kenyans who have access to even the most fundamental forms of electronic payment systems, as has been extensively noted. People in low-income neighborhoods may be more likely to use financial services if broad mobile phone use and government attempts to digitize payments (such as G2P direct cash support programs) are combined. One-third of Brazilians receive financial aid through the Bolsa Famlia program; this assistance is delivered digitally to a card or bank account.

National digital identity (ID) systems

Several nations are beginning to investigate the feasibility of implementing national biometric identification systems. For instance, the Aadhaar system in India enables instantaneous identity verification by fingerprint scanning, iris scanning, and digital face printing. Aadhaar paves the way for the electronic transfer of a variety of governmental subsidies and unemployment payments, among others. Biometric ID programs could be used by banks to verify consumers at ATMs and service counters, hence increasing the number of people who have access to banking services.

Credit data infrastructure

One of the biggest obstacles to getting loans for people who aren't part of the financial system is a lack of data. Some nations have established MSME credit registries to centralize and make easily accessible trustworthy and transparent data that can be used by potential lenders to expedite loan applications. These registries could help financial institutions who want to increase lending to underserved groups deal with information asymmetry and lower their cost of service.

Open access to digital data

Through innovative use of new data sources like social media profiles, financial inclusion can be realized through in-depth assessments of user behavior. Open application programming interfaces (APIs) allow financial institutions to collaborate with FinTechs, governments, and external partners on innovative mobile applications and digital payment solutions. The cost of acquiring new customers can be reduced and the number of people who have access to financial services can grow if businesses work together. Banking apps may considerably benefit from open access to digital data, as shown by the Digital India service, particularly in the areas of security, authentication, e-signature capabilities, and unified payment interfaces.

Currency digitization

The increased transparency of virtual currency transactions might significantly cut down on counterfeiting and other forms of fraud. India is apparently considering releasing its own crypto currency, Lakshmi, after the Bank for International Settlements issued a letter in September 2017 encouraging central banks to consider issuing digital currencies. There needs to be strict regulation, including a tie to fiat money, for digital currencies to reduce transaction costs and boost financial inclusion, and banks need to come up with creative solutions if they want to stay relevant. We anticipate that MSMEs will look for standardized and easier mechanisms to identify and authenticate themselves with a variety of parties as new technological infrastructure progressively facilitates the secure sharing of up-to-date consumer information. Ideas like the Digital Passport, a decentralized mechanism for trusted and secure customer information exchange across multiple providers, would streamline the Know Your Customer (KYC) and onboarding processes that are essential to establishing trust with new customers and retaining existing ones.

Innovation in financial inclusion Policy and systemic drivers

Consumer protections that stand up to aggression and predation in sales and collection techniques are essential, especially for the poor. Building trust in banks and encouraging more financial inclusion may be as simple as enacting and enforcing tough consumer protection rules that emphasize robust transparency and disclosure, financial integrity, and effective redress procedures for grievances. This easily digestible lingo.

Responsible financial literacy programs

If people at the individual and small business levels have access to basic financial education, they will be better able to manage their finances and maximize their potential. As an example of the growing trend of government-initiated financial literacy programs, the Bangko Sentral ng Pilipinas, the Philippines' central bank, has recently formed a specialized advocacy section to handle all inclusion efforts and enhance financial education in the country. Institutions of finance may decide to implement customer loyalty programs.

Bankruptcy regimes

Countries that have regulations in place to supervise the liquidation of insolvent enterprises, protect creditor rights, and allow the fair resolution of claims are leading the way toward financial inclusion. The purpose of insolvency laws is to safeguard creditors and boost the confidence of creditors in financing to SMEs.

Recognizing the potential negative effects of excessive regulation on the banking sector, numerous governments have attempted to reduce the number of specific rules. While governments in countries like Brazil, Peru, Colombia, and Mexico have taken measures to make it simpler for consumers with low balances to confirm their identities and use pressman agents, the Reserve Bank of India has

relaxed restrictions for opening a basic bank account. Government loan guarantees are a good source of funding for small and medium-sized enterprises (SMEs).

Money supply growth without the need for collateral. secured-free loans of up to US$307,000 (INR 200,000) are available through the "Credit Guarantee Fund Scheme'' in India. Similar guarantees shield banks against implicit default risks posed by small and medium-sized enterprises. Numerous financial ecosystems, such as the expanded provision of financial services by NGOs, e-commerce enterprises, FinTechs, merchants, and telecoms corporations, all have a direct impact on the expanding fiscal addition. For this reason, it is essential to foster a robust incipiency community that can access a variety of funding sources. With a total of US$2.9 t processed by the two major Chinese online payment systems in 2016 alone (Alibaba's Alipay and Tencent's Wechat Pay), the value of China's e-payments has increased by a factor of 20 in only four years. Digital finance helps improve deal revenues and access to cash for small merchants, while platforms like Alibaba's Yu'e Bao make financial investments more accessible to lower-income populations. Both are helpful in increasing fiscal contributions to EMs like China. Interoperable monetary systems facilitate the distribution and sale of illicit goods across several internet platforms. Modelo Peru, an interoperable mobile payment platform that enables foreigners to make payments across cell networks and financial institutions, was developed by the Peruvian government, the Peruvian financial sector, and four major telecoms providers in 2016. The utility of lightweight duffel bags is improved.

given by issuers of electronic money and promoting more modest price increases. Together, these five pillars form the foundation of our cooperation with governments to promote fiscal access and responsible fiscal addition. The first step is to establish a national policy and

plan for increasing access to financial services and promoting the usage of fintech. Financial growth assessments and strategies are the primary focus of Pillar 1 of the FICP. Guests are also provided with advice on how to approach financial growth, with a special focus on digital financial growth and the use of fintech to promote financial growth, and how to align across a wide range of behaviors in order to achieve this overarching goal. In pillar 1, we have Financial Sector Assessment Programs (FSAPs), which are a subset of immolation. These evaluations, conducted in tandem with the International Monetary Fund, take a wide-ranging look at the availability of various forms of finance (including digital ones), the reliability and variety of service providers (including innovative ones), the breadth of relevant products currently on the market, and the scope of public programs and initiatives pertaining to monetary augmentation. The term ''national fiscal addition strategies'' (NFIS) refers to plans that aim to improve national or regional economies through means such as the introduction of digital fiscal services. Dimensions and data structures This aids in the development of data structures and dimensionality systems for fiscal growth, such as public demand-side fiscal growth checks, force-side data collection to support dimensionality towards fiscal growth strategy targets, geospatial mapping enterprise for fiscal growth and key performance indicator (KPI) development, and methods for measuring digital fiscal service. Information about financial technologies useful for growing businesses, especially those that help women enter the financial mainstream. The second pillar's primary focus is on providing conditional aid for the implementation of policy reforms related to financial products or providers that benefit underserved segments, such as women and pastoral populations, by assisting tourists in conducting demand-side exploration to more inform design and delivery of applicable products and services for the pastoral

underserved. The underserved were the primary target of the creative service providers. Help in evaluating prospective service providers and developing non-supervisory fabrics and administrative conditions suited to the needs of micro, small, and medium-sized enterprises (MSMEs) and other underserved groups. A level playing field between banks and non-banks (or non-traditional service providers) including telecoms, ''fintech'' enterprises, post services, cooperatives, and agent networks can be achieved through increased nonsupervisory and administrative reforms that increase competition and open up additional entry points. Third pillar financial consumer protection is crucial to ensuring that consumers (especially those new to the formal financial sector) enjoy the advantages of fiscal expansion without being exposed to unnecessary risk. From information security and conflict resolution to monitoring requests and responses, we provide comprehensive expert support for consumer protection issues. The third pillar deals with diagnostics in financial consumer protection; this includes comparing request behaviors to the Good behaviors for Financial Consumer Protection and assessing the efficacy of current statutory and institutional frameworks. Strengthening institutional authorizations for fiscal consumer protection; receiving expert advice on institutional arrangements and coordination mechanisms between financial sector organizations working on fiscal consumer protection. Expertise in crafting financial consumer protection regulation, whether it be product- or provider-specific regulation or flagship FCP regulation, to handle all areas of FCP (for example, with relation to FSPs' behaviour, exposure, internal complaints management, etc.). Managing requests, training staff, conducting risk assessments, and offering advice from subject-matter experts are all part of this. Knowledge and experience in consumer testing of critical data statements, as well as in the design and

drafting of transparency regulations for digital financial services (DFS) products (such as consumer credit, current accounts, insurance, and collaborative investment schemes). Fair treatment of businesses and compliance with company regulations require investment in product governance and felicity, as well as appropriate policy approaches to resolving over-debt. Makes available easily accessible professional advice on ADR mechanisms, such as the establishment of ADR systems (including governance, funding arrangements, structure, and staffing) and the advice on legal frameworks for ADR schemes (including legal powers). Data isolation and protection solutions can help countries apply these principles to the financial industry and mitigate the dangers posed by fintech and DFS, such as those linked to big data, obligatory credit scoring, discrimination, concurrence, algorithmic governance, etc. Financial aptitude and behavioral awareness, the fourth pillar, is the ability to manage one's financial resources responsibly in light of one's own situation and the broader economic, social, and political environment. Consumers that are financially literate are able to make sound financial decisions, as well as locate, assess, and make use of relevant financial services. The Financial Innovation and Capability Partnership (FICP) advises policymakers on how to increase the effectiveness of financial inclusion initiatives by enacting targeted program, reform, and regulatory changes, such as those in the area of consumer protection, based on findings from research on financial capability and behavioral economics. One example of a specialized sacrifice made under this pillar is the incorporation of financial education into programs and interventions designed to improve the financial situations of target populations, especially where these populations are critical for financial addition objects (such as beneficiaries of social transfer programs or programs focused on women's access to finance). Pillar 5: Micro, Small, and Medium-Sized

Enterprise Finance focuses on the constant need for effective methods to cover data on the impact of lending to MSMEs. Given the vast variety and complexity of MSMEs, it might be challenging to secure financing for your company. Authorities' ability to identify ''overheated'' corridors where instability is a risk and request spacing is diminished. The FICP team provides policymakers with the technical resources necessary to conduct force-side diagnostics on a regular basis, rather than as a one-time evaluation of the request, in order to detect dangers and holes in the request and transmit the results to other stakeholders. In addition to these five pillars, we also focus on payments and payment systems as means of promoting monetary growth. Countries are urged to modernize their retail payment systems and government payments to aid in the global shift away from cash and paper-based instruments. It's becoming increasingly common for governments to transfer money directly to citizens' bank accounts, which improves efficiency and broadens citizens' access to credit. It also results in significant cost savings in the administration of payment systems and reduced leakages as a result of corruption and fraud. Reforming public payments systems (NPS), which includes remittance requests, requires comprehensive diagnostics of countries' payments and agreement systems, as well as proposals to improve NPS. The World Bank Group's Identity for Development (ID4D) project relies on our work in this area to facilitate digital social transfer payments, SME support, and agricultural development. The Women Entrepreneurs Finance Initiative (We- Fi) uses this system to help women business owners overcome financial and other obstacles. The DE4A Initiative aims to facilitate the growth and inclusion of Africa's digital economy to benefit the continent's population as a whole. Join the IDA19 initiative to help women in IDA countries become more economically active. We take part in standard-setting bodies, offer guidance to companies that develop standards, and organize conferences covering a wide range of relevant issues. The G20 Global Partnership for Financial Inclusion (GPFI) is an open platform for all G20 governments, interested non-G20 nations, and relevant stakeholders to work together on financial inclusion. The World Bank Group is a managing partner in the GPFI. During China's G20 Presidency, the World Bank Group advised on technical aspects of the New G20 pointers for the Digital Financial Addition and helped craft the G20 High Level Principles (HLPs) for the Digital Financial Addition. The eight High Level Principles have been adopted as a framework for digital financial inclusion by a number of countries. The principles assist prioritize consumer safety and financial literacy while also encouraging government-wide efforts to boost financial growth through digital technologies. The PAFI report, or Payment Aspects of Financial Integration, lays forth seven principles and recommends actions to help countries get access to trade accounts. The Committee on Payments and Request Infrastructures (CPMI) led the group of financial regulators that designed it. As of June 2016, more than $5 billion had been pledged to active backing operations that aid public companies in increasing their net worth. Our new guidelines, individual tools, statistics, and conversation pave the way for future successful public policy, nonsupervisory, and executive textiles.The World Bank Group was able to do more than just meet its goal of assisting 10 IDA nations in meeting their public commitments to financial addition (BB1) standards through IDA17. To help with public financial access and additional commitments after demand exceeded the initial objective, the Bank Group connected money for 16 IDA countries, nine of which are in sub-Saharan Africa. Eleven of those 16 countries have recently obtained access to or expanded infrastructure funded by the World Bank Group.

Supporting transformational reforms and investment in innovative payment services,

digital finance, micro/SME finance, responsible finance, and related areas; creating and implementing National Financial Inclusion Strategies.

Our efforts in this area are complementary to those of other World Bank Group units

The International Finance Corporation (IFC) is the private sector investment arm of the World Bank Group, and one of its goals is to increase people's access to financial services.

Financial inclusion is promoted through responsible market development and advocacy by the Consultative Group to Assist the Poor (CGAP), a global partnership of 34 major organizations located at the World Bank.

Country examples

A new National Financial Inclusion strategy was established in Indonesia in August 2016, and numerous reforms have been implemented over the past few years to improve financial infrastructure and payment systems, increase access to insurance, boost financial literacy, and develop a culture of savings.

The Bank Group is helping the government implement reforms to increase the availability of financial services, digitize payments (including social transfers), broaden the availability of access points, fortify the regulatory and supervisory framework, and educate the populace about money management.

Mexico: More than half of Mexico's population does not have access to the official, regulated financial system, but this is rapidly changing thanks to a national financial inclusion strategy that was launched in June 2016. The Bank Group is providing assistance to the government in order to improve financial sector regulation, encourage credit, and broaden access to financial services.

Mozambique: In July of 2016, with help from the World Bank, Mozambique unveiled a new financial inclusion strategy with the goal of doubling the percentage of the population with access to financial services by 2022, from 24% to 60%.

Pakistan: To increase financial access and inclusion, the World Bank is backing country-led efforts with reforms and other activities. With help from the Bank Group, Pakistan was able to improve its banking system and attract more private investment.

Peru: To ensure that 75% of individuals in the country have access to a transaction account by 2021, the government has pledged to implement a national financial inclusion strategy developed with the Bank's support and released in 2015.

Financial inclusion is a driver of economic growth and poverty alleviation

The reduction of poverty and inequality is a secondary effect of progress in the financial industry. Inclusive financial sector growth offers a double contribution to poverty alleviation by providing acceptable, affordable financial services to the poor, who can thereby improve their wellbeing. They complement one another since an expanding economy allows more people to participate in the formal sector and so contribute to growth through financial inclusion. For the underprivileged, access to affordable and suitable financial services is crucial. In addition to its low level, the instability and unpredictability of impoverished people's income is a major issue. A $2 per day income, for instance, might have extremes of $5 and $0 (see Figure 213) over the course of a year. Farmers and people in other seasonal professions may experience even bigger year-to-year shifts. Low-income persons require effective money management skills to stabilize their normal cash flow and save up for unexpected large expenses. Lifecycle events, such as paying for college or a wedding, as well as economic possibilities, like expanding a firm or investing in new equipment, necessitate lump sum payments. Perhaps more so than for any other socioeconomic category,

managing one's finances is an essential element of every day living for the impoverished. Financial services, such as savings accounts, microloans, domestic and international money transfers, and insurance, are essential for people in poverty, just as they are for the rest of us. The poor rely on informal services because they lack access to formal and semi-formal financial services (and often use these in addition to more mainstream options14). In comparison to their more formal and less informal counterparts, informal services are sometimes more expensive, less secure, and/or less reliable.

Only between 20% to 50% of the people in underdeveloped economies can really use banking institutions. No one, rich or poor, is allowed in. An indirect benefit for the poor can result from helping the not-so-poor gain access to better financial services, which in turn helps the not-so-poor gain access to better financial services, which in turn helps the not-so-poor gain access to better financial services, etc. Therefore, if we want to foster growth that is beneficial to the poor, we need to ensure that those who are currently excluded also gain access. Further benefits are achievable by enhancing financial access through more conventional channels, but this paper does not cover that ground because the Pittsburgh Declaration requested an emphasis on creative solutions.

Finance for economic growth and poverty alleviation

The growth of the economy is fuelled by people putting their money away and then spending it on new machinery and other equipment for the rising productive sector. Financial system institutions facilitate growth by decreasing the price of information, contracts, and transactions. Poverty reduction is yet another indirect result of a flourishing economy. Moreover, there is mounting evidence that improvements to the financial sector foster pro-poor growth through having an effect on economies in ways that help to alleviate poverty.

Key Findings

The State of the Economy Today. Financial markets should be as diversified as possible to spur innovation and provide customers with more options. On average, four of the six categories of institutions used to design the Survey are described as being governed by authorities. Financial cooperatives (present in 65% of responding jurisdictions), non-bank electronic money issuers (59%), other banks (57%), other deposit-taking institutions (56%), and microcredit institutions (52%) are the most common types of financial institutions beyond Commercial Banks (present in all jurisdictions).

Companies Other Than Banks That Issue Digital Currency. NBEIs are frequently essential to the growth of digital financial services. There are 73 (or 59%) nations that claim having a regulatory framework for NBEIs; this includes over 70% of states in both Sub-Saharan Africa and East Asia and the Pacific. Of the 59 countries/regions/territories/etc. that have NBEIs and have disclosed information about their ownership, 63 percent state that some NBEIs in their country/region/etc. are mobile network operators (MNOs) or their subsidiaries.

Methods for increasing the number of people who can use the banking system in a given country. National financial inclusion strategies (NFISs) make it easier to set financial inclusion goals at the national level, increase the momentum of reform efforts, and increase collaboration amongst different stakeholders. 27 of the responding countries have an operational NFIS, while 29 more are in the process of developing one. Approval procedures, coordination structures, and other essential features of NFIS vary widely among the responding jurisdictions. Only 14 NFISs even attempt to address gender inequality.

Having to Trust Third Parties and Agents. Several countries have found success in using agent networks to expand the reach of their

financial services sector at cheap cost and across greater geographic areas. 105 (or 85%) of the nations polled responded that certain types of institutional financial service providers (FSPs) are permitted to enter into contracts with retail agents as third-party delivery channels. Many jurisdictions have rules in place to govern the interactions between FSPs, agents, and consumers because of the new dangers posed by the employment of agents. For instance, in more than 75% of jurisdictions that responded, rules exist that make financial institutions accountable for the activities or omissions of their agents.

Due Diligence for Customers, Simplified. The 2014 Global Findex found that among the top three reasons people give for not having a bank account, ''excessive documentation requirements'' ranked highest. The survey results show that simple identification credentials are not enough for opening an account in many countries. According to the replies, many countries have stricter documentation requirements than the FATF suggests. For specific types of clients (e.g. low income) or account products (e.g. small-value, low-risk transactions), however, customer due diligence standards have been simplified or exceptions have been made in 60 responding jurisdictions (50%) overall.

Protection of Electronic Money Balances. One important function of e-money regulatory frameworks is the protection of clients' e-money balances. Sixty-one of the responding jurisdictions (86%) have mandated that customers' e-money funds be held in a separate account from the issuer's funds at a financial institution subject to prudential regulation. NBEIs are restricted by law in 86% of relevant respondent jurisdictions from using customer funds for anything other than the redemption of e-money and the execution of financial transfers.

Institutional Mechanisms for Safeguarding Customers' Financial Information. The autho-

rities whose purview it is to ensure the safety of monetary transactions for the general public differs widely throughout countries. The majority of countries, 55 (45%) say they use some form of the ''Integrated Sectoral Financial Sector Authority'' model. In this framework, several financial sector authorities are responsible for different parts of supervision (such as prudential and financial consumer protection) for FSPs operating in a certain financial subsector (such as banking). Seventy-five percent of the responding jurisdictions are relevant, and of those, eighty-six have a specialized unit dedicated to financial consumer protection within an institution with a broader scope; seventeen of these jurisdictions (21%) have established this unit since 2013.

Honesty and openness. Consumers benefit from more lucid and comparable information regarding financial products and services. Most jurisdictions (94%) require disclosure of Commercial information, but there is considerable variation in the specifics of what must be declared, when it must be published, and how it is disclosed. While 81 jurisdictions (65%) indicate requiring the use of a key facts statement (or similar) for at least one product by Commercial Banks, that number lowers significantly when looking at other types of institutions.

Equal Opportunity and Professionalism in Business. Financial consumer protection is predicated on the principle of treating clients fairly. Ninety of the responding countries (75%) forbid FSPs from including any term or condition in a client agreement that is unjust, unreasonably imbalanced, or harsh. Despite considerable variation in approach, 110 jurisdictions (or 90%) that responded say they have laws or rules in place to limit personal borrowing. Less common are regulations that allow customers to switch between different banks.

Resolution of Complaints and Disputes. Consumers can settle disagreements with their FSP through easily accessible and effective

dispute resolution processes. Eighty-eight percent of the jurisdictions polled have rules in place for how financial service providers should deal with customer complaints. Sixty-five percent of the countries surveyed report that consumers who cannot resolve their concerns with their FSP have access to an alternative dispute resolution (ADR) institution outside of court (such as a financial ombudsman). ADR entities' roles and institutional structures might differ greatly from one jurisdiction to the next. Among the 51 jurisdictions that provided data, the most frequently complained about issues were (i)interest or fees that were too high, (ii) interest or fees that were not obvious, (iii) transactions that were made in error or without authorization, (iv)ATM transactions, and (v) fraud.

Concluding Remark

Findings from a recent comprehensive review of the literature on financial inclusion were described in this article, with an emphasis on the evidence from policy and academia. I structured the review around questions I'm want to hear policymakers and other readers' thoughts on. The transmission of systemic risk to the formal financial sector, the possibility of optimal financial inclusion, the possibility of extreme financial inclusion, and the topic of extreme financial inclusion are all issues that I bring up to get people thinking. Key findings suggest that financial inclusion influences and is influenced by a wide range of factors, including but not limited to financial innovation, poverty, financial sector stability, economic growth, financial literacy, and regulatory frameworks. There are policy ramifications of the findings.

It is important for policymakers to think about the connections between financial inclusion and issues like poverty, financial innovation, financial stability, the economy, financial literacy, and regulation. Policymakers should discover innovative ways to deliver these services to the people outside of traditional

banking institutions as regulators worry about the stability of the financial system.

Ultimately, the examination identified several interesting new directions to explore in the field of financial inclusion research". The optimal level of financial inclusion, the type of regulation that promotes this level of inclusion, and (v) the other risks associated with financial inclusion and their impact on the poorest users of basic financial services all need more research.

Reference

- Adomako, S., Danso, A., & Ofori Damoah, J. (2016). The moderating influence of financial literacy on the relationship between access to finance and firm growth in Ghana. Venture Capital, 18(1), 43-61.

- Aggarwal, S., & Klapper, L. (2013). Designing government policies to expand financial inclusion: Evidence from around the world. The Journal of Finance, 56(3), 1029-51.

- Akhtar, S., & Pearce, D. (2010). Microfinance in the Arab World: The challenge of financial inclusion. The World Bank, Quick Notes Series, No 25, 1-4.

- Ali, A. E. E. S. (2019). Empowering Women through Financial Inclusion: Some Evidence from Comoros. International Journal of Asian Social Science, 9(2), 256-270.

- Allen, F., Carletti, E., Cull, R., Qian, J. Q., Senbet, L., & Valenzuela, P. (2014). The African financial development and financial inclusion gaps. Journal of African economies, 23(5), 614-642.

- Allen, F, Demirguc-Kunt, A, Klapper, L and Martinez Peria, M.S. (2016), The Foundations of Financial Inclusion: Understanding Ownership and Use of Formal Accounts, Journal of Financial Intermediation, 27, 1-30.

- Al-Mudimigh, A., & Anshari, M. (2020). Financial Technology and Innovative

Financial Inclusion. In Financial Technology and Disruptive Innovation in ASEAN (pp. 119-129). IGI Global. Available at: https://www.igi-global.com/chapter/financial-technology-and-innovative-financial-inclusion/231127.

● Anson, J., Berthaud, A., Klapper, L., & Singer, D. (2013). Financial inclusion and the role of the post office. The World Bank, Policy Research Working Paper, No 6630, 1-30.

● Anzoategui, D., Demirgüç-Kunt, A., & Martínez Pería, M. S. (2011). Remittances and financial inclusion:

● Atkinson, A., & Messy, F. A. (2013). Promoting financial inclusion through financial education. OECD Working Papers on Finance, Insurance and Private Pensions, No. 34, 1-55.

● Ayyagari, M., & Beck, T. (2015). Financial inclusion in Asia: An overview. Asian Development Bank Economics Working Paper Series, No. 449, 1-21.

● Banka, H. (2014). M-PESA at the point of sale: Expanding financial inclusion and reducing demand for physical cash. Journal of Payments Strategy & Systems, 7(4), 359-369.

● P.K. Ozili (2020) Financial inclusion research around the world: a review

● Beck, T., Senbet, L., & Simbanegavi, W. (2014). Financial inclusion and innovation in Africa: An overview. Journal of African Economies, No. 24(supplement), i3-i11.

● Bold, C., Porteous, D., & Rotman, S. (2012). Social cash transfers and financial inclusion: Evidence from four countries. Consultative Group to Assist the Poor, No. 77, 1-28.

● Bongomin, G. O. C., Munene, J. C., Ntayi, J. M., & Malinga, C. A. (2018). Analyzing the relationship between institutional framework and financial inclusion in rural Uganda: A social network perspective. International Journal of Emerging Markets, 13(4), 606-630.

● Bravo, C., Sarraute, C., Baesens, B., & Vanthienen, J. (2018). Credit Scoring for Good: Enhancing Financial Inclusion with Smartphone-Based Microlending. ICIS Conference proceedings. Available at:https://aisel.aisnet.org/icis2018/implement/Presentations/6/

● Chakravarty, S. R., & Pal, R. (2013). Financial inclusion in India: An axiomatic approach. Journal of Policy modeling, 35(5), 813-837.

● Chen, R., & Divanbeigi, R. (2019). Can Regulation Promote Financial Inclusion? The World Bank. Policy Research Working Paper, No. 8711, 1-16.

● Chibba, M. (2009). Financial inclusion, poverty reduction and the millennium development goals. The European Journal of Development Research, 21(2), 213-230.

● Chikalipah, S. (2017). What determines financial inclusion in Sub-Saharan Africa? African Journal of Economic and Management Studies, 8(1), 8-18.

● Chinoda, T., & Kwenda, F. (2019). Do mobile phones, economic growth, bank competition and stability matter for financial inclusion in Africa? Cogent Economics & Finance, 7(1), forthcoming.

● Cohen, M., & Nelson, C. (2011). Financial literacy: A step for clients towards financial inclusion. Global Microcredit Summit, 14-17.

● Collard, S. (2007). Toward financial inclusion in the UK: Progress and challenges. Public Money and Management, 27(1), 13-20.

● Comparato, G. (2015). The rationales of financial inclusion in the changing European private law. European Review of Contract Law, 11(1), 22-45.

- Corrado, G., & Corrado, L. (2015). The geography of financial inclusion across Europe during the global crisis. Journal of Economic Geography, 15(5), 1055-1083.

- P.K. Ozili (2020) Financial inclusion research around the world: a review

- Cull, R., Demirgüç-Kunt, A., & Lyman, T. (2012). Financial inclusion and stability: What does research

- show? Consultative Group to Assist the Poor, 71305, 1-3

- De Matteis, L. (2015). Financial inclusion, policies and instruments for migrants in Italy. Savings and Development, Special Issue, UMM Master Awards, 38-69.

- Demirgüç-Kunt, A., & Klapper, L. (2012). Financial inclusion in Africa: an overview. The World Bank. Policy Research Working Paper No. 6088, 1-18.

- Demirguc-Kunt, A., Klapper, L., & Singer, D. (2017). Financial inclusion and inclusive growth: A review

- Dias, D., & McKee, K. (2010). Protecting branchless banking consumers: Policy objectives and regulatory options (Vol. 64). Consultative Group to Assist the Poor focus note, 1-16.

- Diniz, E., Birochi, R., & Pozzebon, M. (2012). Triggers and barriers to financial inclusion: The use of ICT- based branchless banking in an Amazon county. Electronic Commerce Research and Applications, 11(5), 484-494.

- Donovan, K. (2012). Mobile money for financial inclusion. Information and Communications for development, 61(1), 61-73.

- Evans, O. (2018). Connecting the poor: the internet, mobile phones and financial inclusion in Africa. Digital Policy, Regulation and Governance, 20(6), 568-581.

- Fonté, E. F. (2012). Mobile Payments in the United States: How Disintermediation May Affect Delivery of Payment Functions, Financial Inclusion and Anti-Money Laundering Issues. Wash. JL Tech. & Arts, 8, 419.

Perspectives

AI & Energy: Challanges and Prospects

Dr. Soumen Guha

Managing Director, Sustech Engineering Pty Ltd., Perth, WA

Introduction

The demand of energy has grown simultaneously with the growth of civilisation and prosperity of humankind. This search for energy to enhance the quality of life in a finite world has been an eternal challenge. On the one hand is there is increasing demand, and on the other side there is a dearth of supply. This has led to discovery of new sources of energy, innovation of new technologies and development of efficient machines. Attaining efficiency at every stage of the energy value chain, from production to transmission to distribution and consumption, has been a continuously developing story. In the modern era, with a goal to deliver energy to all, it is a challenge to do so while being carbon neutral. This journey to scale new heights of optimised and efficient use of energy, achieving increased energy consumption while reaching carbon neutrality, will be aided by artificial intelligence (AI) in the coming decades.[1]

Evolution of AI

The beginning of AI, as in the form we understand today, dates back a few centuries, when the pursuit of reason and logic were practiced by philosophers and mathematicians in a systematic and documented way. The first automation occurred in physical mechanical systems. At the beginning these were simple mechanical devices meant for specific set of tasks. Later, these machines evolved to perform more complex tasks.

Then the mechanical computers were invented, which carried out difficult and complex calculations and tasks. But these huge machines had their limitations due to space constraints and manufacturing cycles. The need to overcome these hurdles gave rise to the electronic computers. These electronic computers were fundamentally diffierent and opened up new horizons of virtuality, evolving much faster than their mechanical predecessors. Iterative calculations and testing of ideas became much easier. Storing huge data became increasingly within the reach. Soon people understood the key benefit of the new technology – the ability to identify patterns for predictive analysis. For the first time a machine could replicate a part of the pattern of human reasoning and problem-solving. This is the advent of machine learning and AI.

From this point we could see early machines performing human actions, like robots. Albeit these early robots were preprogrammed. But as we have seen in recent developments, virtual assistants like Siri and Alexa are fed with human intelligence. Technology is now approaching the stage where it could credibly be called AI. Algorithms have become the buzzword. Increasingly we are transforming more subjective tasks like decision-making, personality assessment, product targeting, into computer aided decisions. AI is truly on the march.

Parallelly, data storage and computing technology is scaling new peaks. Hence large data pools can now be captured, leading to advances of machine learning to deep learning.

---

[1] There are serious and valid concerns that AI can be a powerful tool in the hands of unethical people. But our focus for the purpose of this article is on AI's socially legitimate use for the energy world.

Complex human neuron dependent capabilities like image and voice recognition have now become reality.

The algorithms now collect data, analyse and establish patterns, and also aberrations of those patterns, to establish derivative algorithms. We see these manifestations of AI today in everyday applications like self-driving cars on the city roads. The web-based translations are getting refined by the day. Bots are becoming more efficient in recognising moods and responding appropriately.

Today AI takes as inputs, observations from the desired problem space based on complex or less complex sensors like cameras, vibration sensors, videos etc. It then and applies advanced techniques of recognizing patterns, classifying patterns, predicting future behaviour.

If AI could achieve such progresses in extremely subjective individual behaviour and expression related applications, imagine what it can do in the fields of energy, where data is well structured and documented historically.

Image 1: AI - picture of self-driven car

Energy Industry and Data

The energy industry has always generated and accumulated a lot of historical data about generation, transmission and consumption, because of their basic business needs of calculating profitability. For example, all the centralised energy exploration and production companies like oil and gas explorers and coal

miners keep the production and sale data. The power companies maintain data on how much fuel they burn and how much energy they produce. The distribution companies' meter and generate data of their receipt and sale of energy and power.
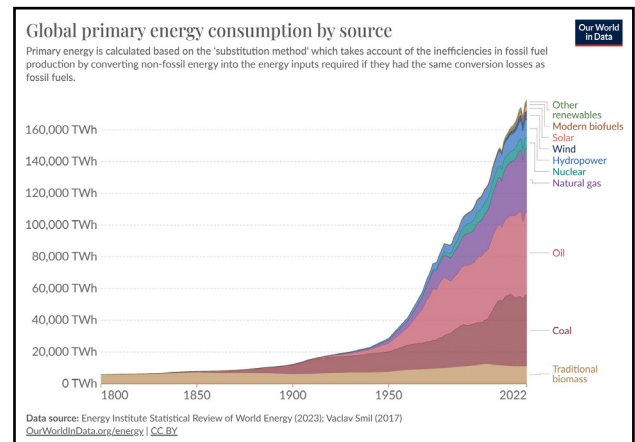
Image 2: Energy Production and Consumption - Our World in Data

Besides increasing profitability, the other driver for making the power industry efficient was regulation that kept a control on price. This continuous improvement of processes and machines was possible because of measurable data.

For example, based on the collected data, the energy distributors communicate with consumers through simple communication platforms like the energy bills, providing consumers with the option to choose between diffierent energy plans. This kind of planned consumption commitment gave the advantage of optimising the grid.

In the present age of big data and enormous computing power, further scope of optimised use of energy and management of complex grids including consumer generated energy (e.g. solar cells), becomes even more possible. Predictions about needs and supply of energy is made based on historical data. The famous duck curve (see Image 3) is an example of how the energy business planners and engineers use such data for forward planning. All these are possible because of the data rich energy industry.

The data collected over a very long period in the energy industry when statistically analysed, shows some patterns. These patterns can be processed and presented through conventional computer programming to assist data-driven decision making. This is what has been practised for many decades now by business analysts and decision makers. One can imagine how much data can be co- related and compiled from these well-structured datasets, increasing the ease of well-informed decision-making. This data can be the bedrock of machine learning. With enough data available for machine learning, simulating human cognitive and analytic explanations of the data, the AI will evolve, and its capabilities will grow.
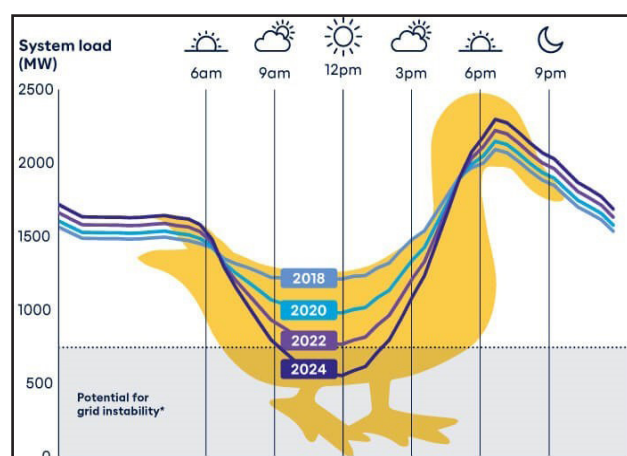

Image 3: Solar Duck Curve Explained: What it Means in Western Australia (synergy.net.au)

Traditional Energy and AI

Below here are some real-life examples of how AI can be applied to the Energy Industry and make it efficient. In the process, both energy costs and carbon emission may be reduced.

Case Study

Problem

A power corporation is being plagued by high cost of maintenance of electric poles. These poles have to be checked on a regular basis for pilferage, for damage, for wear and tear. And these are high tension line poles that are tremendous safety hazards if they break down.

A team of 4 or 5 people, daily or twice a day, take photographs of each of the poles from diffierent angles and save the images in long-term storage. They send it to a control room. The expert engineer identifies the defects from the pictures and sends back a request to the observation team for either retaking the pictures from a nearby view or sends a request to the maintenance team to fix the identified defects. This method is time consuming, error prone, therefore expensive.

Solution

Imagine a drone circling those poles from a measurable distance, with high optical zoom cameras installed. Live feeds of the poles from diffierent angles could be streamed to the control centre. Then the data can be processed by machine learning algorithms and defects will be identified within few minutes of the image being captured. Thus, the cycle time and processing-analysis cost goes down drastically. The state of the art in machine learning is such that the defects which need to be identified can be determined by standard machine learning techniques within a very high degree of accuracy.

AI finds further application in this scenario where the drone's flight path is being controlled by an automatic control system, and the streaming video is being processed in real time to give a classification of the defects, if any. After that, some traditional software steps can be taken, like notifying, mailing, calling relevant support levels.

Methodology and Principles followed for the solution

- Images and videos are used as the sensory medium.

- These are captured on a near real time basis by drones.

- The flight path of drones is controlled by an automated system.

- Images and videos are transmitted via the internet to the servers doing the analysis.

- The servers doing the analysis apply advanced machine learning techniques to classify the defect into categories, which they infer from the images.

- On finding a defect classification in any image, the servers transmit the control signal to the drone to capture images or videos of the relevant pole at the proper angle.

- The servers then communicate to the relevant maintenance and support centres.

Energy Audits

Modern-day automation techniques mean that we now have energy audit sensors placed at all of the relevant consumption points, which constantly stream power and energy data in real time. Instead of periodic energy audits, now it is continuous. The accumulated audit data help identify the anomalies in the consumption pattern, irregularities in the machinery maintenance, aberration of regular patterns in the utility billing. Also, the data allows real time alerts regarding impending high billing errors. However, this is state of the art analytics rather than machine learning or AI.

AI involves the prediction of the consumption patterns and altering the schedule of the consumption, to bring down energy consumption. For example, all air conditioners in a large office complex are switched on simultaneously at the beginning of the day. This causes a sudden spurt in energy demand. Once this is identified using the continuous energy audit, a simple step of staggering the start of the machines can avoid the demand spurt.

Based on the audit data, AI can show the energy consumption patterns of machines and the identification of peak and trough periods during the week. This can even out demand by scheduling and loading the machines over the entire day.

Macro and Micro Scale Energy Production

In the macro sphere, entities responsible for energy production, both government and private, are resorting to prediction of consumer demand in the near future and taking necessary action to meet it. Daily changes in energy production and in energy consumption patterns can be studied very easily from a one-year historical data record of energy production and consumption at diffierent points in the grid. Diffierences in demand during the day, during the week, during the month and during certain months can be identified. Accordingly, many proactive measures can be adopted to even out the supply and demand to accommodate or address the patterns. Storing the excess energy in periods of low demand and pumping it back to the grid during high demand periods has been practised for quite some time now. Parallels of this solution can be found in the telecommunication operators' industry, where bandwidth is utilised during low demand periods by downloading data based on the user's preferences, and served from cache during high demand periods, to reduce the load on the network. All of these solutions are facilitated by machine learning systems with appropriate algorithms and a good analytics system.

In the micro scale energy production, solar energy is now a reality. A household with a significant solar energy generation capacity has a utility energy source, solar energy source, battery storage capacity and devices which consume energy. Now hardware is available which has AI built into the firmware which balances the power consumed from the utility energy source based on how much solar energy and stored energy is available at an instant. Rules are being set in the firmware, which can be configured by the energy consumer. Based on consumption patterns and time of day and the real time balance of energy sources, whether to increase or decrease the power drawn from utility, when to divert utility power

for immediate consumption or battery storage etc. is being decided by the machines. The machines have AI and internet of things built-in to enable this. This results in a drastic reduction in unnecessary power consumption in peak demand periods and wasted utility energy in low demand periods.

On a macro scale, the same strategy is being employed by the power utility companies, through the concept of the smart grid. Energy demand in a particular grid or area at a particular time is being mapped. Areas with more demand at any point of time are being allowed to draw the energy from areas in the grid that have less demand at that moment.

The smart grid concept is thus minimising waste and enabling the efficient utilisation of energy. While still new, with the progress of machine learning and AI based optimisation techniques and strategies, and improvement in electrical and electronic hardware, the smart grid system will be far improved and matured.

A step further is for the smart grid projections to be integrated for the entire nation and beyond. This would approach an almost real time management of energy generation, making the whole energy production and distribution more capital efficient. This would also help in predictive pricing of energy and assisting policy makers with forward planning and resource allocation.

Renewable Energy and AI

Renewable energy sources, including solar, wind, hydroelectric, and biomass, made up approximately 30% of the total electricity generated globally. As of 2022, hydroelectric power is the most common source of renewable energy globally, with an installed capacity greater than 1,200 GW. In comparison, there are more than 600,000 wind turbines are operating globally, with a combined capacity greater than 600 GW. Wind energy was the fastest-growing source of electricity globally, with a growth rate of 15%, while solar energy was the fastest-growing source of electricity in the United States, with a growth rate of 27%. China is the world's largest producer of solar energy, followed by the United States and India.

The horizon of AI in energy will be beyond the bounds of generation and consumption of conventional energy fields. It will expand to renewables and other forms of explorations of renewable energy.

As a simple example, predictions of renewable energy generation can be made based on weather modelling. This data can be used to configure and schedule the consumption points and activate the storage units downstream. In our journey of net zero and to restrict the global warming to 1.5°C, AI has a big role to play.[2]
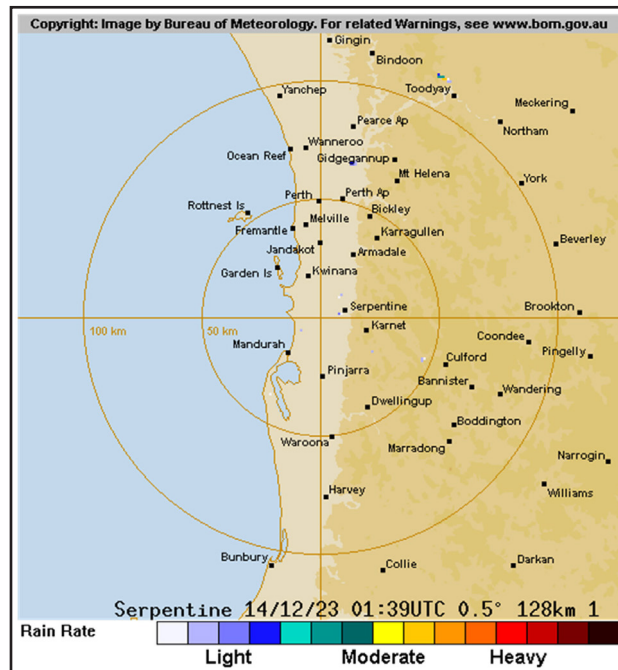

Image 4: Weather Forecast maps, Bureau of Meteorology (bom. gov.au)

---

[2]This Society of Petroleum Engineers article discusses the status of renewable and clean energy in the Global energy map, and how is AI being used there: https://jpt.spe.org/ai-paves-the-way-for-a-sustainable-energy- future

The use of AI in the renewable energy sector can reduce the project capital costs and operating costs and increase the availability and reliability of the energy. With the efficient management of energy supported by AI, renewables can eventually become more commercially viable than explored and mined energy. This journey has started.

Exploration and Planning

AI improves the efficiency and project economics of exploring and converting naturally occurring renewable energy forms to usable renewable energy. AI can be used to analyse large datasets from satellite imagery, sensor networks, and other sources to identify the optimised locations for renewable energy projects such as solar farms, wind farms, geothermal plants, and hydroelectric dams. AI can also predict the viability of renewable energy projects based on factors such as weather conditions, land use, and the availability of resources, for more informed decision-making about where to invest. AI can help create detailed hydroelectric and geothermal reservoir models, which are typically used for identifying the most efficient site locations and for designing the operational infrastructure for the most effective generation of renewable power. AI can also be for installation and operation of renewable energy plants by helping fine tune the placement and orientation of solar panels and wind turbines, maximising energy production and increase plant efficiency.
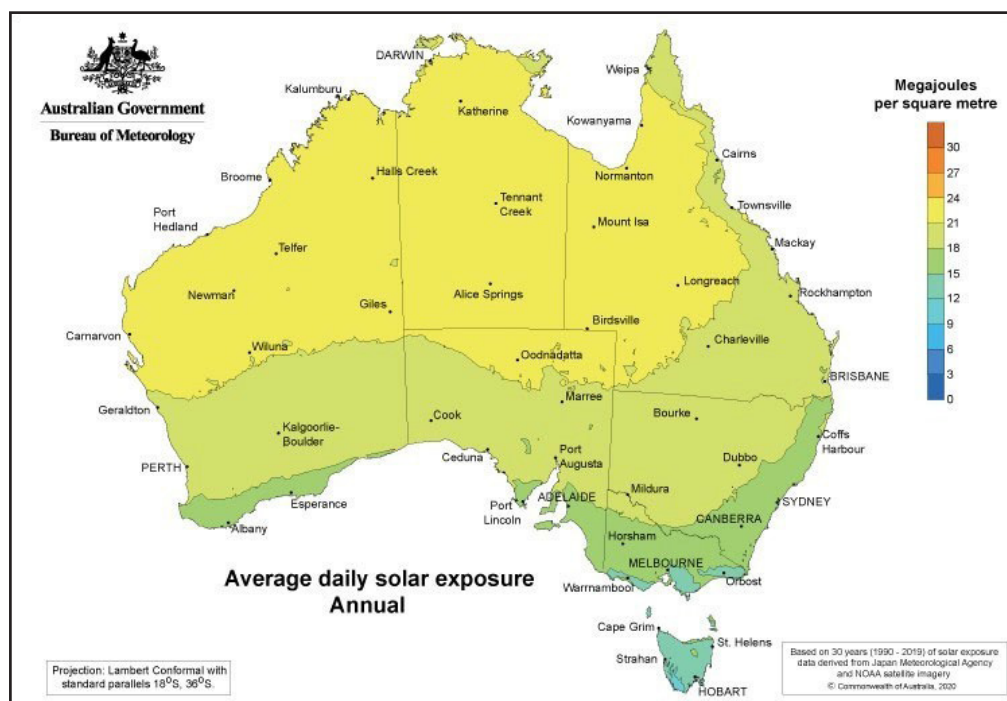
Image 5: Average daily solar exposure maps, Bureau of Meteorology (bom.gov.au)

Performance Optimization

Environmental impacts of excessive energy use can be reduced significantly through performance optimisation of the renewable-energy systems. AI can be used to optimise the energy usage of electric vehicles (EVs) by predicting the most efficient route to a destination. Using the data on traffic and weather conditions, AI can reduce a vehicle's energy consumption. Furthermore, AI can optimise battery charging in EVs by predicting the best times to charge based on factors such as electricity prices and availability.

In the case of solar panels and wind turbines, AI can improve performance by predicting when to adjust the angle of the panels and turbines, to maximise the amount of sunlight and wind they receive. Similar performance enhancements have been demonstrated in geothermal energy where AI tunes the performance of geothermal power plants by adjusting the flow rate of the geothermal reservoir to maximise energy production while ensuring sustainable heat extraction with minimal environmental footprint.

Energy Production Forecasting

The use of AI in renewable energy industry can improve the accuracy and reliability of energy production forecasts, allowing energy companies to make more informed decisions about their energy transition strategies. Energy companies can then plan for the future by predicting how much renewable energy will be available and what their energy mix and infrastructure investments should be. AI-backed renewable-energy production forecasting can help energy companies reduce costs and downtime by avoiding overproduction or underproduction of renewable energy. AI can help analyse data from a variety of sources, including weather forecasts, satellite imagery, sensor networks and other state of the art technologies to predict the likely performance of renewable energy plants. AI will become crucial for real-time data collection and remote-controlled operation, predictive as well as pre-emptive maintenance needs, improving the reliability and predictability of renewable energy sources and its power generation. AI can help ensure that renewable energy sources are operating at their maximum capacity, thereby giving the best return of the capital invested.

Safety

AI is needed in the renewable energy sector to improve safety. AI has already been used in real-time monitoring of structural integrity of wind turbines and the temperature of solar panels to identify potential problems before they cause damage or failure. AI can facilitate the on-time maintenance and repairing of renewable energy systems, reducing the risk of accidents and downtime.

AI can also be deployed for predicting the likelihood of natural disasters such as earthquakes and hurricanes and to optimise the response to these events to minimise the damage to renewable energy systems, by prompting the emergency response protocol of operating plants, a major part of which can also be AI-driven. AI can predict when EV batteries and other components will need maintenance or repair, allowing for proactive rather than reactive maintenance before the car becomes un-roadworthy and creates a safety hazard for the public.

Waste Management and Recycling

AI is routinely used to predict the likely lifespan of renewable energy systems and optimise the timing of their decommissioning and recycling. AI can be further used to optimise the recycling of materials used in renewable energy systems, such as solar panels, wind turbines, and hydroelectric dams, by identifying the most valuable materials in these systems and then determining the most efficient recycling processes.

Conclusion

AI is the frontier of our generation. It has the capacity to drive all aspects of life, including energy production-transmission, distribution and consumption, making the industry highly efficient and interactive. This is because of the enormous amount of historical data that the energy industry has collected over the years. In the new age, with application of AI, more renewable sources of energy can be discovered. The energy value chain can be mapped out and accounted for. AI can help us in our journey to achieve net zero. Waste can be minimised, and a quantum leap of societal efficiency can be achieved. There is a world of opportunity for AI in energy.

Artificial Intelligence and Its Relevance in Fake News and Deepafakes : A Perspective

Prof. Amrita Mitra Mukherjee

Faculty, Globsyn Business School, Kolkata

Abstract

With the constant technological up gradation of the world, it has suddenly become the norm of the day to move to the forefront using Artificial Intelligence (AI). The ideas expressed in this paper cater to the fact that all is good so long the boundaries are set in media to use AI within a reasonable limit. The fact that fake news is now more popular than the real news, is what is more worrisome. The paper discusses how disinformation clearly sets the ball rolling and misinformation automatically creates the disruption in the society. Whether it is politics, personal space, campaigns or even Page 3 contents, the dissemination of fake news has been ubiquitous and has reached far enough to create an avalanche of miscommunication for the masses. With the rolling out of devices designed to use internet for their operation and AI enabled software to modify and dish out the sensation that can be created by disinformation, the world is now exposed to higher levels of fake news and it is growing in an alarming rate. "Deep fakes", an outcome of AI enabled communication, is a manipulative move, misappropriating channels of communication. The paper also looks into the possible solutions to combat the threat of fake news from influencing people, using AI.

Keywords: Disinformation, fake news, artificial intelligence (AI), deep fakes, misinformation

Introduction

Transmission of information has been extra-ordinarily affected since people are used to availing news across devices and with the help of internet. It has been the observation of the researchers of Oxford University, published through a report that there are concerns regarding using the social media to transfer misinformation, including private messaging app, for e.g. WhatsApp, to spread fake news. AI generated fake videos, images, content – deliberately used to mislead and provoke the sentiments of people are used to manipulate largely the power dynamics, with its holocaust effect on the understanding and belief of the mass that has been targeted. The aim of such AI generated fake news is to generate public acceptance and thereby create the desired result of hegemony, chaos and counterproductive revolution. The challenge lies in working out solutions for them.

How disinformation is a shot in the arm to misinformation

On the onset, one must understand the difference between disinfor-mation and misinformation to understand how the former dislodges information to create misinformation. According to Wardle (2017), misinformation refers to *"the inadvertent sharing of false information"*, while disinformation can be defined as *"the deliberate creation and sharing of information known to be false"*.[1] It is noteworthy that only the 'intention' is what separates disinformation from misinformation. Both aim at spreading fake news and false information. The only difference is, disinformation has deliberate intention to cater to a group or to the mass with specific intention, whereas misinformation aims at just spreading the fake news, in general.

Notwithstanding the fact that the execution is more or less the same, we can't but agree that

disinformation is definitely a catalyst to sustain misinformation. Not just sustain, but also expand further, the negative aspect of misinformation by synchronizing disinformation at levels where it would be prudent to serve the purpose. It is also noteworthy that the lack of governance in maintaining what should be generated and what should be in embargo, has added on to the widespread prevalence.

How has AI been instrumental in furtherance of fake news

Generative AI has been instrumental in creating the upsurge of doctored content, creating discord among public. However, on the flip side we have the possibility of detection of the fake news using AI again. In the newsroom the journalists generally fall back onto AI as a part of their design process which can create info graphics, illustrations and images.

It gives an advantage of staying cost-effective with high end production. No wonder the visuals idealize the best narratives and thereby the production has better audience engagement. However, by mystifying the AI tools, the battle of using AI to generate and combat fake news or deep fakes have become even tougher. The production of AI generated fake news has contributed to data driven information avalanche where there is a blurred frontier of truth and falsehood.

A country like that of India, is a greater sufferer, since there are language variants and the penetration in the social strata is higher because AI is capable of generating deep fakes over internet using AI bots and tools and that is indeed capable conjuring evidences which are not original. This is a serious threat that is pre-empted by the people in media and the thinking minds who have been foreseeing this vindictive side of AI in its nascent state.

'Deepfakes' : AI has the power to create

"This is the first time we've seen this in the wild," said Jack Stubbs, the vice president of intelligence at Graphika, a research firm that studies disinformation.[2] This was after the two broadcasters for a news outlet called Wolfnews, using computer generated avatars did broadcast how an avatar maligned The USA for lacking actions against gun violence, and the other spoke of China's role in geopolitics at an international summit meeting. Pro-China bot accounts distributed these videos a year later on Twitter and Facebook. This was taken cognizance as they looked like fictitious people and this was the first known instance of deepfake technology.

The progression of this technology has been steady. Deepfakes may alter geo-politics dynamics. Let's take the example of Volodymyr Zelenskyy, who is seen urging the military to lay down their weapons and surrender to the invading forces.[3] Zelenskyy's office was quick at disapproving its authenticity. It was clear that the Russian propagandist had taken to deepfakes in order to create disinformation and resultantly create dissent, confusion and distrust. This is an adversity that can be curbed by thinking of AI as a saver of the situation.

AI as an affirmative tool to curb fake news/deepfakes

Undoubtedly AI can be used to breach the sanctity of information but AI can also be used to curb the fake news or the deepfakes. If we take India, existing laws of IT, Copyright and Data Protection Act 23 can be used to counter

[1]Claire Wardle, https://medium.com/1st-draft/fake-news-its-complicated-d0f773766c79

[2]Adam Satariano and Paul Mozur, https://www.nytimes.com/2023/02/07/technology/artificial-intelligence-training-deepfake.html

[3]BUFFETT BRIEF • JULY 2023 https://buffett.northwestern.edu/documents/buffett-brief_the-rise-of-ai-and-deepfake-technology.pdf

the problem. India has started using various technologies to detect, verify and counter deepfake contents using blockchain, digital watermarking and other forms of AI. What is required is a consistent analysis of quality and authenticity of the videos and images, which is possible through the implementation of various AI tools. Blockchain cannot be ruled out either as recorded data in blockchain technology cannot be altered. Distribution of deepfakes also needs to be arrested and better implementation of cyber laws can enhance the possibility of reduction of fake news and deepfakes all over the world. No doubt Generative AI is better in efficiency to create the deepfakes, but a combination of art and science can also help in restricting the proliferation. First it is required

to detect and identify looking at the gross level the discrepancies of not being a human and then examining the metadata of the video or audio file to determine any manipulation or alteration. Spoofing attacks can be curbed by companies making overwhelming attempts through Cyber security and Infrastructure Security Agency. The future of AI is questioned because it is difficult to predict if ever deepfake attacks can be totally curtailed. No wonder the world is aware of the turmoil AI can create in the area of deepfakes and fake news and thereby is and will be consistently working to combat the nuisance that AI can create. The aforementioned remedies are just the beginning since AI will be pitted against AI and the exploration will continue to stop the menace.

Transformative Role of AI Powerful Grid

Chandrim Banerjee

Advisor to Min. of Power, Govt. of India

The global energy sector, which encompasses thousands of private and public enterprises and companies, is currently facing challenges. Let's view some of them to find out how AI can help solve these:

Carbon emissions: According to the International Energy Agency's report, global CO2 emissions rebounded to the highest level in history, with an annual growth of 6%. The global growth in energy demand was cited as one of the primary reasons for such an unprecedented increase. Even though there is no one-size-fits-all solution to reduce CO2 emissions, Artificial Intelligence in energy can help develop cleaner production processes, enhance monitoring and compliance standards for fossils, and create targeted mitigation strategies.

High centralization : The global energy network relies more on major grids and highly centralized providers than ever before. Such a centralization scale poses several challenges for sustainable development. The possibility of creating smaller, interconnected networks of energy grids powered by AI is a go-to option for reducing the reliance on central utilities. This way, Artificial Intelligence in the energy sector can balance the supply needs in real-time and ensure the resilience of power resources in the long run.

Smooth transition to renewables : Regardless of projections, the share of renewables in power generation will increase from 44% to a highly-optimistic 80% by 2050. With more breakthroughs and massive adoption of solar and onshore wind technologies, ensuring a smooth transition is crucial. AI in energy contributes to the real-time monitoring of power grids, more accurate predictions of power fluctuations, and the development of new strategies to work with geothermal energy sources.

But before jumping to conclusions, it's equally vital to understand that the mere application of AI to the energy project won't solve all problems at once. The well-thought, researched, and integrated approach, combined with Data Science and Machine Learning programs, will show more noticeable results. Let's move on and view the critical advantages of AI in energy.

One of the most common uses for AI by the energy sector has been to improve predictions of supply and demand. Developing a greater understanding of both when renewable power is available and when it's needed is crucial for next-generation power systems. Yet this can be complicated for renewable technologies, since the sun doesn't always shine, and the wind doesn't always blow. That's where machine learning can play a role. It can help match variable supply with rising and falling demand – maximising the financial value of renewable energy and allowing it to be integrated more easily into the grid.

To address this, Google and its AI subsidiary DeepMind developed a neural network in 2019 to increase the accuracy of forecasts for its 700 MW renewable power plant. Based on historical data, the network developed a model to predict future output up to 36 hours in advance with much greater accuracy than was previously possible. This greater visibility allows Google to sell its power in advance, rather than in real time. The company has stated that this, along with other AI-facilitated efficiencies, has increased the financial value of its wind power by 20%.

Additionally, with a more accurate picture of peaks in output, consumers are able to shift the timing of peak consumption and doing so avoids the need to buy additional power from the market. This capacity, if expanded more widely, could have a significant impact on the promotion of load shifting and peak shaving – especially if combined with better demand forecasts. For example, Swiss manufacturer ABB has developed an AI-enabled energy demand forecasting application that allows commercial building managers to avoid peak charges and benefit from time-of-use tariffs.

AI and machine learning can unlock flexibility by forecasting supply and demand

Another key AI application is predictive maintenance, where the performance of energy assets is continuously monitored and analysed to identify potential faults ahead of time. Maintenance typically happens on a regular schedule; poles on a transmission line, for example, might be examined once within a pre-defined period and repairs carried out as needed. This one-size-fits-all approach can lead to inefficiencies if maintenance happens too early or, more problematically, too late. To address this, a range of utilities are developing AI-enabled schemes to help monitor physical assets and use past data on performance and outages to predict when intervention is required. Utility company E.ON, for instance, has developed a machine learning algorithm to predict when medium voltage cables in the grid need to replaced, using data from a range of sources to identify patterns in electricity generation and flag any inconsistencies. E.ON's research suggests that predictive maintenance could reduce outages in the grid by up to 30% compared with a conventional approach.

Similarly, in 2019 Italy-based utility Enel began installing sensors on power lines to monitor vibration levels. Machine learning algorithms allowed Enel to identify potential problems from the resulting data and discern what caused

them. As a result, Enel has been able to reduce the number of power outages on these cables by 15%. Meanwhile, Estonian technology startup Hepta Airborne uses a machine learning platform with drone footage of transmission lines to identify defects, and State Grid Corporation of China uses AI extensively to carry out actions such as analysing data from smart meters to identify problems with customers' equipment.

Potential uses for AI across power systems are likely to soar in the years to come. In addition to better forecasting of energy supply and demand and predictive maintenance of physical assets, applications could include:

- Managing and controlling grids, using an array of data from sensors, smart meters and other internet-of-things devices to observe and control the flow of power in the network, particularly at the distribution level.

- Facilitating demand response, using a range of processes such as forecasting electricity prices, scheduling and controlling response loads, and setting dynamic pricing.

- Providing improved or expanded consumer services, using AI or machine learning processes in apps and online chatbots to better customers' billing experiences, for instance.

AI can also prevent grid failures, increasing reliability and security The technology will enable digitalisation, but addressing risk is also essential

Without AI, system operators and utilities will only be able to make effective use of a fraction of the new data sources and processes offered by emerging digital technologies, and they will miss out on a significant proportion of the benefits on offer. However, risks associated with AI must also be considered and addressed before the technology is scaled across the sector. These include, but are not limited to, threats to cybersecurity and privacy, the influence of

biases or errors in data, and miscorrelations due to insufficient training, data or coding mistakes.

The availability of workers with the right skills is a significant challenge for any sector looking to tap AI's potential. The energy industry will need to compete to recruit the best data scientists and programmers, while firms looking to retain staff that understand the sector should consider uptraining and reskilling parts of their existing workforce.

Digital training courses, supported by governments with input from the private sector, will be vital to these efforts. However, the availability and quality of such courses is not yet consistent across the largest global economies. For AI to be an effective ally towards efficient, decarbonised and resilient power systems, governments will also need to develop mechanisms for data sharing and governance.

A coordinated global approach can enable internationally applicable and replicable solutions, transfer learnings globally, and expedite the energy transition while reducing its costs. Currently, the most ambitious projects are concerned with a smart grid, energy-efficiency programs, digital twins, and renewable energy integration.

Smart grid

A smart grid is a new approach to energy efficiency networks, capitalizing on the two-way flow of electricity and data. The main difference from the usual networks is the implementation of AI, Cloud, and digital technologies that support control and self-regulation. One of the prominent examples of the smart grid is the cooperation between London's National Grid and IBM's cloud-based analytics. The smart grid provides preventive and predictive maintenance, which are crucial parameters of the grid's functionality. Overall, the AI-powered smart grid helps provide more precise forecasting, displaying higher resilience and improved security for the grid.

Energy-efficiency programs

Energy efficiency, one of the Sustainable Development Goals, should be treated seriously. AI-powered energy efficiency programs oversee energy usage, provide a framework for smart forecasting, and regulate usage during peak hours. When using model-based predictive control, it's possible to yield an energy-efficiency improvement of 10.2% to 40%. Predictive analytics and Machine Learning can present up-to-the-point predictions. Consequently, these estimates are used for designing and implementing energy efficiency plans at the company, municipality, or state levels.

Digital twins

Digital twins were seen as the life-saving framework for the industrial energy complex. A digital twin refers to the multi-dimensional visual representation of a process, facility, or physical object. These digital twins act like real-time virtual models that present more research possibilities than simulations. In the energy and Artificial Intelligence sector, digital twins help study wind turbines and power-generation facilities. Using AI, a digital twin can be a step forward in better servicing, experimenting, maintaining, and optimizing the energy network, either traditional or renewable.

Leveraging AI for a Sustainable and Greener Tomorrow

Prof. Saptarsi Ganguly

Faculty, Globsyn Business School, Kolkata

Prof. Doyel Mukherjee Prodhan

Faculty, Globsyn Business School, Kolkata

Introduction

Before observing the influence of Artificial intelligence on sustainability, it is healthier to twig the two conceptions exclusively. The first concept that is to be taken into consideration is Artificial Intelligence. As far as AI is concerned, it was first familiarized to humanity by Warren McCulloch in 1943 CE. At that point in time it was called 'Artificial Neurons'. After that there had been more than a few vicissitudes and adaptations to the concept especially during the post-World War II era and during the cold War (Schuett, 2019). However, the technology lacked modernization and dimensions then thereby the arrival of the technology had to bear a long cooling period of around 6 years which is also known as the 'AI winter.' It is from 2011 CE that the world had started to witness a major spring in the technology of AI. AI is nothing but the antonym of human intelligence. It aims to deliver an enhanced yield at everything than what a human mind could undertake. However, till date it can only do what is nursed to its system by humans (Caradonna, 2022). On the other hand, sustainability is the progression of safeguarding that ecological, economical and human health is well-maintained in the long-run. The study aims to accomplish a correspondence between the two conceptions of AI and sustainability in this regard.

How will AI make a sustainable future?

Sustainability is currently a widely discussed topic worldwide. The current global trend revolves around sustainability or environmentally friendly practices. Sustainability entails fulfilling the needs of the present generation without jeopardizing the ability of future generations to meet their own (Brundtland Commission, 1987). The rising challenges of Global Warming coupled with pollution and loss of bio diversity and growing environmental concerns are compelling organizations across all sectors to adopt sustainable business practices.

In this multi-hyphenated business landscape and competitive environment, an organization's success is often defined by its socio economic and environmental contributions rather than profitable business outputs. However, the organizations are often faced with the challenge of how to measure their sustainable practices leading to positive outcomes. Here comes Artificial Intelligence which plays a pivotal role in helping businesses measure their greener outcomes.

So what does AI actually refer to?

Artificial Intelligence is a branch of science which involves machines or computer systems simulating human intelligence processes, with the capability to enhance themselves iteratively by constructing and improving models from gathered information (PK, 1984).

AI plays a pivotal role in fostering a sustainable future across various domains. Its integration into diverse sectors contributes significantly to addressing environmental challenges and promoting sustainable practices.

Various AI algorithms and models can help in optimizing energy consumption in buildings. It has given birth to life altering interventions like smart homes, autonomously controlling lighting or heating based on specific timings, usage patterns and temperatures.

The different predictive models and machine learning algorithms in AI enable improved forecasting of energy production from renewable sources of energy like wind, solar, hydel etc.

It also has the potential to address grave environmental issues ranging from creating energy efficient structure, to monitoring deforestation and biodiversity and optimizing the use of renewable energy. AI algorithms analyse extensive datasets and assist various stakeholders, including climate regulatory bodies and other decision-making organizations, in collecting crucial data on worldwide emissions, as well as monitoring air and water quality through satellite monitoring.

In this regard a breakthrough has been introduced by UNEP by launching WESR (World Environment Situation Room) which is a digital platform that searches, aggregates, analyses and visualizes the best available earth observations and represents real-time information as well as future predictions regarding carbon foot prints, atmospheric CO_2 concentration, glacier meltdown and sea level rises.
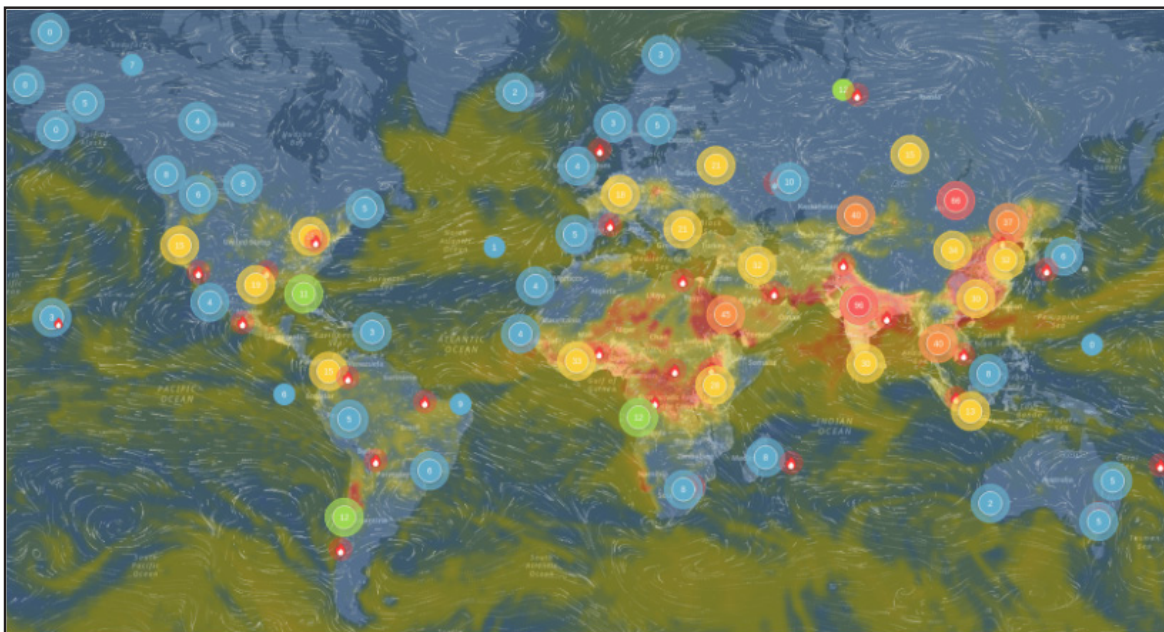
Image Courtesy: UNEP

According to a research conducted by PwC UK, applications and integration of AI across various sectors such as energy, transportation, waste management has the potential to lead to a 4% reduction in Global Greenhouse Gas emissions by 2030. Therefore, by leveraging the capabilities of AI in these and other areas, we can create innovative solutions to address global challenges and move towards a more sustainable and resilient future.

AI's impact on Radiation and Emission

In the pursuit of sustainable future, Artificial Intelligence emerges as a transformative force in addressing the pressing challenges of harmful radiations and emissions across diverse industries. From intelligent systems that monitor and control emissions in industrial settings to predictive algorithms optimizing transportation networks for reduced fuel consumption, AI is instrumental in mitigating the detrimental

impacts of radiation and emissions. Moreover, owing to its unique capability to collect and analyze large, complex datasets on emissions, radiations and climate changes, it can support all concerned stakeholders to take more precise and data driven decisions to control their emissions thus leading to a greener and cleaner future.

In a global survey conducted by Boston Consulting Group (BCG) in May 2022, 87% of leaders in both public and private sectors dedicated to climate and AI expressed a positive perception of AI as a valuable instrument in combating climate change. Additionally, 43% indicated their ability to foresee the integration of AI in their respective organizations' initiatives aimed at addressing climate changes and emission.

Exhibit 1 - Public- and Private-Sector Leaders Who Oversee Climate and AI Topics Support Using AI to Fight Climate Change

Source: BCG Climate AI Survey, May 2022

Due to the onset of the Covid-19 pandemic, the healthcare industry has become a significant contributor to the worldwide radiation load through the utilization of diverse advanced medical imaging techniques. Nevertheless, contemporary AI technology plays a crucial role in mitigating the radiation impact while upholding diagnostic precision (Hu et al., 2023)

Contrastingly, the extensive computational power needed for advanced AI technology, researching, and training predictive data models results in significant carbon emissions. For instance, various global cryptocurrency applications alone consume an annual energy amount equivalent to that of an entire nation. Furthermore, the data centers responsible for monitoring diverse global emissions demand substantial volumes of water for cooling purposes. All of these factors stand in contradiction to the fundamental principles

of achieving a sustainable or environmentally friendly future.

Therefore, while Artificial Intelligence holds immense potential in addressing environmental challenges, it is crucial to recognize that complete reliance on AI solutions may have adverse effects, especially considering the significant environmental footprint associated with advanced technologies.

Artificial Intelligence and impact on economic growth

Artificial Intelligence has become a pre-dominant indispensable for any organization to blossom in the modern-day corporate edifice. The advent of Artificial Intelligence has rehabilitated the game of business as far as maneuvers is concerned. In such a consequence it has become germane to discern how the insertion of Artificial Intelligence has fetched a

change in the field of basic business procedures such as manufacturing, logistics, inventory management and so on. It has to be assumed in this regard that AI systematizes things in a more expedient and structured way provided that it has been provided with the correct and pertinent stimuluses and guidelines (Gonzales, Implications of AI innovation on economic growth: a panel data study 2023). The amount of human interposition required in the field of business has been minimized after the introduction of AI, at least as far as the concerned stated fields of manufacturing and logistics is concerned. This, in due course aids in ensuring economic growth to some extent for countries in which it is implemented.

Contribution to Economic Growth from the demand and supply side

AI has been showing traits that countenances the industry to venture that it has the aptitude to stimulate both demand and supply of goods and services thereby increasing the economic growth of any economy. As far as the intensification in supply is concerned, AI tends to upsurge the overall productivity of an organization by the automation of the manufacture procedure by instigating automatons and self-driving automobiles and apparatuses (Gonzales, Implications of AI innovation on economic growth: a panel data study 2023). It tends to generate demand through personalized marketing. Artificial Intelligence tends to advertise to specific individuals on the basis of their specific search preferences and history. It ensures that the correct product is advertised to the correct person (Gonzales, Implications of AI innovation on economic growth: a panel data study 2023).

Ability to uphold the manufacturing process

The introduction of technologies in the business has changed the entire dynamics of the same and renamed it as 'Industry 4.0'. The initiation of technologies such as big data analysis, IOT, cloud computing and 5G has transmuted the manufacturing progression into a singular-cyber-physical arrangement (Szczepański, Economic impacts of artificial intelligence (AI) 2019).

Conclusion

The study in hand, concludes with the understandings of the basic concepts of Artificial Intelligence and the effects of the same on the modern-day business.

Will AI be a prospect or an apprehension?

Artificial Intelligence has become the talk of the hour. Since the initiation of AI, the entire business scenario has changed. Be it the production process or marketing, nothing remains the way it used to. The complete amendment in the industry due to the annexation of AI has taken the industry towards 'Industry 4.0'. However, the consequences of the toting of AI in business is yet to be appraised. It is not that all consequences would be optimistic in this regard. There can be certain aspects of the same which would cause an undesirable upshot. Same goes for global sustainability. Though there are numerous recompenses of adding AI to augment sustainability, there could be several adversities as well of the same. This is something that is yet to be estimated through trial and testing. The test of time would be the unsurpassed route to quantify the possessions of AI on business in precise and economic growth and sustainability in general.

The concept of AI had come as early as in the 1950s. However, there had been huge loss of funding due to the incapacity of the then technology. This phenomenon was named as the AI winter back then. Will another AI winter come in the recent future? Nobody knows as of now. The intelligence mapping of AI is snowballing day by day and as an outcome of that the expectations of the general public from these technologies is increasing. Therefore, things that were considered to be impressive a year ago

are becoming normal habits of end consumers today. This creates a sense of insecurity in the industry as to how much artificial intelligence is too much artificial intelligence. The whole crux of the argument is that it can be foreseen that the know-how of AI might get inundated in the near future.

In the end, it can be clinched that the panorama or uneasiness of AI depends on the test of time and the routines of civilization as far as economic growth and sustainability is concerned.

References

- Caradonna, J. L. (2022). Sustainability: A history. Oxford University Press.

- Gonzales, J. T. (2023). Implications of AI innovation on economic growth: a panel data study. Journal of Economic Structures, 12. https://doi.org/https://doi.org/10.1186/s40008-023-00307-w

- Schuett, J. (2019). A legal definition of AI. arXiv preprint arXiv:1909.01095.

- Szczepański, M. (2019). Economic impacts of artificial intelligence (AI). European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637967/EPRS_BRI(2019)637967_EN.pdf

- Brundtland, Gro Harlem. "Our common future—Call for action." Environmental conservation 14.4 (1987): 291-294

- PK, FATHIMA ANJILA. "What is artificial intelligence?." "Success is no accident. It is hard work, perseverance, learning, studying, sacrifice and most of all, love of what you are doing or learning to do". (1984): 65.

- https://www.unep.org/news-and-stories/story/how-artificial-intelligence-helping-tackle-environmental-challenges

- https://www.pwc.co.uk/services/sustainability-climate-change/insights/how-ai-future-can-enable-sustainable-future.html

- https://web-assets.bcg.com/ff/d7/90b70d9f405fa2b67c8498ed39f3/ai-for-the-planet-bcg-report-july-2022.pdf

- Hu, J., Mougiakakou, S., Xue, S. et al. Artificial intelligence for reducing the radiation burden of medical imaging for the diagnosis of coronavirus disease. Eur. Phys. J. Plus 138, 391 (2023). https://doi.org/10.1140/epjp/s13360-023-03745-4

Case Studies

AI-Powered Transformation in Indian E-commerce: Blinkit's Innovative Leap

Sreshtha Roy Gupta & Sucharita Mitra

Student, Globsyn Business School, Kolkata

Introduction

To say Artificial Intelligence is the talk of the town would be the understatement of the century. It encompasses the nooks and crannies of our lives either directly or indirectly. Britannica defines Artificial Intelligence as "the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings…endowed with the intellectual processes characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experience".

When we mention the word AI, we usually visualize the likes of Sophia the robot, the cute little Japanese waiter robots or the movie "The Matrix". These are all indeed brilliant examples of AI but arguably the best kind of AI are the ones so ingrained in our daily convenience, it barely takes notice. The type of AI we are discussing today is in E-Commerce. The rise of AI has significantly affected a lot of sectors in the world and the e-commerce sector is no exception. The use of AI has stepped up the customer service game to its peak. With arsenals like personalization, operational efficiency, and customer satisfaction in its ambit, the tool promises higher conversion rates, higher click-through rates, optimized inventories, and reduced overstocking. Each of these are foolproof game changers in the market for companies to become successful, and AI is bridging the gap.

How are e-commerce platforms nowadays using Artificial Intelligence?

Catering to 8.1 billion people who has equally numerous options to choose services from, each company is fighting tooth and nail to grab each customer's attention and loyalty. The winning company wins by a fraction of a difference in services. Thus, the advent of AI is such a big deal. AI promises service and customer satisfaction that was hitherto undreamt of, and which has now become a necessity for each company.

In e-commerce, AI ensures success as seen below-

- **Building a Loyal Customer Base:** By analysing consumer data, artificial intelligence (AI) customises the shopping experience through dynamic pricing, targeted marketing, and personalised suggestions, increasing customer pleasure and loyalty.

- **Recognising client needs:** AI examines browsing patterns, past purchases, and comments to obtain important information about the preferences and problems of customers. Initiatives in customer service, marketing, and product development are all influenced by this data.

- **Real-time insights and adaptability:** Artificial intelligence (AI) is a tool that continuously analyses data to give organisations insights into market trends, rival activity, and consumer behaviour. This makes it possible to quickly modify plans and products, keeping companies on the cutting edge.

- **24/7 customer support:** AI-powered chatbots and virtual assistants provide round-the-clock customer service by managing straightforward requests, responding to simple inquiries, and making product

recommendations. This improves overall customer satisfaction while freeing up human reps for more complicated concerns.

- **Beyond the basics:** Chatbots are fast evolving, even if they presently do mundane duties. AI-powered assistants who can comprehend complicated questions, provide individualised advice, and even recognise emotional indicators are a promising development for the future.

- **Predictive consumer behaviour:** AI systems are able to forecast what things people will buy, how they will act when shopping, and how firms may establish trusting bonds with them. This translates into proactive customer care, customised product recommendations, and focused marketing initiatives.

- **Meeting client demands:** AI enables companies to customize their products and services to satisfy clients at any time or place by evaluating consumer satisfaction data and comprehending their needs. This creates a win-win situation where people and machines work together to boost revenue and profitability.

In this report, we are going to focus on India and the Indian E-commerce company, Blinkit, to understand how the big-name companies are going about utilizing the AI technology for their success.

Use of Artificial Intelligence by Blinkit- A grocery delivery platform by Zomato

Blinkit, initially founded as Grofers in December 2013 by Albinder Dhindsa and Saurabh Kumar, and acquired by Zomato in 2022, specializes in delivering various items like groceries, fresh produce, meat, stationery, bakery goods, personal care items, baby and pet care products, snacks, flowers, and more throughout India.

Blinkit and Zomato are at the forefront of using AI to transform food and grocery delivery experiences. Their adoption of generative AI and

focus on machine learning represent significant advancements in the domains of fast-food delivery and online shopping. Both companies aim to improve customer satisfaction, streamline operations, and bring creative solutions by incorporating AI into their systems.

Blinkit's parent company Zomato has reportedly collaborated with tech giants like Google, Adobe, OpenAI, and Microsoft for its AI product development.

The current usage of AI by Blinkit is as follows:

Machine Learning (ML): Blinkit's AI is a triple threat- it outsmarts traffic for speedy deliveries, helps in giving personalized service to customers, minimizes waste, and keeps shelves stocked.

Blinkit has developed a strong predictive system to anticipate demand, ensuring the availability of appropriate products in specific locations. This system utilizes GIS (Geographical Information System) to optimize Blinkit's supply chain, benefitting both customers and the delivery team. It enables Blinkit to perform anomaly detection for addresses, manage service boundaries intelligently, and create efficient delivery routes using advanced techniques such as time windows and capacity-based vehicle routing. Additionally, Blinkit has designed models for estimating the effort required for order processing in warehouses, allowing real-time capacity management and effective manpower planning.

a. Delivery time prediction: Blinkit's AI goes beyond planning delivery routes; it anticipates them by analyzing historical data and current traffic information. Through this predictive analysis, AI optimizes delivery routes and assigns orders to riders in real-time, reducing delivery durations and maximizing resource utilization. By considering variables such as traffic conditions, rider availability, weather fluctuations, and order urgency, it dynamically plans the most efficient delivery

routes. Consequently, this approach also contributes to reducing fuel consumption.

b. Demand Forecasting: AI anticipates product demand by examining past purchases, seasonal variations, and local preferences. This aids Blinkit in maintaining optimal inventory levels, reducing waste, and ensuring products are available when needed—achieving precision in stocking the right products in suitable quantities at the appropriate times. By analyzing customers' purchasing histories, AI identifies frequently chosen items, individual preferences, and seasonal patterns, enabling predictions of future demand for specific products and categories. AI incorporates location-specific elements such as community inclinations, cultural events, and weather conditions. This insight helps in identifying products likely to be in high demand in specific areas. Real-time data like social media trends, news updates, and weather forecasts are monitored by AI to detect sudden increases in demand for particular products. This allows Blinkit to respond and adjust inventory levels as necessary promptly.

c. Personalization: Blinkit's machine learning utilizes user preferences and shopping behaviors to personalize the grocery shopping journey. This includes suggesting frequently purchased items and providing alternatives if something is unavailable. The AI doesn't just comprehend what users buy but also how they make purchases. It observes item frequency, preferred brands, and even buying patterns to anticipate future needs, proposing "smart refills" before supplies run low. This functionality is akin to how Amazon suggests products based on past purchases or views. The AI dynamically adjusts the app or website interface according to individual preferences, enhancing navigation similarly to how social media platforms modify content based on user interactions.

Natural Language Processing (NLP): NLP, or Natural Language Processing, enables AI-driven chatbot called "Blinkbuddy" to manage customer inquiries and solve problems around the clock, decreasing the necessity for human customer support. Voice-activated shopping has emerged as a feasible option. Blinkit's AI helpers comprehend spoken commands, suggest alternative products when items are unavailable, and nowadays even provide ingredient lists for various recipes.

Intelligent Automation using AI: Intelligent Automation employing AI aids Blinkit in integrating artificial intelligence technologies into automated processes, boosting efficiency, precision, and flexibility across a range of tasks.

a. Dynamic Pricing: Blinkit's AI has the capability to modify prices in response to demand, supply, user actions, and additional market factors. This enables Blinkit and its sellers to utilize the platform for competitive pricing and revenue optimization.

b. Personalized Offers and Promotions: AI employed RL (Reinforcement Learning) algorithms tailor offers and promotions to users by considering their buying history and preferences, boosting both engagement and sales. Additionally, this assists sellers in effectively marketing their products to the most suitable customers.

c. Automating the supply chain: Blinkit is considering AI implementation for automating the selection and packaging of groceries. Moreover, Blinkit's technology infrastructure provides the adaptability to promptly respond and adjust the supply chain to manage diverse constraints and opportunities within operational activities. [7]

The recent technical developments of Blinkit: Advanced AI models like OpenAI's ChatGPT, Midjourney's image generation engine, and Google's BARD have gained significant popularity for their ability to tackle intricate

inquiries, code writing, and content generation using expansive language models that comprehend basic text inputs to provide human-like responses. Leveraging these technologies, Blinkit has introduced several new features in their offerings.

a. Recipe Rover- Blinkit's AI-driven recipe generation engine: Blinkit introduced Recipe Rover, an AI engine using ChatGPT and Midjourney tech. It suggests recipes and locates ingredients by leveraging vector search. This feature ensures customers find ingredients available for immediate use, streamlining the process. By extracting ingredients from AI-generated recipes and cross-referencing them with Blinkit's available products, vector search ensures customers only see recipes they can prepare immediately. This intelligent matching of ingredients enables Blinkit to assist customers in finding all necessary ingredients in one place. The app displays recipe cards with available ingredients, nutrition info, and cooking steps for popular searches. It also offers an auto-suggest function for personalized dish recommendations and showcases daily rotating dishes on the homepage for ongoing variety.

b. India's inaugural Instant Print Delivery Store, utilizing IoT for doorstep printout delivery: Blinkit inaugurated India's pioneering Instant Print Delivery Store, employing IoT for doorstep printouts. The technology, powered by affordable IoT-friendly hardware like the Raspberry Pi, manages data flow, interpreting commands for print actions (e.g., double-sided, color, A4) received in JSON format from the backend services. Due to the printer's inability to transmit telemetry data, a controller service handles this function along with retry policies and hardware recovery in case of glitches. This service enables seamless updates and maintenance without human intervention. To maintain data persistence, a proxy printing service, acting as middleware, organizes and queues data received from the controller service for printing, utilizing Google's gRPC framework for connections. To secure customer data, Blinkit developed a feature that immediately erases files once printed, ensuring confidentiality in handling sensitive documents.

Conclusion

The infusion of Artificial Intelligence (AI) into the realm of e-commerce has sparked a remarkable shift, completely transforming how customers interact, operations are managed, and overall efficiency is optimized. Blinkit, an Indian online shopping platform specializing in grocery deliveries, stands out for its innovative application of AI technologies, reshaping the established conventions of digital shopping.

By adeptly employing Machine Learning (ML), Natural Language Processing (NLP), and smart automation, Blinkit has surpassed traditional boundaries, offering a personalized and seamless shopping experience. The implementation of predictive algorithms for estimating delivery times and predicting demand hasn't just sped up deliveries but has also ensured better inventory management, minimizing waste and boosting customer satisfaction.

Furthermore, Blinkit's integration of AI-driven personalization, seen in tailored product suggestions and adaptable user interfaces, has heightened customer engagement and fostered loyalty. Their inventive features like Recipe Rover, an AI-generated recipe engine, and the introduction of India's inaugural Instant Print Delivery Store, highlight Blinkit's commitment to embracing cutting-edge technologies to meet the evolving demands of customers.

Partnerships with industry leaders and strategic collaborations have propelled Blinkit's AI initiatives, allowing the platform to maintain a leading position in technological innovation within e-commerce. By seamlessly integrating

AI into its operations, Blinkit hasn't just streamlined procedures but has also paved the way for a more efficient, responsive, and customer-centric environment.

In the constantly evolving e-commerce landscape, Blinkit serves as a testament to the potential of AI-powered solutions in reshaping the standards of convenience, dependability, and advancement. As Blinkit continues harnessing the potential of AI, it remains ready to set new benchmarks, reshaping the future of online grocery delivery and influencing the broader e-commerce industry.

Recommendations

● Enhancement in Chatbot Functionality: Blinkit should aim to elevate customer experiences by refining its AI-powered chatbot, "Blinkbuddy." This might entail enhancing multilingual capabilities to encompass more Indian languages, expanding customer service reach for greater accessibility. Additionally, sentiment analysis involving scrutinizing feedback from social media and reviews to pinpoint improvement areas and tackle prevalent concerns can be implemented. To ensure inclusivity, efforts can be made to optimize chatbots for users with disabilities, integrating features compatible with screen readers and assistive technologies. Moreover, it is essential to create a chatbot that doesn't just provide customer support but also offers suggestions. For instance, integrating Recipe Rover into the chatbot interface will allow users to request recipe recommendations directly, expanding the chatbot's capabilities beyond its conventional role of providing customer support to offer a variety of suggestions.

● Avenues for improvement in the machine learning domain: Improving machine learning within Blinkit might involve refining delivery time predictions and enhancing route planning efficiency. This can be achieved by analyzing historical and real-time traffic data in more detail, considering factors like road conditions for better route optimization. Introducing adaptable machine learning models to handle unexpected changes, such as sudden traffic or variations in rider availability, would further enhance delivery precision. Additionally, refining algorithms to capture subtle patterns, like emerging social media trends or local events affecting customer buying habits, can enhance predictive accuracy. Utilizing more real-time data sources and agile algorithms to respond swiftly to sudden surges in demand can optimize inventory management. Further advancements include a deeper analysis of user behavior, where advanced recommendation systems considering browsing patterns, wish lists, and time-sensitive preferences can provide more personalized suggestions.

● Providing insights on AI recommendations: Enabling users to understand the rationale behind AI recommendations can foster trust and promote greater user interaction with AI-driven functionalities. This transparency, such as revealing the basis for suggested items or the method used for estimating delivery times, has the potential to enhance user satisfaction. Additionally, granting users the ability to manage and customize AI-powered functionalities, like personalizing recommendation algorithms or manually adjusting AI-proposed substitutions, empowers users and enhances the overall intuitiveness of the user experience.

References

■ **Research Papers**

● Akter, S., Dastagir, M. I., & Sarker, I. H. (2020). Artificial intelligence in e-commerce: A critical review of research and practice.

Journal of High Technology Management Research, 21(1), 1-19.

● Chen, Y., Li, S., & Wang, Y. (2020). Voice search and online shopping: A review and research agenda. Electronic Commerce Research and Applications, 40, 100821.

● Duan, Y., Li, J., Huang, Z., & Su, Y. (2019). Chatbots, e-commerce, and customer service: A review of the literature. Journal of the Association for Information Systems, 20(3), 673-718.

● Saikat Gochhait, O. Mazumdar, S. Chahal, P. Kanwat, S. Gupta, R. Sharma, V. Pandit, R. Brahma & R. Sachan. Role of Artificial Intelligence (AI) in Understanding the Behavior Pattern: A Study on E-Commerce.

■ **Web References**

● https://asianatimes.com/zomato-powerful-generative-ai-to-enhance-32-customer/

● https://blinkit.com/aboutus

● https://blinkit.com/blog/building-technology-first-company

● https://blinkit.com/blog/indias-first-instant-print-delivery-store-leveraging-iot-deliver-printouts-your-doorstep

● https://blinkit.com/blog/recipe-rover

● https://inc42.com/buzz/after-blinkit-zomato-starts-experimenting-generative-ai/

● https://startupnews.fyi/2023/06/08/zomato-ventures-into-generative-ai-to-enhance-food-delivery-platform-and-user-experience/

● https://www.bigcommerce.com/articles/ecommerce/ecommerce-ai/

● https://www.britannica.com/technology/artificial-intelligence

● https://www.geeksforgeeks.org/zomato-announces-10-minute-food-delivery-service/

● https://www.indiatoday.in/technology/news/story/zomato-and-blinkit-likely-to-get-ai-tools-to-improve-services-plan-to-hire-more-engineers-data-scientists-2390275-2023-06-08

● https://www.livemint.com/technology/apps/zomato-and-blinkit-set-to-take-the-next-leap-plans-to-introduce-generative-ai-to-enhance-its-services-claims-report-11686210619922.html

Assimilation of 'Artificial Intelligence' (AI) in 'Amazon' : An in depth Research Case Study

Subhajit Biswas

Student, Globsyn Business School, Kolkata

Introduction

Artificial Intelligence, commonly known as AI, involves replicating human-like intelligence through the implementation of software-driven heuristics and algorithms.

E commerce is a word frequently used in business rules these days. It represents the practice of buying and selling goods and services entirely online.

The Indian E commerce sector has experienced substantial growth in the past 4-5 years. In 2018, the market size stood at $38.5 billion and has since surged to $69.2 billion in 2022, showcasing a remarkable compound annual growth rate (CAGR) of 22.5 percent. Amazon India, a major contender in this arena, has played a pivotal role in fostering market expansion and developing the associated infrastructure. Amazon initiated its operations in India back in 2013, initially focusing on book sales. Over time, the business has expanded significantly.

Artificial intelligence plays a role in every stage of the customer experience in E commerce, beginning with a tailored E commerce homepage, extending through robot-assisted package sorting, and concluding with the delivery driver completing the drop-off. In the ever-evolving realm of E commerce, Amazon has emerged as a pioneer in harnessing the power of artificial intelligence (AI) to reshape and elevate various aspects of its operations. Amazon integrates AI into workplace safety initiatives, deploying over 750,000 robots to reduce physical strain on employees, thereby enhancing ergonomics and minimizing injuries. Logistics optimization sees the orchestration of the world's largest fleet of AI-driven mobile robots, streamlining inventory retrieval and ensuring seamless navigation. AI proves instrumental in revolutionizing last-mile delivery, with over 20 synchronized machine learning models enhancing route design and decision-making for efficient customer deliveries. In the fight against fraudulent activities, Amazon's AI scrutinizes diverse data sources to preemptively identify and thwart potentially deceptive practices, safeguarding the integrity of its platform. The innovative use of generative AI extends to ad creation, where advertisers can effortlessly generate brand-themed images, streamlining the creative process. Amazon's commitment to quality is evident in AI-driven damage detection, ensuring defective products are identified before shipping. Personalized product recommendations, extracted from extensive data analysis, contribute to increased customer satisfaction and sales. The optimization of the search bar through the A10 algorithm showcases Amazon's strategic use of AI, significantly boosting conversion rates and exemplifying its leadership in leveraging AI for optimal results.

Objectives

To investigate the transformative impact of AI on safety, logistics, and fraud prevention within Amazon's operational framework.

To examine AI's role in Amazon's pre-delivery preparations, focusing on its strategic implementation months before delivery commencement.

To evaluate the strategic integration of AI in customer interactions, advertising, and overall business performance, showcasing its comprehensive influence across diverse facets of Amazon's operations.

To analyse the improvements attributed to Amazon's strategic leveraging of artificial intelligence across its diverse operational domains.

Findings

A Comprehensive Exploration of Artificial Intelligence Implementation in Amazon's Ecosystem, and how artificial intelligence is shaping the future of the E commerce giant.

AI in workplace safety: Amazon has invested over $550 million in safety projects, utilizing over 750,000 robots to improve workplace safety by reducing physical strain on employees. Robotics, including AI and machine learning, contribute to workstation safety, minimizing repetitive motion injuries and enhancing ergonomics.

AI in Logistics: Artificial intelligence plays a pivotal role in Amazon's logistics, orchestrating the world's largest fleet of mobile industrial robots. These AI-driven systems enhance efficiency by optimizing inventory retrieval, facilitating seamless navigation for the entire robot fleet. Additionally, AI-powered robots like "Robin" assist in sorting packages based on their contents, ensuring a streamlined process from fulfillment centers to delivery stations, ultimately enhancing the customer's doorstep experience. Robin uses its AI enhanced vision system to understand what objects are there—different sized boxes, soft packages, and envelopes on top of each other.

AI in delivery optimization: Amazon tackles the intricate challenge of route design and optimization, crucial for diverse daily customer orders. Leveraging over 20 synchronized machine learning models, the company delves into generative AI and large language models

for last-mile delivery. This AI-driven approach streamlines driver decisions by enhancing customer delivery notes comprehension, particularly in sizable buildings. Furthermore, it empowers the system to grasp various attributes of a delivery address, such as building outlines and road entry points, aligning them seamlessly with the physical world for efficient deliveries. The impact of artificial intelligence is evident in simplifying and refining the complex logistics involved in Amazon's delivery operations.

AI in fraud prevention: Amazon employs cutting-edge AI advancements to preemptively thwart hundreds of millions of potentially fraudulent online activities, including fake reviews, manipulated ratings, and false customer accounts. Utilizing machine learning models, the system scrutinizes diverse proprietary data, such as seller ad investments, customer abuse reports, behavioural patterns, and review history.

Large language models, in conjunction with natural language processing, discern anomalies in the data, signalling potential fake reviews or those incentivized by gifts, free products, or other forms of compensation. The application of artificial intelligence proves instrumental in safeguarding customers from deceptive practices on the platform.

AI in generating ads: Amazon Ads introduces a beta version of image generation powered by generative AI, aimed at eliminating creative obstacles for brands. Within the Amazon Ad Console, advertisers can effortlessly produce lifestyle imagery for their products by selecting the item and clicking "Generate." Leveraging generative AI, the tool swiftly generates a set of brand-themed images based on product details. Users can refine the images by entering brief text prompts, allowing for the creation and testing of multiple versions to enhance ad performance. This innovation streamlines the ad creation process and provides brands with a quick and effective means of visual content.

AI in customer reviews: Introduced in 1995, customer reviews have been a foundational aspect of Amazon's platform. Originally a ground-breaking concept, allowing customers to openly express opinions on products was initially met with skepticism. Now, Amazon introduces an AI-powered feature displaying a concise paragraph on product detail pages. This feature extracts key product features and sentiments frequently mentioned in written reviews, offering customers a quick overview to assess product suitability. The AI-generated review highlights are drawn from a trusted corpus of verified purchases, ensuring that customers can swiftly grasp the community's opinions with confidence.

AI in damage detection: Amazon utilizes artificial intelligence to identify defective products before shipping, employing a damage-detecting technology that relies on extensive data and software. Despite the rarity of damaged items, the challenge lies in the scarcity of training data due to Amazon's vast and diverse inventory. The research team devised a solution by supplying a machine learning model with reference images to teach it how to compare products to their ideal counterparts. Using computer vision, every warehouse item near Berlin undergoes scanning, with a machine learning model analyzing the scans to discern patterns and enhance damage detection continuously. This innovative approach allows AI to make subjective decisions about damage, mirroring human judgment in such situations.

AI in personalized product recommendations: Employing personalized product recommendations as a strategic marketing tool, Amazon enhances sales and customer satisfaction by anticipating and aligning with users' preferences. The concept involves crafting suggestions closely tailored to users' likely purchases. Amazon's recommendation engine relies on extensive data analysis, encompassing customer buying patterns, items in the shopping cart, viewed products, and the most frequently searched items. Leveraging this user-specific data, Amazon generates recommendations that accurately predict each customer's potential purchases. This approach subtly encourages users to add more items to their carts, effectively driving increased purchases on the platform.

AI in search bar optimization: When customers utilize Amazon's search bar, there's a substantial 42% likelihood of them progressing towards a potential purchase, surpassing figures for Walmart at 16% and Etsy at 13%. Amazon's adept use of smart AI is evident in the performance of its search bar. While the overall site conversion averages at 2.17%, initiating a search catapults the conversion rate to an impressive 12.29% — almost a six fold increase. The proprietary A9 algorithm, now known as A10, underscores Amazon's commitment to prioritizing sales conversions and further solidifies its prowess in leveraging AI for optimal results.

AI for synthetic data generation: Amazon utilizes generative AI to produce synthetic data, employing it to simulate diverse scenarios that robots might encounter during high-demand periods such as the Great Indian Sale or Diwali Sale. This synthetic data is crucial for training their machine learning models.

Conclusion

In conclusion, this research illuminates Amazon's strategic integration of Artificial Intelligence (AI) across its multifaceted operations in the realm of E commerce. From bolstering workplace safety with a substantial investment in robotics to orchestrating the world's largest fleet of AI-driven mobile robots for logistics optimization, Amazon exemplifies a pioneering approach to harnessing AI for transformative impact. The findings underscore how AI permeates every stage of the customer experience, from personalized product recommendations based on extensive data analysis to the innovative use of generative AI in ad creation. Notably, Amazon's

commitment to customer safety is evident in AI-driven damage detection, ensuring defective products are identified before shipping. The company's adept use of large language models and machine learning extends to fraud prevention, where AI scrutinizes diverse data sources to preemptively identify and thwart potentially deceptive practices. Commencing as a book-centric enterprise and transforming into the widely recognized household entity it stands as today, Amazon has undergone a substantial evolution. The substantial influence of artificial intelligence is unmistakable in Amazon's ascent to dominance in the E commerce landscape and as a result in the fiscal year 2022, Amazon Seller Services, the entity operating the Amazon India platform, recorded a significant 32% increase in total revenue, reaching Rs 21,633 crore on a standalone basis. The company witnessed a growth in revenue from operations, rising from Rs 16,200 crore in the previous year to Rs 21,462 crore in FY22. Additionally, the E commerce marketplace successfully reduced its net losses by nearly 23%, decreasing from Rs 4,748 crore in FY21 to Rs 3,649 crore in FY22. Although the integration of artificial intelligence into Amazon's E commerce operations has yielded positive outcomes, yet warrants consideration of potential drawbacks. Privacy concerns arise with the extensive use of AI in customer data analysis, raising questions about the processing of sensitive user information in personalized features. The deployment of a massive robot workforce, exceeding 750,000 units, prompts worries about job displacement for human workers, highlighting potential obsolescence in the face of advancing AI and automation technologies. Algorithmic biases within AI systems, stemming from training data, pose risks of discriminatory outcomes, affecting fairness and inclusivity. Overreliance on AI introduces the potential for errors and malfunctions, requiring human oversight to prevent unintended consequences and system failures. Manipulation loopholes may

undermine the credibility of customer reviews despite AI's role in fraud detection. Ethical concerns emerge in AI-generated content for advertising, necessitating careful consideration.

Overall, Amazon's strategic deployment of AI emerges as a key driver in reshaping and elevating various facets of its operations, contributing to enhanced efficiency, customer satisfaction, and business performance. As E commerce continues to evolve, Amazon's innovative use of AI positions it as a leader in leveraging technology for optimal results in the dynamic landscape of online retail.

Recommendations

Amazon's strategic integration of AI has undeniably propelled its dominance in the evolving landscape of E commerce. To sustain and enhance this trajectory, Amazon should persist in substantial investments in AI research and development. Exploring emerging technologies, such as advanced machine learning models and natural language processing, will further augment safety, logistics, and customer interactions. A critical imperative for Amazon is to strike a delicate balance between AI-driven personalization and user privacy. Implementing robust privacy measures is crucial to address concerns and maintain customer trust, especially in light of potential regulatory challenges.

Addressing apprehensions about job displacement due to the extensive robot workforce, Amazon should champion initiatives promoting human-AI collaboration. Upskilling programs for employees to work alongside AI systems will ensure a harmonious integration, mitigating concerns about potential obsolescence. Algorithmic bias mitigation is another priority, requiring regular audits of training data and continuous monitoring to ensure fairness and inclusivity.

Human oversight is imperative to prevent unintended consequences and system failures, necessitating the establishment of fail-safe

measures and protocols for intervention. Amazon must continually enhance fraud detection systems to stay ahead of deceptive practices, concurrently minimizing manipulation loopholes in customer reviews for sustained credibility. Adopting a thoughtful and ethical approach to AI-generated content in advertising is essential, ensuring transparency and addressing concerns about authenticity. Collaboration with regulatory bodies, customer education on AI use, and a commitment to sustainable AI practices will collectively reinforce Amazon's position as a leader in leveraging technology for optimal results in the dynamic E commerce landscape.

Moreover, a holistic approach to AI adoption should be embraced. Companies should not only focus on algorithmic advancements and robust technology infrastructure but also nurture a conducive organizational culture and streamlined processes. Swift enhancement of AI maturity is paramount for companies aspiring to compete globally, ensuring they stay ahead in the dynamic technological landscape.

Furthermore, building a collaborative ecosystem is pivotal. Engaging with AI research institutions, start-ups, and industry forums fosters knowledge exchange and innovation. These collaborative efforts will not only strengthen individual companies but contribute to the collective growth of AI adoption, propelling the Indian business landscape into a new era of competitiveness and economic growth.

References

■ **Website**

Author: Amazon India

Source: [URL : https://www.abaoutamazon.in]

■ **Article**

Author: Forbes India

Date: 2023, September 29

Title: Inside amazon's Game Plan for India

Source: [URL : https://www.forbesindia.com/article/take-one-big-story-of-the-day/inside-amazons-game-plan-for-india/88633/1]

Implementation of Lean Manufacturing in the Indian Context: A Case Study of Indian Industry Including MSME Sector

Dr. Kavita Shastri & Prof. Sanjoy Mukerji

Faculty, Globsyn Business School, Kolkata

Adarsh Pandey

Student, Globsyn Business School, Kolkata

Abstract

Manufacturing is an important sector which drives a nations economy. Improvements in Manufacturing can reduce costs and/or increase productivity and thus increase competitiveness in the market. In recent times consumers have become important in deciding the choice of products and services and this has had an impact on the manufacturing process. Consumers tastes and preferences have undergone a change. Consumers are now demanding products meeting the requirements of cheaper cost, lower time to market, higher quality and more variety. This has made the market competitive and to meet the market headwinds manufacture's have been compelled to adopt tools and techniques to reduce their costs, increase productivity and enhance competitiveness. Lean Manufacturing is one such technique which can facilitate in resolving the above factors. The essence of Lean Manufacturing lies in the reduction of all types of wastes prevalent in the production process. It increases competitiveness by reducing costs. The impact of lean methods can be profound in sectors where manufacturing is concentrated and if we are to consider different sectors, the MSME sector plays a dominant role in India's economy accounting for 33% of India's GDP. As per the portal of Udyam[14], as in Dec 2022 there are approx. 1.28 crore MSME industries employing 9.31 crore people. Lean manufacturing can play an important role in increasing the competitiveness in this sector. However, it is observed that diffusion of Lean concepts remains weak and there have been challenges in its implementation. This paper will examine what is lean, the extent to which it has been applied in industry including MSME Sector illustrated by case studies and the challenges faced in its implementation as highlighted by research studies so far. The data for this paper has been obtained from secondary sources and the experiences of the authors in various industrial domains.

Keywords: *Lean, TPS (Toyota Production System), Waste, Micro, Small and Medium Enterprises (MSME), Lean Manufacturing Competitive Scheme (LMCS)*

What is Lean?

Lean management is an approach focused on maximizing value for customers while minimizing waste. It originated in manufacturing but has been widely adopted in various industries. Key principles include continuous improvement, respect for people, and eliminating activities that do not add value. The goal is to streamline processes, reduce inefficiencies, and enhance overall productivity. Lean management originated in Japan, primarily from the Toyota Production System (TPS) in the mid-20th century. Taiichi Ohno and Shigeo Shingo in Toyota revolutionized the manufacturing processes under their leadership. They emphasized eliminating waste, improving efficiency, and empowering workers. The principles of TPS, later termed "lean," were introduced to the

world through books like "The Machine That Changed the World." by James Womack. It was Womack and Daniel Jones who coined the term Lean in the 1990s. Since then, lean management has evolved and been adopted globally across various industries beyond manufacturing. Lean was essentially developed for eliminating three types of deviations i.e Muda(waste), Mura(unevenness) and Muri(overburden).

Lean has its origin surprisingly from American Supermarkets, where the system is of replenishing the inventory as customer's 'pull them 'from the shelves.

This is the Kanban system which results in substantial reduction of inventory also called the Just in Time system. Lean, which believes in the reduction of waste in the form of inventory supports the "pull "rather than the conventional "push" system of building inventories in advance.

The later processes like Six Sigma introduced by Motorola in 1987 also compliments lean as it leads to reduction in variability and high-quality level. Six Sigma confirms to a quality level of producing no more than 3.4 parts per million opportunities.

Other methods which help in wastage reduction is the 5 S Method comprising of the stages of sort, shape in order, shine, standardize, sustain and also the Total Productivity Maintenance (TPM) Method, a holistic method of maintenance.

Types of Waste

In the context of Lean Management, "TIMWOOD" is an acronym representing seven types of waste that organizations aim to minimize or eliminate to improve efficiency. The seven wastes are as below:

Transportation(T): Wastage takes place due to unnecessary transportation of materials in the shopfloor. This does not add any value to the process and efforts should be made to minimize it. Rearranging or modifying the layout can greatly minimize the cost of transportation.

Inventory(I): Inventory comprises of waste locked up in idle capital which can be in the form of raw materials, work in progress or finished goods. Inventory waste is also contributed by associated costs like storage area costs, insurance costs, handling costs of inventory.

Motion(M): Wrong process design can lead to unnecessary motion involving movement of people or equipment which may not be required in the first place. If a machinery operation is not ergonomically designed, then movement made by the operator leads to wastage in the form of loss of time and loss of production due to fatigue etc. If tools, other equipment, and materials are not kept properly, then it causes unnecessary motion leading to waste.

Waiting(W): During the production process often the in-process materials are required to wait if the process takes longer than the others in the sequence. There can be a situation when all the processes are not synchronised and have different production rates which contributes to the waiting time which is in fact a waste. In a service situation, people are required to wait in queues which results in wastage.

Over-processing(O): This refers to performing more work than what is necessary. Overengineering of product is to be avoided as it does not add value. Any value required more than what is needed by the customer comes under over processing. Thus, in such a situation the process needs to be redesigned.

Overproduction(O): Producing more than is immediately required. This mostly happens due to lack of robust planning. Overproduction leads to accumulation of finished goods inventory which is not required and produced not as per proper plan. It not only results in depleted raw materials, but capital and storage costs are tied up in unsold inventories resulting in wastage which needs to be minimized. Consistent overproduction can lead to surplus items and sometimes the only option remains is to dispose

the materials as scrap. Disposal of material can also have serious environmental impact. Thus, the aim should be to produce the items following the 'Just in Time' principle.

Defects(D): Errors or mistakes that require correction when products do not meet the specifications desired by the customer are called Defects. Defects lead to rectification or replacement involving correction time, labour costs, additional material costs which are all forms of waste which can be avoided. Defects also cause a loss in the brand image and reputation leading to loss of customer base. Thus, it is an exponentially costly form of waste and as they say 'Do right the first time '.

Recently another waste which is the eighth one related to utilization of human resources has been introduced. Human Resource is the major factor whose optimal use can bring much needed value addition. Lean recognizes that it is necessary to exploit the potential of human resources by creating a problem-solving environment in which the workers can grow and contribute professionally. For this purpose, Lean philosophy takes the help of 'Kaizen' or continuous improvement to eliminate waste in the value delivery process. This is normally done at the place where value is created called 'Gemba' in Japanese. The Lean concept believes that staff training imparted at the workplace is more effective to bring in the necessary changes in the workers and to bring out the best potential in them.

Lean also encompasses concepts like Single Minute Exchange of Dies (SMED), Total Productivity Maintenance (TPM) and others given at Table-II.

Diffusion of Lean Philosophy in the Indian Industries

Lean Management has been in vogue in India for many years now. A few of the companies where Lean has been adopted include Tata Motors, Mahindra, Maruti, TVS Group, John Deere, Cummins to name a few. Lean has been accepted within various industrial sectors in India such as automotive, pharma and steel plants [3] Although Lean has been implemented in many of the established large companies, its implementation in MSME sector companies is yet to take roots in a big way. In fact, during his visit to India in 2008, Dr James Womack while praising the work done by the TVS Group felt that much more could be done in India. The selected case studies highlighted below gives a snapshot of the extent to which Lean has been applied in India.

Lean Implementation in Maruti Udyog Limited

Lean is a holistic philosophy which includes under its ambit teamwork and communication, participative management, Kaizen (or continuous improvement), flat organization and also Just in Time Manufacturing. Maruti was amongst the first companies in India which implemented Lean at all levels. If one visits the Maruti factory in Delhi, he will be in for a surprise. The factory is scrupulously clean, with not a speck of dust, materials and tools neatly stacked, adequate lighting and a clean pollution free atmosphere. To bring this remarkable result Maruti has followed the Japanese philosophy of ' Plan, Do, Check , Act ' to good effect. It has been done in a methodical fashion with the overall targets fixed by top management which were then broken down into subordinate activities with mini projects worked out to achieve the objectives. Observation and Videography was used to measure the eight types of waste at each observation point. The bottlenecks were identified, and the process was eventually streamlined. The results were astounding. In 2005 it was producing 1200 cars per day when it had 6700 employees but after lean implementation it was producing more (@2000 cars per day) with a much-reduced employee strength of around 4500. The supply chain system was improved simultaneously leading to improvements in inventory turnover. The next days production

target is placed with the vendors the previous day. Lean implementation helped Maruti to work with a maximum of four hours for local items and six days on an average for imported materials.

Although big industries like Maruti, TVS, Tata Motors have been quick to realize and embrace productivity, the MSME Sector for a variety of myriad reasons have been slow to adopt. Maruti's sub vendor Sona Steering was one of the first in the Mid Industry- MSME Sector to adopt Lean Concepts.

Lean Implementation in Sona Steering Ltd.

In 1985, Maruti took various initiatives to develop vendors in and around its mother plant at Gurgaon. The plan was to improve coordination between the vendors and usher in 'Just in Time 'operations. One of the initiatives was to promote the formation of Sono Koyo Steering Systems Ltd, a flagship company of Sona Group founded in 1985 as Sona Steering Ltd. Technical collaboration agreement was signed by the company with Koyo Seiko Co Ltd Japan for the manufacture of manual steering gear assemblies and steering column assemblies. Maruti Udyog Ltd also picked up a 10% stake in the company. The company at that point in time was beset with multiple problems. The 'Up-Time ' of the plant was lower than desired, there was an increase in input costs of power, fuel etc. and there was a high setup time mismatch with market requirements of low volume/high variety. To resolve the problems, Sona decided to adopt Total Productivity Maintenance (TPM) in the year 2000. TPM is a holistic initiative to improve the production and quality system, reduce waste, improve equipment availability thereby leading to decrease in costs. TPM has many significant features and among them the concept of preventive maintenance, early maintenance, autonomous maintenance are noteworthy. As a result of TPM Implementation, Profits (grew from Rs 150M to Rs 300M, Production cost reduced from 69 % of sales to

60% of sales and OEE improved from 62% to 90%.

Implementation of Lean in Industry Clusters

Realizing the importance of Lean, the Govt. of India has taken initiatives to implement Lean. In order to enhance competitiveness in the MSME Sector, the Government has rolled out the Lean Manufacturing Competitiveness Scheme (LMCS). The Development Commissioner, Ministry of Micro, Small & Medium Enterprises (DC-MSME), Govt. of India, is empowered to implement the scheme. LMCS Scheme is a novel scheme of implementing Lean in an effective manner in the MSME Sector. Realizing that MSMEs would need some handholding in the initial stages, the scheme stipulated the appointment of a Lean Management consultant with National Productivity Council (NPC) as a nodal agency. NPC has been appointed as a National Monitoring and Implementation Unit under the LMCS Scheme. A total project cost of Rs 240.94 crores (Govt of India contribution Rs 204.94 crores and beneficiary contribution Rs 36 crores) has been made under the 12th Plan. The benefits are to be made available to MSME's registered with District Industrial Centers (DICs) or any other professional bodies. The implementation of the scheme would be done Cluster wise via the formation of Mini Clusters having a minimum of 6 and maximum of 12 units, producing similar products and located within an identifiable and as far as possible contagious area. The scheme envisages the formation of 500 such Mini Clusters. A tripartite agreement is required to be signed between the Mini Cluster representative, NPC and the Lean Management Consultant who would provide support and guidance to the sector. The following case studies are illustrated to highlight the challenges faced and the benefits accrued [2].

Brass Component Cluster: Located in Jamnagar, Gujarat the cluster has a total of 9 units comprising manufacturing of a wide array of items like

electrical distribution boxes, energy meters, fuse fittings, door locks, tire tube accessories etc. Many challenges were identified like high wastage in inventory, culture not conducive for growth, workplace having less than required skills, poor maintenance among others. Lean tools like 5S, Kaizen, Visual Management, SOPs for critical processes were adopted to counter the challenges. On implementation there was a reduction of 40% in brass inventory, 25% improvement in machine availability, 70% reduction in machine transportation.

Packaging Cluster: Located at Hardwar, Uttarakhand and has a total of 10 units involved in developing packaging parts. Some of the products produced include corrugated boxes, corrugated rolls, printed and non-printed nano cartons. The challenges identified by the consultant in the cluster include lack of records, no production panning, uneducated workforce, poor maintenance of machines, high inventory, high attrition rate among others. To address the issues training was carried out at all levels, 5S, Visual Management, Asset Management and Kaizen was adopted. After adoption of Lean Methods there has been a significant increase in production with a significant increase in sales.

Auto Cluster: Located in Noida, this cluster formed by Minda Corporation Noida for implementation of Lean methodology among supply chain entities. The cluster comprised of 10 member units manufacturing auto components. The major challenges identified include lack of faith of Lean Management tools, high attrition of workers and resource limitations. The steps involved to improve performance and productivity include assessment of existing infrastructure, Value Stream Mapping, 5S, TPM to name a few.

Knit Garment Cluster: The cluster comprising of 8 units is located in Tirupur Tamil Nadu. It is a Knit Garment Cluster comprising 6 units. The cluster specializes in producing knitted garments for men, women, and children.

The major challenges faced in this cluster include weak material accountability, delayed shipments, high inventory levels and lack of data-based decision making. To address the issues 5S, Kaizen, Quality Control measures were implemented resulting in better waste disposal, material control, reduction of clutter at workplace, reduction of defects, increase in on time delivery to name a few.

Although the concept of Lean is not a relatively new term, studies have indicated that the adoption rate of lean practices have been average with the Lean Manufacturing system being regarded as the intended direction rather than a steady state[1].

Challenges in Lean Implementation

The above case studies given earlier highlight numerous challenges which are endemic to the Indian MSME Sector. They are linked to behavioral issues, technical issues regarding process, high inventory levels, lack of planning to name a few. The case studies and experience of the authors point to the following major challenges.

Behavioral Issues: Human Behavior is an important factor which acts as an impediment to lean implementation. Workers working in MSMEs are mostly uneducated and they are reluctant to change the way of working which they have been used to. This is compounded by the fact that their Owners/Managers remain skeptical of the lean philosophy due to lack of continuous training and exposure to the latest technology.

Process Issues: The process machinery adopted in most MSMEs are outdated which are responsible for longer cycle times, higher defects and overall lower productivity. Further the overall layout is not scientifically made resulting is more material movements. Much time is also wasted in tool /die changeover.

Material Issues: Inventories tend to be higher in MSMEs due to lower awareness of inventory

control techniques, lack of proper planning and conservative planning. Due to outdated processes the in-process inventories also continue to be on the higher side.

Financial Issues: The above issues have in turn been responsible for suboptimal operations resulting in higher costs. Lack of Management focus and long-term vision has resulted in capital funding being denied for Lean initiatives.

The above reasons have been corroborated in many earlier studies in (Siddhartha Pal (2019): 'Toyota Production System – Applications and Benefits for Indian Pump and Motor Manufacturing Industry[6] According to this study the challenges of lean implementation have been identified into four major categories viz Management issues, Organizational issues, Finance issues and other issues. Management issues include lack of focus, long term vision, lack of risk-taking ability, lack of capital among others.

Organizational issues include lack of training, lack of company culture, lack of labor resources among others. Finance issues include the perception that lean is costly and that there are no immediate financial advantage benefits to be gained. Other issues cited include unstable demand and employee resistance to change. Another study by Akhtar Waseem & Ahsari Afsar [8] involving a survey of 120 companies in North India, the respondent companies who did not implement Lean believed that lack of awareness of knowledge skills was the main underlying factor.

The foregoing discussion emphasized primarily manmade factors responsible for slow adoption of lean. However Lean Implementation also depends upon the intrinsic nature of industry. Studies have shown that while adoption of lean in discrete manufacturing has been widespread but in process industries the implementation has not been a straightforward process. The process industries have continuous flow of materials, very

large and fixed capacity requirements and with such constraints it is a challenge to implement some of the lean practices like 'kanban', setup reduction and cellular manufacturing in such set ups. Major lean practices being used mostly relate to waste elimination like inventory reduction or improvement in quality.[4] In the Indian process industry also varying levels of lean implementation has been observed with adoption of lean practices relatively higher in chemical, textile and steel industries. Further adoption of lean is not widespread and formal in process industries. In process industries practices like 5S, Work Standardization, TPM, Quality Management has been followed more as compared to other lean techniques [4].

Conclusion - The Way Forward for MSMEs

The foregoing paragraphs have tried to convey the issues surrounding Lean implementation in the Indian MSME Sector and the extent to which Lean has been implemented in the MSME Sector.

MSMEs are faced with tough competition from global markets every day and higher customer demand. Lean Philosophy or TPS offers a holistic strategy to eliminate waste, achieve good quality products and process quality and reduce lead times. While large companies are able to provide the necessary resources and expert who know how to configure and implement the TPS, MSMEs have lack of these essential resources and finances for the organization and they have technological and labor-related challenges. According to a study (2019) [8] out of the 42% of MSMEs are those who have tried to implement the TPS methodology in India and only 54% of those companies have set TPS methodology in application targets for all services. (The samples include 48 MSMEs in the automotive, manufacturing and service sector in India). From the review of existing literature Lean Implementation in MSME Sector has started but yet to accelerate to its full potential. The following actions according to the authors are required to be taken by the stakeholders:

- The total process to be studied and via techniques like Value Stream Mapping nonvalue added activities to be eliminated. The tools and techniques relevant to the situation to be adopted. Lean Techniques to be applied not in a piecemeal fashion but in a holistic manner to realize the full benefits.

- MSMEs should be made to realize in clear terms the importance and benefits of Lean Manufacturing. This can be done by spreading awareness in the form of training at all levels. MSMEs should be made to operate only if certain key personnel get certified in Lean Management techniques. Certain tax concessions can be linked to this condition. Institutes for imparting training can also be set up by the Govt.

- Often Finance remains a problem for implementation of Lean schemes. Banks may provide finances at attractive interest rates for lean implementation.

- Govt can institute a mechanism for monitoring the lean implementation in clusters as per the LMCS Scheme.

References

- Khadse B Priti, Sarode D Avinash, Wasu Renu(2013)"Lean Manufacturing in Indian Industries A Review" International Journal of Latest Trends in Engineering and Technology(IJLTET) Vol 3 Issue 1 Sept 2013 pp 175 to 181

- Bhattacharya Indrajit, Ramachandran Anandhi (2021) "Lean Manufacturing Techniques – Implementation in Indian MSMEs and benefits realized thereof" Indian Journal of Engineering and Materials Sciences Vol 28, February 2021, pp 89-101

- Solaimani Sam, Rajagopalan Jayaraman (2019) "Lean Management in Indian industry : an exploratory research study using a longitudinal survey" International Journal of Lean Six Sigma October 2019

- Panwar Avinash, Jain Rakesh, Rathore Ajay Pal Singh (2015) "A survey on the adoption of lean practices in the process sector of India with a comparison between continuous and batch process industries" International Journal of Manufacturing Technology and Management, January 2015

- Panwar Avinash, Jain Rakesh, Rathore Ajay Pal Singh (2015) " Lean Implementation in Indian process industries – Some empirical evidence

- Pal Siddhartha (2019) " Toyota Production System(TPS) – Applications and Benefits for Indian Pump and Motor Manufacturing Industry : A Case Study" International Journal of Research in Engineering, Science and Management Vol -2, Issue-9, Sept 2019

- Mishra Matharu, Neena Sinha (2019) "Lean Implementation in Indian Manufacturing MSMEs- A SAP-LAP Analysis" Management and Production Engineering Review Vol 10, No 1, Mar 2019 pp 68-78

- Akhtar Waseem, Ahsari Afsar (2020) "The Implementation of Toyota Production System(TPS) in Indian MSMEs- A Study of Motive Barriers, Challenges, Success Factor and Applications" International Journal of Emerging and Applied Sciences and Technology 2020 Vol 4, Issue 12, pg 102-111

- Mutsa Chiranga, Jacob Dahl, Tony Golad, Gary Pinshaw, Marnus Sonnekus(2012) "Mckinsey Report Micro, Small and Medium Sized Enterprises in Emerging Markets

- Annual Report 2022-23 Ministry of Micro, Small and Medium Enterprises, Govt of India. www.msme.gov.in

- Business Standard Feb 6, 2013 " How Maruti Innovated Work Practices to Advantage https://www.business-standard.com/article/management/how-maruti-innovated-work-practices-to-advantage-104061101116_1.html

- Barney Heather and Kirby Nataraj Sheila Book Title: Organizational Improvement and Accountability Chapter Title : Toyota Production System/Lean Manufacturing published by Rand Corporation https://www.jstor.org/stable/10.7249/mg136wfhf.9

- Liker K Jeffrey, Margan M James (2006) "The Toyota Way in Services: The case of Lean Product Development" Academy of Management Perspectives Vol 20, No 2(May 2006) https://www.jstor.org/stable/4166229

- https// www.eudyogaadhar.org

Annexure -I

Definition of Micro, Small and Medium Enterprises [10]

Sl. No.	Type	Definition
1	Micro	Investment in Plant, Machinery or Equipment does not exceed Rs 1 crore and turnover does not exceed Rs 5 crores
2	Small	Investment in Plant, Machinery or Equipment does not exceed Rs 10 crore and turnover does not exceed Rs 50 crores
3	Medium	Investment in Plant, Machinery or Equipment does not exceed Rs 50 crore and turnover does not exceed Rs 250 crores

Annexure -II

Lean Tools Specified Under Lmcs [2]

Sl. No	Lean Tool	Description
1	5S	Helps in bringing order in the workplace comprising of 5S which stands for sort, set in order, shine, standardize and sustain
2	Visual Control	Charts, Lane marking on floor, Safety instructions etc.
3	Standard Operating Procedure(SOP)	SOPs to be made wherever possible to streamline the processes
4	Just in Time	To make available a product just in time for manufacturing almost resulting in Zero inventory
5	Kanban System	In this system components are pulled by succeeding work centers and at the same time it is replenished by preceding work center resulting in minimal inventory
6	Cellular Layout	Manufacturing layout in which similar parts are manufactured in cells arranged in a semi-circle with a view to minimize handling
7	Value Stream Mapping	Entire Map of all activities with a view to eliminate non-value added activities
8	Poka Yoke	Innovative product/process design interventions to avoid human mistakes
9	Single Minute Exchange of Dyes(SMED)	Minimizing the time taken to change dies by upto 10 mins
10	Total Productivity Maintenance(TPM)	It involves the entire system comprises of operators, staff and management to work holistically to improve the maintenance
11	Kaizen	Management program involving all levels and an approach towards continuous improvement

Book Review

Hidden Circuitry of the Present and Future

Manas Chakravarty

Faculty, Globsyn Business School, Kolkata

Chip War: The Fight For The World's Most Critical Technology
Chris Miller
Simon and Schuster, 2022

FT Business Book of the Year 2022

We know that chips are ubiquitous but the extent to which the world is dependent on them and the length to which countries may go to protect national interest may be beyond our imagination. *Chip War* by Chris Miller lays bare the past, present and future of the tiny chip, its technological evolution, commercial significance and military implications. The essence of the book is well captured in the subtitle: *The Fight for the World's Most Critical Technology.*

The theme being what it is, the book is suffused with technical details and involves numerous characters unfamiliar to the lay reader. Very thoughtfully therefore it starts with a glossary and a cast of characters. The lucid introduction that follows provides comforting assurance that the book will be an easy read in spite of high technicalities of the subject.

Chips owe their existence to a long lineage of physical sciences but a convenient starting point of its history is the Moore's Law. Fairchild Semiconductors co-founded by Gordon Moore in south of San Fransisco announced its new product Micrologic in 1961 which had four transistors embedded in a silicon chip. Soon four became twelve, then hundred, and by 1965 Moore predicted that the number of components that could be fit on each chip and therefore its computing power will double every year for a decade as transistors become smaller and smaller.

Indeed, even beyond Moore's imagination, what was 4 in 1961 is today counted in billions. Tinier the chip becomes, the less power it consumes and more versatile grows its use. As it unfolds in the book, this remarkable fruit of human endeavor is the result of not just scientific breakthrough but as much of manufacturing expertise and astute business decisions including supply chain gambles.

In the chip industry, advantages and vulnerabilities of players have varied from time to time. This is due to outsourcing of even critical activities to remain focused on core competence, calculated give and take to gain access to vast markets and state intervention to protect national interest.

Chips are still largely designed in US but fabrication is concentrated in Taiwan after which a vast number of them go to China for assembly into consumer goods. It is a hugely complicated inter-dependent mesh. Yet there are severe vulnerabilities due to monopolization. Just three US based companies—Cadence, Synopsys and Mentor—provide the software used in nearly every chip. Just two companies—Korean Samsung and Taiwanese TSMC—fabricate all of the most advanced logic chips except those that Intel builds for itself. The Dutch company ASML with its San Diego subsidiary Cymer is now the world's only manufacturer of EUV (extreme

---

ultraviolet) lithography tools without which advanced chips cannot be fabricated. Guided by national security concerns, countries which wish to move away from China's Huawei the world's foremost supplier of 5G network gear, have just two other options—Sweden's Ericsson and Finland's Nokia. Except for Huawei, the handful of companies that could act as choke points in the massive supply chain, all belong to US or its allies. The book paints thrilling pictures of how the world is dealing with what has been called weaponized interdependence.

The book is spread over 54 delightfully short chapters grouped into eight parts. Between them it chronicles how military power switched from steel to silicon, when companies and countries gained and lost heft, what contributions were made by just a handful of individuals to propel the silicon movement and where the world is heading in the chip war.

The main body of text, the copious notes and minute indexing together make Miller's work into a single volume encyclopedia of sorts. It serves as a primer as well, taking the reader through elementaries like why is a "chip" called a chip, what is "semi" about semiconductors, why "debugging" is called so, and what is "integrated" in an integrated circuit. Every chapter is structured to stand alone. This has necessitated some repetition which however fortifies the reader with ready recap. Apart from chronicling the history of the semiconductor industry, the book also allows a peep into the future like beamforming technique that will let cell networks send radio signals directly towards a phone and harnessing artificial intelligence which will require a triad of data, algorithm and computing power.

For the Indian reader, the book offers a sobering reality check. The voluminous text detailing the role of individuals, institutions and nations on the cutting-edge as well as lagging-edge of the most important technology of our time, carries no mention of India save once, that too

pejoratively, to say that though Chinese military has proven success in seizing Himalayan peaks from India, grabbing Taiwanese chip making facilities is entirely a different matter!

Chip War by Chris Miller has been deservedly adjudged the FT Business Book of the Year 2022. Incidentally, the winner of the previous year was Nicole Perloth's *This Is How They Tell Me The World Ends*. The geo-strategic implications of a full-blown chip war suggests an ominous connection between the two successive winning titles. In any case, as the author notes in his closing words, chips provide the hidden circuitry that has structured our history and will be shaping our future.

Mercurial Musk and Artificial Intelligence

Dr. Sujata Mukherjee

Faculty, Globsyn Business School, Kolkata

Digital Life has indeed had a transformative impact on human life by augmenting various capabilities while disrupting eons old traditional activities (Ahmed, 2023). Experts predict that artificial intelligence (AI) will not only amplify human effectiveness but also threaten human autonomy, agency, and capabilities (Pew Research Institute, 2018). Elon Musk, the world's richest person shares with CNBC "Artificial Intelligence will eventually create a situation where no job is needed. AI will have the potential to become the most disruptive force in history" (Browne, 2023). Walter Isaacson's Ne biography 'Elon Musk' has created abuzz, where Elon Musk has been portrayed as a callous, chaos loving man without any empathy. The biography also refers to some of the most important technology jumps in the digital era and the advances in the way humans and machines communicate with each other known as 'human-computer interfaces'. In the seminal paper written by Licklider in 1060 on "Man-Computer Symbiosis", Licklider shows how video displays could "get a computer and a person's thinking together and the hope is that, in not too many years, human brains and computing machines will be couples together very tightly" (Isaacson, 2023, pg. 359). Musk was fast to jump into the superfast train called 'Technology' and created the humanoid robot "Optimus", Neuralinks, and Starlink satellites.

The author tries to make sense of the billionaire entrepreneur he has shadowed for two years. Isaacson portrays Musk as a mercurial individual who has Asperger's which he describes as a "gene" that's "hard-wired." Musk according to Isaacson is a visionary as he has the desire for total control; obsession; resistance to rules and regulations; insensitivity; a love of drama and chaos and urgency(Grady ,2023) ."He didn't have the emotional receptors that produce everyday kindness and warmth and a desire to be liked. He was not hardwired to have empathy," Isaacson writes(Grady ,2023). Even as he struggles to relate to the actual humans around him , his plans for humanity are majestic .While other entrepreneurs struggle to develop a world view, Musk developed a cosmic view. Musk is known for his ambitious vision of colonizing Mars and his concerns about potential existential risks to humanity.

The billionaire technology entrepreneur and leader, who is the CEO of Tesla, Space X and CTO and executive chairman of X and the owner of AI start-up xAI and shared that AI will have the potential of becoming the "most disruptive force in history". He as a co-founder left the company board of xAI in 2018 and no longer holds stakes in the company(Novet and Kolodny, 2018).

[1]Joseph C.R. Licklider, contributed to interactive computing and computer networks. He was a member of the Harvard University 's faculty and a researcher in its Psycho-Acoustics Laboratory from 1941 to1946,. He was a lecturer at the Psychology Laboratories until 1949, after which he joined the MIT as a faculty. In 1957 he was named vice president in the area of psycho-acoustics, engineering psychology, and information systems at Bolt Beranek and Newman (BBN), and in 1962 he was appointed director of behavioral sciences and information processing research at the Advanced Research Projects Agency (ARPA) of the US Department of Defense.

[2]Asperger's is a previously used diagnosis on the autism spectrum. In 2013, , it became a part of one umbrella diagnosis of autism spectrum disorder (ASD). People who have Asperger's tend to have a hard time relating to others socially.

Musk's take on artificial intelligence has been very astute and critical. He thinks that artificial intelligence could eventually put everyone out of a job. On various occasions Musk has warned of the threats AI poses and also remarked that AI could be more dangerous than nuclear weapons for humanity (Browne, 2023). Musk and many other technology leaders have called on AI laboratories to pause the development of systems which are in direct competition with huma level intelligence. In an open letter signed by Musk, Apple co-founder Steve Wozniak and 2020 US Presidential candidate Andrew Yang have urged to refrain training models more powerful that GPT-4 (Browne, 2023). The letter shared by Future of Life Institute mentions that technology leaders and academia have accentuated that AI systems with human-competitive intelligences presents esoteric risks to humanity and society.

Humankind should use AI judiciously and carefully as there are several concerns and challenges associated with the deployment and impact of AI AI systems can inadvertently perpetuate and reinforce biases present in the data they are trained on. The biases can manifest in various applications, such as hiring processes, criminal justice systems leading to unfair and discriminatory outcomes. Furthermore, the AI in surveillance systems raises concerns regarding the potential for increased monitoring of individuals eroding privacy. The use of automated decision-making supported by AI can blur accountability of public officials as it may be challenging to determine the attribution of accountability. Additionally, AI enhanced disinformation poses a threat to democratic processes during elections. The ability of AI systems to generate and disseminate misleading information at scale can influence public opinion and potentially undermine the integrity of the electoral process. AI systems also challenge the existing regulatory frameworks. The traditional methods of oversight and regulations may not be well-suited to address the complexities introduced by AI, and there

is a need for updated and adaptive regulatory approaches (AI Advisory Body Interim Report, 2023). Addressing challenges faced from AI on humanity requires a holistic and collaborative approach involving technology developers, policy makers, ethicists and the broader

Reference

- Browne, R. 2023. "Elon Musk and other tech leaders call for pause on 'dangerous race' to make A.I. as advanced as humans" ; CNBC, December 2, 2023, https://www.cnbc.com/2023/03/29/elon-musk-other-tech-leaders-pause-training-ai-beyond-gpt-4.html

- Browne, R. 2023. "Elon Musk says AI will eventually create a situation where 'no job is needed"; CNBC, December 3, 2023, https://www.cnbc.com/2023/11/02/tesla-boss-elon-musk-says-ai-will-create-situation-where-no-job-is-needed.html

- J. C. R. Licklider(1960). "Man-Computer Symbiosis ", IRE Transactions on Human Factors in Electronics, volume HFE-1, pages 4-11, November 30, 2023, https://groups.csail.mit.edu/medg/people/psz/Licklider.html

- Novet, J and Kolodny, L. (2018). "Elon Musk, who has sounded the alarm on AI, leaves the organization he co-founded to make it safer"; CNBC, December 2, 2023, https://www.cnbc.com/2018/02/21/elon-musk-is-leaving-the-board-of-openai.html

- United Nations High Level Advisory Body on AI. (2023). "Governing AI for Humanity", Interim Report, United Nations, December 2, 2023, https://www.un.org/sites/un2.un.org/files/ai_advisory_body_interim_report.pdf

- https://www.pewresearch.org/internet/2018/12/10/artificial-intelligence-and-the-future-of-humans/

- Grady, C (2023). "The big Elon Musk biography asks all the wrong questions", November 19, 2023, https://www.vox.com/culture/23872485/elon-musk-walter-isaacson-biography-review

- Ahmed, A. (2023). "Artificial Intelligence and the Future of Humans", December 9, 2023, https://www.linkedin.com/pulse/artificial-intelligence-future-humans-anish-ahmed/

A Bold Call on AI

Titas Roy Chowdhury

Faculty, Globsyn Business School, Kolkata

The next "wave" of improvements in AI and biotech will change everything, including jobs, businesses, and national governments — according to Mustafa Suleyman and Michale Bhasker. Just like the internet made it easier for everyone to get information, this wave will make power easier for everyone to get as well Anyone will be able to spread chaos with deepfakes, make deadly microorganisms with cheap equipment, and easily fight cyberwar by making computer viruses that change on the fly to avoid being found and removed.

Suleyman is warning us about technological expansionism through his book "The Coming Wave." In its almost three hundred pages, it tries to persuade readers that the rise of artificial intelligence (AI) and synthetic biology (SB) are threats to our very existence and that we only have very little time to thwart them before it's too late. Suleyman is most concerned with how quickly these changes will happen. In a similar way that computer chips' abilities have expanded a millionfold in a matter of decades, he claims that AI capabilities that should worry ourselves are already here.

We are not being forced to use AI and SB. We are ok with them because they assure us to create good future but also solves our biggest difficulties, like climate change, cancer, and maybe even death. Suleyman can see the attraction, and he says that these technologies will "usher in a new dawn for humanity".

Suleyman founded DeepMind in 2010 and was subsequently acquired by Google. He is most fascinating when he talks about the pros and cons of this new world. He talks about how humans have finally gained control over intelligence and life itself in easy-to-read, sometimes breathless text.

The problem is that the technologies that help us treat diseases could also be used to make them happen. According to Suleyman, the cost of genetic sequencing has gone down a lot and there are several tools available that make it much easier to change DNA in the near future, anyone will be able to turn their garage into a genetics lab. He fears that the temptation to tamper with the human genome will be enormous.

But biologically altered human aren't the only scary things that are coming. Suleyman thinks that technology will work together to make it easier for bad people to make new viruses. An AI-designed and SB-engineered virus could "cause more than a billion deaths in a matter of months.". It would be less likely to spread than chickenpox (4%), and will have 50% mortality rate (about the same as Ebola). But Suleyman believes nations will not contain AI technologies due to economic benefits. Suleyman's "Coming Wave" argues that smart AIs will increase power of people with evil intent rapidly, leading to cyber-attacks, job loss, and political instability, as institutions are not prepared.

Suleyman, an experienced AI scientist, frequently asserts that the coming wave is coming, despite the fact that AI has experienced "winters" in the past when expectations and funding dried up. He fails to consider the possibility of this happening again, which would allow more time to adjust to social change or even stop it altogether.

The solution, according to Suleyman is containment. But "containment" has a bit of

history by itself. An American diplomat in Moscow wrote a telegram back to US. Kennan warned in this famous telegram that the Soviet Union was naturally expansionist because it was committed to communism. He asked the US government to fight any Soviet efforts to gain more power. This plan quickly became known as "containment," and it set the tone for 40 years of American foreign policy. Here is a point, AI is also expansionist, but unlike communism it is actually embraced by world. Will "containment" be successful??

However, societies undoubtedly won't put up with the moral abuses Suleyman is most worried about, even if progress keeps moving at its fast pace. In 2018, China sentenced a scientist with three-year jail term on charge of changing human gene of twin girls and was widely criticized. Since then, there have been no more reports of this happening. The EU's new AI Act will make it illegal for some types of AI, like face recognition in public places. Most likely, normal law and cultural pushback will slow the spread of the most upsetting and disruptive behaviours.

Suleyman says the containment problem is the "defining challenge of our era," but he doesn't support a suspension on AI tech. At the end of the book, he instead makes a selective suggestion. They aren't reassuring, sadly.

For example, Suleyman suggests companies must increase their R&D funds on AI research geared towards safety, but doesn't explain why they should curtail their marketing budget. He prescribes political parties must be banned for using AI in their ads, but it would go against the laws of many countries. Without elaborating on its enforcement mechanism, Suleyman suggests a global treaty to stop AI research.

Here comes an interesting conflict, in one side Suleyman is suggesting to follow his suggestions which is surly counterproductive and on the other side he maintains that his doomsday scenario has very less probability to occur. Yes, there is no doubt that even if the probability is low, consequences will be so dreadful that we must treat possibilities seriously. On major crisis that we are going through right now is climate change. Given that recent hot climatic situation, it seems that our first priority must be climate not AI. Containing carbon is most important task at hand, not AI. Suleyman is over optimistic here by saying AI will solve climate problem. My question here is if AI can do everything, it can solve containment problem too.

In my view Suleyman did a great task by opening up dreadful side of AI, but it suggestion to contain it seems unrealistic, so we can safely ignore.

globsyn
business school
AMBITION OF THE YOUNG

ABOUT GLOBSYN MANAGEMENT JOURNAL

Globsyn Management Journal is an EBSCO listed bi-annual publication of Globsyn Business School, Kolkata, India. Globsyn Management Journal (GMJ) is also available in the Pro Quest database. Its objective is to contribute to a better understanding of organizations and their functioning by presenting conceptually sound and methodologically rigorous articles which provide insights and advanced knowledge on managerial, business and organizational issues.

A typical issue of the journal would carry a mix of research articles, book reviews, perspectives and case studies. *Research Articles* would be analytical and/or empirical in nature and focus on the analysis and resolution of managerial issues in organizations. *Book Reviews* would present reviews of current books on various domains of management. *Perspectives* would aim to identify and highlight emerging issues and paradigms in management *Case Studies* would aim at an intensive analysis of a real life decision taken at the individual or the organizational level, which may be functional, operational or strategic in nature.

GUIDELINES FOR AUTHORS

Globsyn Management Journal invites original contributions from both academicians and practitioners on various management, business, and organizational issues. The journal welcomes research-based articles on topics of current concern.

Articles, based on theoretical or empirical research or experience, should illustrate the practical applicability and/or policy implications of the work described. Each article is refereed.

Submissions should indicate relevance and clarity. Empirical articles should have an appropriate methodology and be able to justify the use of the methodology to arrive at the findings besides relating their findings to the existing literature in this body of research. Methodological articles must attempt to show how they inspire further development and research.

The Journal tries to maintain a balance between purely research-oriented articles and those based purely on the experiences of practitioners involved in different areas of management.

A typical research arrticle may have the following headings and sub-headings:

1. Introduction
2. Literature Review
3. Objective of the Study
4. Methodology
   a. Sample Design
   b. Methods of Data Collection
   c. Data Validation
5. Data Analysis or Findings
6. Conclusion
7. Way Forward
8. Bibliograhy

Manuscript

The author/s should send three copies of the manuscript. The text should be typed double-spaced only on one side of A4 size paper in MS Word, Times New Roman, 12 font size with one-inch margins all around. The manuscripts should have a cover page bearing only the title of the article, author/s' names, designations, official addresses, phone/fax numbers, and e-mail IDs. The first page of the article must also provide the title of the article but it should not give the author/s' name and address. The author/s' name should not appear anywhere else on the body of the manuscript to facilitate the blind review process. The articles should be in clear, coherent and concise English. Professionally drawn graphs and diagrams must be provided wherever necessary along with the manuscript.

For all tables, charts, and graphs, the source should be indicated, wherever necessary. Tables should be numbered consecutively in Arabic numerals and should be referred to in the text as Table 1, Table 2 etc. All notes must be serially numbered. These should be given at the bottom of the page as footnotes.

The following should also accompany the manuscripts on separate sheets: (i) An abstract of approximately 150 words with a maximum of five key words, and (ii) A brief biographical sketch (60-80 words) of the author/s describing current designation and affiliation, specialization, number of books and articles in refereed journals and membership on editorial boards and companies, etc.

The author/s can also e-mail the manuscript to GBS Journal Office at **gbsjournal@globsyn.edu.in**

The hard copy and electronic files must match exactly. Author/s should also certify that the article has not been published or submitted for publication elsewhere.

The word limit of the various sections are as follows:

- Research Article - 5000 words approx
- Perspective - 1000 words approx
- Case Study – 5000 words approx
- Book reviews - 500 words approx

Review and Acceptance

The review process followed by *Globsyn Management Journal* is systematic and thorough. Articles submitted to the journal are initially screened by the editor for relevance and quality including presentation of concepts, methodology and findings. Inappropriate or weak submissions are not forwarded for a formal review. Those considered appropriate are put through a double blind review process that may take between three to four months. Author/s may be asked to revise and resubmit a manuscript based on the referees' comments.

Once an article is accepted, a camera-ready copy of it (the final version) must be sent in a CD to the editor. The CD should not contain any other files (i.e., not related to the article being submitted). In case of multiple authors, all correspondence would be done with the first author, unless otherwise stated. For this, the author must provide an easily contactable email address or phone number/fax so that the editorial office can get in touch with the author in case of queries during the copy-editing stage.

All material and editorial correspondence should be addressed to:

The Asociate Editor,

Globsyn Management Journal,

Globsyn Business School - Kolkata

Globsyn Campus:

Mouza Chandi, P.S. Bishnupur, J.L. No. - 101, District - 24 Parganas (South), Kolkata - 743503.

Tel: +91-33-6600 3600, Fax: +91-33-2480 8032

Website: *http://www.globsyn.com/gbs/index.htm).*

The contributions received will be acknowledged immediately.

Manuscripts not considered or not accepted for publication will not be sent back. Contributors whose contributions are accepted or rejected will be informed by e-mail only.

References

References should be given separately at the end of the article and arranged alphabetically. The list should include *only* work that has been cited. *The following style should be strictly followed*:

For Journals:

Cascio, W F (1993). "Downsizing: What Do We Know? What Have We Learned?" *Academy of Management Executive, 7(1), 95-104.*

For Books:

Drucker, P (1999). *Management Challenges for the 21st Century*, New York, NY: Harper Collins.

For chapters in books:

Srinivas, E S (1994). "Perceived Quality of Working Life (PQWL) and organizational commitment: A study of managers in select organizations" in Gupta, N and Ahmad, A (eds.), *Management Research: Contemporary Issues*, New Delhi: South Asia Publications.

For electronic documents:

Basu, I (2004). "India's thorny FDI rule under scrutiny," *Asia Times*, May 28, http://www.atimes.com/atimes/South_Asia/FE28Df03.html Accessed on April 27, 2004.

In the text, the reference should appear as follows:

Theil (1970) has shown… or Recent studies (Gupta, 1990; Srivastava, 2003; Sen, 1999, 2001; Dasgupta, 2003a, 2003b) indicate...

Page numbers should be given whenever another author/text is quoted:

According to Saini (2000, 35), "The buzz word in people management in India is HRD and not HRM."

Every article must be accompanied by a statement that the article is the author/s' own work and has not already been published or submitted to any other journal for publication.

All authors must sign the 'Transfer of Copyright' Agreement before the article can be published. This transfer agreement enables GBS to protect the copyrighted material for the author/s, but does not relinquish the author/s' proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microform or any other reproductions of a similar nature and translations and includes the right to adapt the article for use in conjunction with computer systems and programs, including reproduction or publication in machine-readable systems.

Also, author/s are responsible for obtaining from the copyright holder permission to reproduce any figures for which copyright exists that they use in their contribution.

Note: The views expressed in the articles in Globsyn Management Journal do not necessarily reflect the opinion of the Institute.

Globsyn Knowledge Campus

Mouza Chandi, PS - Bishnupur, J. L. No. - 101, District - 24 Parganas (South),

Kolkata - 743 503 Phone: +91-33-6600-3600

gbsjournal@globsyn.edu.in

www.globsyn.edu.in