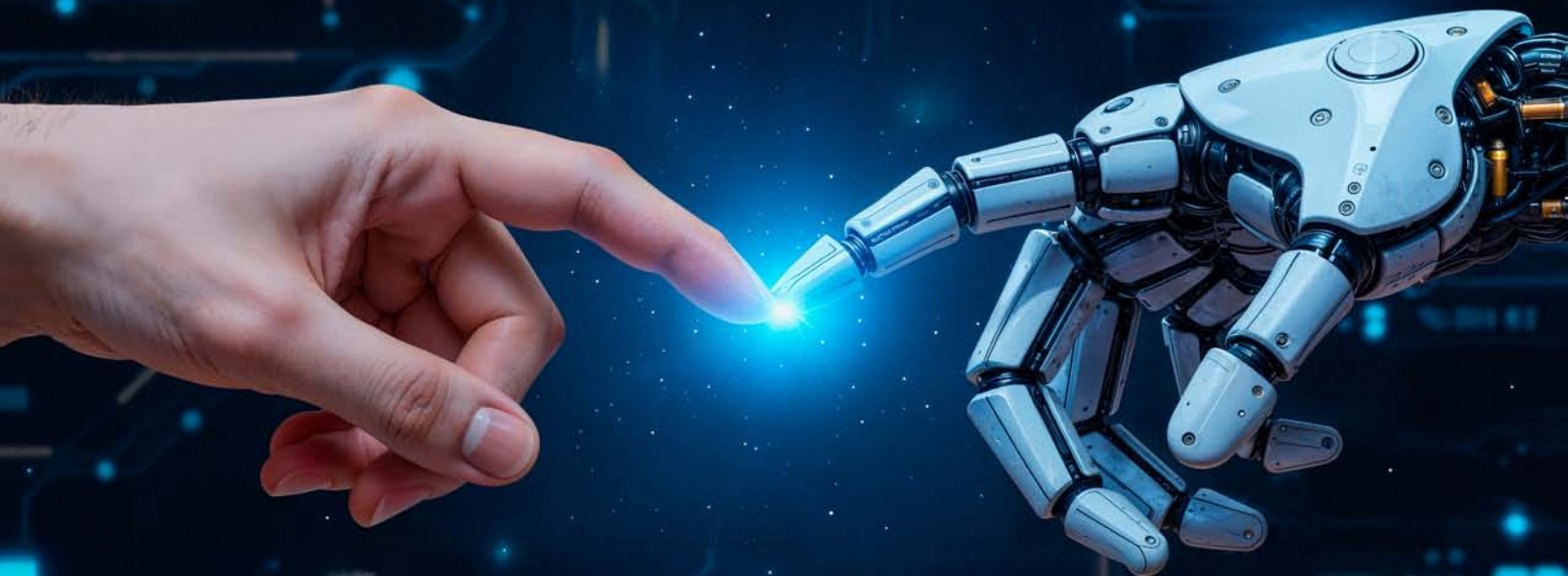


HUMAN-COMPUTER INTERACTION IN INDUSTRY 5.0

INNOVATION, SUSTAINABILITY,
AND THE FUTURE OF WORK



Editor:
Sonal Trivedi

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Human-Computer Interaction in Industry 5.0: Innovation, Sustainability, and the Future of Work

Edited by

Sonal Trivedi
School of Business
Manav Rachna University
Faridabad, Haryana
India

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FOREWORD

We are living through a new era where the interface between human capability and machine intelligence is determining the course of the future of all domains, sectors, and institutions. Having been part of the evolution of both technological developments and institutional strategies over the last several decades, I can say with a great deal of conviction that this book happens to be a timely one. "Human-Computer Interaction – "Managing Innovation and Sustainability" is much more than just a book on an academic subject. It is a harbinger of what is to come.

This book is a rare one – it not only asks us to reconsider the topic of HCI, but also to consider it through the prism by which we should measure our own social responsibilities, our economy, and our philosophies of leadership. Yes, the world is ready to talk about disruption and what is being automated – this book asks for more than that. It highlights the need to innovate in ways that not only accelerate progress but also promote justice, particularly in an era where data are easily accessible but wisdom is scarce. The strength of the book lies in its multidisciplinary approach. This book draws on the thinking and influence of people from diverse streams: the corporate sector, the legal profession, the education sector, and engineering. This allows it to create a rich tapestry that is relevant to the subject. The takeaways from this book will encourage people across diverse disciplines to move beyond the boundaries of their subject disciplines and think from a systems approach.

This is not a book with easy solutions or a utopian philosophy toward technology. Rather, it is one that raises questions of relevance—questions that are inciting, demanding, and urging us to lead with our minds and with our moral character. This is precisely what all great scholarship should ever hope to accomplish: it increases the dialogue and raises the level at which we think about the future.

I would like to congratulate the editors and the contributors on the clear sense of purpose and collaborative endeavor that has gone into the compilation of the book. This book is much more than an addition to the academic literature; it is an essential companion for anyone seeking to build a more connected, conscious, and sustainable world.

Balamurugan Balusamy
School of Engineering and IT
Manipal Academy of Higher Education
Dubai Campus, Dubai, UAE

PREFACE

The Human-Machine interface is no longer only a domain of engineering and design; it is also one of the defining aspects of our lives in the twenty-first century. As we enter Industry 5.0, it is important to note that Human-Computer Interaction has undergone a radical shift. Human-Computer Interaction is not only dealing with making computers user-friendly anymore; it is now all about building a dialogue between human intellect and technological progress that not only answers to the needs of our present scenario of climate change, resource depletion, global instabilities in economies, and increasing digital divide or disparities, but is also doing it in a way that is sustainable in nature. Within this framework, it is important to note that “Human-Computer Interaction: Managing Innovation and Sustainability” is a book that makes a necessary contribution to today's world.

This book is a compilation of various scholarly and professional writings that embody both the hope and the need that come with innovation. As digital transformation sweeps across various industries like supply chain management, marketing and advertising, communication, finance, education, and governance, it is important to remember that the human element is at the heart of any successful use of technology. The contributions in this book discuss various ways in which artificial intelligence, blockchain, IoT, big data, and other forms of digital technology may aid and not overshadow human decision-making, creative thought, and values. The views presented in the book offer profound insights into global realities and social and cultural settings in countries like India, Malaysia, South Africa, Zimbabwe, and Italy. The book presents technology not as a panacea but as an enabler that needs to perform in relation to design and strategic vision.

The authors of this edited book tackle very important issues: How can renewable energy infrastructure transform supply chains for a low-carbon economy? How can communication technologies empower knowledge workers and institutions around the world? What leadership approaches are required to navigate risk and complexity in a volatile, uncertain, complex, and ambiguous (VUCA) world? How can learning institutions become breeding grounds for green innovation and social responsibility in the age of intelligent machines? These issues are interconnected and woven into the overall tapestry of human-centric change. Industry 5.0, in contrast to its predecessor, is more interested in collaboration, empathy, flexibility, and a sense of meaning than in mere efficiency and automation. The future of innovation, as indicated in the chapters of this book, will not be determined by how quickly we implement systems, but by how carefully we connect them to the needs of humanity and the planet.

However, what makes this book unique is its application of academic insights to real-life or macro-relevance. However, whether it is developing a curriculum at a business school, driving digital transformation at a public organization, or developing sustainability strategies at a multinational corporation, many of the ideas discussed in this book will serve as a directional force or inspiration for many people around the world. Another interesting characteristic of this edited book series is that the publishing background of authors and publishers ranges from business and law to engineering and media-related fields, hence establishing the interdisciplinary nature of the field of study referred to as HCI.

The editors have conceptualized this volume not just as a compilation of research but also as a site for conversation between regions, disciplines, and generations. It is meant to spur deeper thinking about how we, the global community, can imbue innovation with goals that are economically profitable, socially equitable, and environmentally regenerative. It is a call to

action: to think beyond narrow definitions of progress, to embrace complexity, and to co-create solutions that enhance rather than diminish the human experience. It dares us to dream of futures wherein humans and computers do not compete but collaborate in a common march toward sustainability.

We would like to thank all the contributors whose intellect and vision have made this book possible, and the various academicians and reviewers who have aided in its development. We hope that the readers of this book, whether educators, researchers, entrepreneurs, students, or policymakers, will find both clarity and curiosity, as well as frameworks and vision within its pages. In a world that finds itself struggling to adapt to the pace of technological progress, we hope that this book will be a constant reminder that the true key to innovation is our ability to put the human spirit at the forefront of every leap we make into the digital age.

Sonal Trivedi
School of Business
Manav Rachna University
Faridabad, Haryana
India

List of Contributors

Anjali Hans	Faculty of Social Science, Arts and Humanities, Lincoln University College, Kota bharu, Malaysia
Anesu Ngoro	Department of Business Management, Midlands State University, Gweru, Zimbabwe
Emmanuel Hans	Faculty of Social Science, Arts and Humanities, Lincoln University College, Kota bharu, Malaysia
Gurpreet Kaur	School of Management & Commerce, Manav Rachna University, Faridabad, Haryana, India
Gurpreet Singh	School of Computer Science and Engineering, Lovely Professional University, Jalandhar, Punjab, India
Kunal Singh	School of Management & Commerce, Manav Rachna University, Faridabad, Haryana, India
Leeroy Murombedzi	Department of Business Management, Midlands State University, Gweru, Zimbabwe
Mamta	Chitkara Institute of Engineering and Technology, Chitkara University, Rajpura, Punjab, India
Mamta Sharma	Department of Business Administration, Chandigarh Engineering College (CEC), Mohali, Punjab, India
Mohd Afjal	College of Economics and Management, Al Qasimia University, Sharjah, UAE
Mufaro Dzingirai	Harold Pupkewitz Graduate School of Business, Namibia University of Science and Technology, Windhoek, Namibia
Neha Kamboj	School of Management, IILM University, Gurugram, Haryana, India
Payal Sanan	Prin. L. N. Welingkar Institute of Management Development & Research (PGDM), Mumbai, Maharashtra, India
Robin Atwal	Chitkara Business School, Chitkara University, Rajpura, Punjab, India
Simranjeet Kaur	Chitkara Business School, Chitkara University, Rajpura, Punjab, India
Sonal Trivedi	School of Business, Manav Rachna University, Faridabad, Haryana, India

CHAPTER 1

Global Perspectives on Communication Technology: Unified Communication and Voice Over Internet Protocol

Emmanuel Hans^{1,*} and Anjali Hans¹

¹ Faculty of Social Science, Arts and Humanities, Lincoln University College, Kota Bharu, Malaysia

Abstract: Communication technology encompasses the diverse tools, systems, and techniques used to transmit information and share ideas among individuals or groups across distances. Communication technology refers to electronic tools or automated systems developed to store, manage, and process data efficiently. Communication technologies allow us to perform activities such as working online, shopping online, using applications, and engaging with social media platforms. In a highly interconnected world, communication technology plays a central role in global interaction, influencing how individuals and organisations communicate and collaborate today. Two significant developments in communication technology are Unified Communications (UC) and Voice over Internet Protocol (VoIP), both of which have transformed how communication takes place worldwide. Unified Communication and Voice over Internet Protocol lie at the core of modern communication technology, bringing about major changes in the way people connect and collaborate worldwide. Their influence goes beyond simple convenience, promoting greater inclusivity, lowering costs, and supporting a more connected world. As technology continues to advance, UC and VoIP are set to assume an increasingly vital role in shaping the future of global communication. This research paper is therefore valuable for academicians, IT students, and IT professionals.

Keywords: Apps, Communication technology, IT tools, Information technology, Unified communication, Voice over internet protocol.

INTRODUCTION

Communication technologies facilitate the storage of digital information on different types of electronic media storage devices, such as digital files and memory cards (Trivedi *et al.*, 2021). Digital information includes items such as

* Corresponding author Emmanuel Hans: Faculty of Social Science, Arts and Humanities, Lincoln University College, Kota Bharu, Malaysia; E-mail: emmuhans@gmail.com

web pages, images, music, videos, documents, and other related forms of data (Trivedi, 2024). Digital information includes video, images, text, and audio (Trivedi, 2024). Communication technology is a wide field of engineering that focuses on transforming data into information and converting information back into data (Trivedi, 2024). Furthermore, communication technology enables the transmission of data and information in the form of text, images, audio, and video (Trivedi & Malik, 2022). Communication technology devices include a wide array of tools and equipment created to enable the transfer of information between individuals or organizations. Unified Communication (UC) involves the integration of multiple communication tools and technologies into a unified system, aimed at improving and simplifying communication processes both within and across organizations (Trivedi & Malik, 2022). UC includes various communication methods such as instant messaging, voice calls, video conferencing, email, and file sharing, all available through a single platform (Trivedi & Malik, 2022). This unified approach enables real-time collaboration, minimises communication barriers, and enhances overall productivity (Trivedi, 2023). The implementation of UC has greatly influenced global business operations (Trivedi, 2023). By offering a smooth and integrated communication experience, UC facilitates remote work, promotes international collaboration, and improves customer service. It allows companies to connect effortlessly with clients, partners, and employees across different locations, creating a more agile and responsive business environment.

Voice over Internet Protocol (VoIP) is a technology that allows voice communication and multimedia interactions to occur over the Internet (Trivedi, 2023). Unlike conventional telephone systems that depend on circuit-switched networks, VoIP transmits voice data *via* packet-switched networks (Trivedi & Malik, 2021). This approach greatly lowers the cost of long-distance and international calls and offers additional features such as voicemail, call forwarding, and conference calling (Trivedi & Begde, 2024). VoIP has made voice communication more affordable and widely accessible globally (Trivedi *et al.*, 2024). It has also enabled the development of innovative communication solutions, including cloud-based phone systems and mobile VoIP apps, providing increased flexibility and scalability for both businesses and individuals.

BACKGROUND

Unified Communication (UC) and Voice over Internet Protocol (VoIP) are two technological innovations that have profoundly transformed global communication (Choudhary & Trivedi, 2023). Their progress is closely linked to the wider evolution of communication technology, which has shifted from

analogue to digital systems over the past few decades (Choudhary *et al.*, 2023). Unified Communication (UC) emerged from the merging of multiple communication technologies, with the goal of unifying various communication methods into a single, cohesive system. In the past, organizations depended on separate tools such as traditional telephones, email, and fax. The emergence of digital communication in the late 20th century paved the way for advanced tools such as instant messaging, video conferencing, and collaborative platforms. Unified Communication (UC) represents the peak of these developments, providing a single interface for various communication channels and thereby simplifying and improving organizational communication. Voice over Internet Protocol (VoIP) emerged in the 1990s as a major innovation, using the Internet to transmit voice data. Early VoIP systems were basic and faced challenges such as low sound quality and delays. However, improvements in Internet infrastructure and compression technologies have made VoIP a dependable and cost-efficient alternative to traditional telephone services. Companies like Skype and Vonage played a key role in popularizing VoIP for both consumers and businesses, showcasing its potential for affordable and flexible voice communication.

LITERATURE REVIEW

UC combines multiple communication tools and services into a unified platform, improving both the efficiency and effectiveness of communication. Its components often include instant messaging, voice and video calls, email, voicemail, and collaborative features such as document sharing and virtual whiteboards (Garrett, 2020). The concept of UC arose in the early 2000s as organisations aimed to simplify communication processes and cut costs. Initial implementations concentrated on merging voice and email systems, gradually adding advanced features such as video conferencing and mobile integration. Progress in cloud computing and artificial intelligence has significantly expanded the capabilities of UC platforms. Cloud-based UC solutions provide scalability, flexibility, and cost efficiency, while AI improves functionalities such as virtual assistants, automated transcription, and advanced analytics.

The adoption of UC has been motivated by the demand for smooth, real-time communication, particularly in remote and hybrid work settings. Research shows that UC enhances collaboration, productivity, and employee satisfaction, leading to improved organisational performance (Johnson *et al.*, 2021). VoIP technology enables voice communication to be sent over the Internet instead of conventional telephone lines. It transforms analogue voice signals into digital data packets that are transmitted through IP networks. VoIP began in the mid-1990s with the introduction of Internet telephony software like VocalTec. Since then,

CHAPTER 2

Future Trends and Prospects of Artificial Intelligence, Internet of things, Big Data, and Machine Learning in Industry 5.0

Mufaro Dzingirai^{1,*}, Leeroy Murombedzi² and Anesu Ndoro²

¹ *Harold Pupkewitz Graduate School of Business, Namibia University of Science and Technology, Windhoek, Namibia*

² *Department of Business Management, Midlands State University, Gweru, Zimbabwe*

Abstract: The technological advancement wave is transforming every business activity. As managers are still grappling with Industry 4.0, Industry 5.0 is gaining momentum, especially in the developed countries. It is widely accepted that Artificial Intelligence (AI), the Internet of Things (IoT), big data, and machine learning necessitate a paradigm shift in industry and commerce. As such, strategic managers are expected to be well-prepared and adopt proactive strategies to harness the transformative power of these technologies. However, it appears that managers in developing countries are lagging when it comes to the adoption of these advanced technologies of Industry 5.0. Therefore, this chapter established the future trends and prospects of AI, IoT, big data, and machine learning in Industry 5.0. This study concluded that these advanced technologies are playing a significant role in promoting the sustainable growth of companies in the industry and commerce. The advanced technologies of Industry 5.0 are associated with several positive effects. However, some limitations warrant the attention of strategic managers. It is recommended that managers focus on evidence-based management supported by AI, IoT, big data, data analytics, and machine learning to foster corporate sustainability.

Keywords: Artificial intelligence, Big data, Data analytics, Industry 5.0, Internet of things, Machine learning.

INTRODUCTION

In recent years, it is common knowledge that Artificial Intelligence (AI), the Internet of Things (IoT), big data, and machine learning are revolutionizing how businesses operate. These technologies are driving and supporting the 4th Industrial Revolution, which is accelerating a paradigm shift in all areas of

* **Corresponding author Mufaro Dzingirai:** Harold Pupkewitz Graduate School of Business, Namibia University of Science and Technology, Windhoek, Namibia; E-mail: mufaro.dzingirai@gmail.com

business (Mhlanga *et al.*, 2023). The technological developments in Industry 5.0 justified the need to broaden our understanding of advanced technologies within the business fraternity. It is not surprising to notice that journalists, policymakers, business leaders, civil society, researchers, and development practitioners are very interested in how to harness the power of data warehousing, virtual reality, IoT-based devices, and AI in achieving the targets of sustainable development (Mhlanga & Dzingirai, 2023). It is unfortunate that the Global South countries are adopting these technologies at a very slow pace in comparison to the Global North countries.

Going forward, Global North countries like the UK (United Kingdom) and the USA (United States of America) are reshaping the technological adoption discourse in Industry 5.0 as they have robust policies and innovation platforms (Bigan, 2022). With fertile ground for Industry 5.0, many developed countries are supporting technological advancement at an alarming rate. This can be attributed to the fact that they have strong financial muscles to support innovation hubs. More interestingly, developed countries attract a pool of technological talent across the globe.

It is widely accepted among various authors from different disciplines that digital technologies like AI and IoT are playing a transformative role in many fields like health, finance, economics, agriculture, development, law, and sociology (Dzingirai & Mveku, 2023; Mhlanga *et al.*, 2023). In terms of the value chain, the adoption of advanced technology is the game-changer as it is associated with fundamental structural change. With the advances in technology, some key trends have been identified. In this respect, the multimodal AI is gaining momentum. Notably, the development of more customized home-based data pipelines, as well as powerful virtual agents, is supported by governments. More interestingly, the issues related to shadow AI, AI regulation, copyright violation, ethical AI concerns, and corporate AI policies are trending concepts in Industry 5.0.

It is imperative to capture the transformative power of machine learning, IoT services and devices, AI, virtual reality, data analytics, and smart sensors in the business world, although the implications of these advanced technologies are limited in the Global South countries. The limited understanding and fragmented literature on Industry 5.0 demand further research. Hence, the current study bridges these gaps by answering the following research question: *Which trends and prospects of machine learning, IoT-based services and devices, AI models, and data analytics techniques are shaping Industry 5.0?*

ROLE OF AI IN PROMOTING CORPORATE SUSTAINABILITY

Given the dominance of corporate sustainability narratives in the business fraternity, organizations are investing in digital capabilities like AI technology as strategic intangible assets that can be used to drive the development of innovative sustainable products, minimize manufacturing waste, enhance resource utilization in accordance with circular principles, and promote the achievement of sustainable development targets (Kumar *et al.*, 2020). The provision of real-time data is the main benefit of integrating AI platforms into all functions of the business. As such, businesses are at the forefront in the implementation of AI technologies when creating new business opportunities and surpassing customer expectations.

Business professionals are assessing the viability of business alternatives by leveraging the power of AI algorithms when analyzing business data extracted from a multiplicity of sources, like IoT services and devices, smart sensors, mobile networks, smart motion sensors, and connected devices. In this context, Li *et al.* (2020) expressed that AI algorithms are generating business value in areas like water conservation, biodiversity management, waste elimination, green product innovation, and energy efficiency. While small and medium businesses face financial challenges, big companies are gaining a competitive advantage from the power of AI in the competitive market, leading to higher profits. In the context of facilities management, Wang *et al.* (2020) observed that AI algorithms are applied to reduce energy consumption by 30%. In the agricultural sector, Chlingaryan *et al.* (2018) documented that AI-powered techniques help farmers with soil moisture content analysis, crop health assessment, optimal irrigation scheduling, weather forecasting, input wastage analysis, and minimizing water consumption. The transformative power of AI has become increasingly relevant in Industry 5.0 in areas of corporate sustainability practices.

As the concept of social responsibility has garnered much attention in business circles, the transformative power of AI in fostering social responsibility has not been widely researched. It is within this context that proactive entities are using AI-powered algorithms in inclusivity assessment and business ethics evaluation. Interestingly, Duan *et al.* (2020) suggested that AI technologies and platforms are vitally important in the employee hiring process, sustainable product development, inclusion assessment, equity evaluation, and detection of potential errors in forward-looking decisions. The social impact of the business can be easily assessed by stakeholders by applying AI algorithms in e-education, e-finance, e-health, and smart agriculture towards the attainment of sustainable development targets.

CHAPTER 3

Assessment of Flexibility in Service Businesses: A Review and Research Framework**Payal Sanan^{1,*} and Mohd Afjal²**¹ *Prin. L. N. Welingkar Institute of Management Development & Research (PGDM), Mumbai, Maharashtra, India*² *College of Economics and Management, Al Qasimia University, Sharjah, UAE*

Abstract: The chapter aims to conduct a rigorous review of the literature on service flexibility and extract distinct themes. A systematic literature review was conducted to develop the underlying themes of service operations flexibility. NVIVO 10 was used to evaluate the research papers retrieved from the electronic database for the present study. The thematic analysis indicated the presence of several patterns, which were then clustered into various themes. Eight distinct themes encompassing different facets of service flexibility were reported. The paper provides critical insights for service providers by highlighting the advantages of developing service flexibility mechanisms in the service processes of the firms. The study further provides a framework for future research by raising compelling questions.

Keywords: Service flexibility, Service encounter, Service recovery, Service innovation, Thematic analysis.

INTRODUCTION

Businesses in Asian markets have been experiencing tremendous growth following the rapid increase in demand and economic growth across Asian countries. Growth in the Asia-Pacific region was likely to surge to 4.6% in 2023 from the 3.8% recorded in 2022, as per the reports of the International Monetary Fund. The report also emphasized that the growth would be majorly led by India and China. The IMF report quoted that “Asia and Pacific will be the most dynamic of the world’s major regions in 2023, predominantly driven by the buoyant outlook for China and India”. Investors across the globe are showing strong confidence in Asian markets and making huge investments in Asian businesses. Though Asian markets demonstrate huge potential for growth and steady development, they have now become more volatile and dynamic than ever

* **Corresponding author Payal Sanan:** Prin. L. N. Welingkar Institute of Management Development & Research (PGDM), Mumbai, Maharashtra, India; E-mail: payal.sanan@welingkar.org

before. Thus, it is likely that firms operating in these regions may be exposed to a high degree of risks and uncertainties and may be required to remain alert and adaptable to cope with new business paradigms.

A significant amount of research in the past has highlighted that businesses always face a high degree of uncertainty and the issues associated with it. The uncertainty may arise from internal or external sources as well as from micro- or macro-environmental factors. Rapid changes in the business environment may be in the form of global competition, rapid technological shifts, changing customer preferences, and shorter product life cycles. (Zhang *et al.*, 2003). All these scenarios, and many more, are challenging today's firms across most industries. Scholars have argued that organizations must achieve 'flexibility' at various levels to provide value to their customers. Flexibility refers to "the capability of an organization to respond to the rapid changes taking place in the business environment". The concept of flexibility is quite diverse and can be found in literature across various disciplines. The scope of flexibility is equally vast, as this concept can be traced across manufacturing, services, supply chain, HR, CRM, and e-commerce in the extant literature on flexibility. Recent studies have also focused on the significance of flexibility in achieving organizational excellence (Lucianetti *et al.*, 2018). Thus, it becomes imperative to explore the concept of flexibility and to fathom its various elements and linkages.

There has been a considerable increase in the literature on the concept of flexibility in recent years. The concept of flexibility is multidisciplinary in its scope and can be applied across numerous domains. Despite several research outcomes highlighting the dimensions and linkages with flexibility, researchers have noted that there are still areas of the theory of flexibility that lack clarity and understanding. Though a vast body of literature exists on the applicability and relevance of flexibility in the manufacturing sector, the existing body of flexibility research data is not sufficient in the context of services. The services sector has grown rapidly and contributed to the economy's development tremendously. The contribution of the services sector to GDP for selected Asian countries ranged from 21.4% to 63.9% in 1980 and rose from 33.7% to 86.5% in 2002 (Lovelock & Gummesson, 2004). Uncertainties on both the demand and supply sides are a concern for service operations, which can be addressed by adopting flexible service processes. The significance of flexible processes in service operations for customer satisfaction and value creation cannot be ignored. Despite researchers' acknowledgement that flexibility is important in service operations, there is very little research to support this claim.

The present study, a systematic assessment of the literature on flexibility, identifies a knowledge gap and fills it with new perspectives on established

theories. The paper attempts to collate all flexibility research data, organize and analyze them, and provide a comprehensive understanding of the advancement in this academic area.

FLEXIBILITY RESEARCH: THE BACKGROUND

Researchers in recent years have shown great interest in studying the concept of flexibility and its various aspects and contexts. Flexibility is a competitive dimension that a firm can develop to deal with environmental changes and uncertainties. It can be defined as “the ability of the organization to adapt to substantial, uncertain, and fast-occurring environmental changes that have a meaningful impact on the organizational performance” (Browne *et al.*, 1984). The idea of flexibility was first introduced in the manufacturing sector during the 1980s, when a lot of studies were conducted to understand the success of Japanese manufacturers (Schonberger, 1982). A considerable body of literature has developed on the concept of flexibility in manufacturing since then. Flexibility is regarded as one of the important components in a firm’s manufacturing processes, playing an important role in two ways: firstly, flexibility can be viewed as one of the critical features of an organization when it faces environmental turbulence, and secondly, flexibility is very pervasive and can impact other firm’s competitive strengths such as delivery speed and dependability (Corrêa & Gianesi, 1994).

Some authors have noted a paradox in the fundamental concept of flexibility: in many definitions, flexibility opposes stability. Studies have highlighted that having too great a capacity to adapt and being overly flexible in one’s approach may lead to indecisiveness, rapidly increasing costs, and continuous revision of plans (Colwell *et al.*, 2008). On the other hand, if the reaction time is too short or the reaction capacity is too high, it may result in overreaction. Sometimes it may also lead to excessive search for information and the wastage of valuable resources (Volberda, 1996).

A large part of the literature on flexibility is about the discussions on the definition of flexibility. Scholars have interpreted the concept of flexibility in various ways. One of the early definitions of flexibility is “the ability to respond quickly to the changing environment”. Flexibility is a term that has a wide scope and various interpretations. The connotation of this term is quite diverse. A few words from the literature are quite close in meaning to the term flexibility: responsive, adaptive, adjustment, agility, resilience, and robustness. Flexibility means the competence of the system to adjust to the changes (Gupta & Goyal, 1989). It can also be viewed as “the adaptability of a system to a wide range of possible environments that it may encounter” (Sethi & Sethi, 1990). Flexibility has also been defined as “the organization’s ability to meet an increasing variety

Transforming Industry 5.0: Bank Stability and Sustainable Economic Development

Mamta Sharma^{1,*} and Neha Kamboj²

¹ *Department of Business Administration, Chandigarh Engineering College (CEC), Mohali, Punjab, India*

² *School of Management, IILM University Gurugram, Haryana, India*

Abstract: A well-organized allocation of resources, control of financial risks, maintenance of employment levels close to the average rate of the economy, and the abolition of relative changes in real or monetary resources that might jeopardize economic security or employment levels are all characteristics of a sound financial system. The 2008 crisis showed that various vulnerabilities in the banking system could harm the global economy. This crisis teaches a lesson to many economies that they need to establish regulatory frameworks to reshape the guidelines that oversee financial stability systems and prime institutions. These frameworks will be helpful in commencing policy and, therefore, help improve financial stability. The present time marks the fourth industrial revolution. In the era of the fourth industrial revolution and after the COVID-19 pandemic, banking stability plays an important part in any economy. It is rightly said by the Russian Congress party that sustainable development must go hand in hand with rapid development, a principle reflected in banks that have adopted banking intelligence. These two will affect each other at both the macro and micro levels in both the short and long runs. The literature that connects banking stability to economic sustainability is exceptionally scant. The limited literature on banking stability and manageability can be credited to one key limitation: how to calculate sustainability. Most strategy creators and specialists depend on macroeconomic factors like GDP, GRP, and so on as indicators of sustainability. In any case, these pointers fail to present a thorough perspective of the genuine importance of sustainability. In the present study, we examine the impact of banking stability on sustainable economic growth over the years 2017-2021 for 8 economies with the top 25 highly market-capitalized banks. Here, Panel Fully Modified Ordinary Least Squares (FMOLS) is applied and unfolds the outcome. We took the economic sustainability index as an indicator for sustainable economic development. To assess banking stability, we used the non-performing loan ratio, the Bank Z-score, and the bank capital-to-assets ratio. In this way, three independent variables, viz. non-performing loan ratio, Bank Z-score, and the bank capital-to-assets ratio, and one dependent variable, the economic sustainability Index, were considered. The empirical results of the analysis show that Bank Z-score and bank capital-to-asset ratio have a positive and

* **Corresponding author Mamta Sharma:** Department of Business Administration, Chandigarh Engineering College (CEC), Mohali, Punjab, India; E-mail: mamtasharma447@gmail.com

significant relationship with the dependent variable, *i.e.*, the sustainable development index, and a negative and significant relationship with the non-performing loan ratio. We conclude that increased banking stability has a markedly favorable effect on sustainable economic development, which ensures inclusive and long-term economic growth. This study has significant implications for bankers, regulators, policymakers, and the economy as a whole.

Keywords: Bank stability, FMOLS, NPL, Sustainable economic development, Z score.

INTRODUCTION

Sustainable development is the major focus of the current century. The whole world is being taken hold of by the concept of sustainable development. It is listed as an agenda for the Millennium Development Goals (Zadek & Kharas, 2018; Levine, 2005). The World Bank, an influential body of the 193 United Nations Member States, implemented the 15-year SDGs program on September 25, 2015 (www.companiesmarketcap.com). “Transforming Our World: 2030 Agenda for Sustainable Development” was made possible. It has drawn the interest of global as well as local communities and organizations and led them to adopt a number of policies to support SD initiatives, such as the G20 Action Plan for Sustainable Development (www.imf.org). The financial sector has often been cited as the cornerstone of sustainable development (www.companiesmarketcap.com).

With the deluge of drives in banking systems lately, most analysts have diverted their endeavors to grasp the connection between stability in banking and sustainable economic development (Gel *et al.*, 2008). Others are focusing on the two edge effects (Guy & Lowe, 2011). For instance, it has been discovered that bank stability in European nations is regarded as a driver of their economic growth (Demetriades & Rousseau, 2016). There is a one-way association between the industrial sector, growth, and banking sector improvement, contrary to a previous study (Narayan & Narayan, 2013) that identified a two-way relationship between banking sector development and agricultural sector development. Thus, the study reveals the major influence of the growth of banking on that of the industrial sector, but not the other way around, despite academics' best efforts to explain how financial stability influences measures of macroeconomic stability. Previous studies are undeniably less clear on whether the banking sector stability is the fundamental trigger of economic or financial development, or whether it just slows it down. In this way, it is challenging to isolate circumstances and logical results in the nexus between the real economy and the economic sector (Demirgüç-Kunt & Detragiache, 1999; Hamilton, 2006). These investigations clarify that the connection between banking stability and financial movement is

particularly noteworthy to strategy creators, as it is one of the reasons they choose financial arrangement choices based on monetary conjectures. In terms of economic sustainability and financial stability, the global financial system will be at the center of humanity's efforts to achieve Sustainable Development Goals, according to Schmidt-Traub and Shah Murphy *et al.* (2017) (SDGs). Late gauges indicate that the SDGs will require an additional US\$2.4 trillion in annual investment (public and private) in well-being, energy, agriculture, education, low-carbon infrastructure, and other sustainability areas worldwide (www.theglobaleconomy.com). The monetary framework (particularly the banking sector) has the obligation to mobilize this capital for the SDG plan (Ozili, P. K. 2023). To accomplish the global SDGs, every nation plays a critical part. In this manner, it suggests that nations must ensure financial strength to fund the SDGs at the national level.

LITERATURE REVIEW

Despite the fact that studies linking banking stability and sustainable economic development are very few in number, a few endeavors have been undertaken by specialists around the world. In Nigeria, Azeez & Oke (2012) examined how the country's banking system and its changes maintained stability and competence in the banking framework, which was researched to gauge the influence of banking reforms on Nigeria's economic growth. They made use of time series analyses. They reasoned that there appears to be a long-term association between changes in the banking sector and Nigeria's economic growth. The general findings showed that banking changes do not significantly and favorably affect the economy (Demetriades & Rousseau, 2016; Beck, De Jonghe & Schepens, 2013).

Similar to this, Jayakumar *et al.* (2018) focused on how banking stability affects development. A panel vector autoregression strategy was used. They concluded that a key factor in GDP growth is banking stability. Parallel to this, Murphy *et al.* (2017) used an autoregressive distributed lag model to investigate the effect of economic sector growth on India's monetary growth. The analysis revealed that India's economic growth is positively impacted by financial development. Apart from these studies that take the example of one country, we found few studies that examined the impact of banking stability on long-run economic growth using cross-country analysis (Tongurai & Vithessonthi, 2018; Zhuv *et al.*, 2016; Jayakumar *et al.*, 2018; Mhadhbi, 2014). Though the results are inconclusive, a few studies have found a positive and significant impact among the selected variables (Schmidt-Traub & Shah, 2015; Milne, 2014; Younsi & Bechtini, 2018). Others found negative impacts among the selected variables (Jokipii & Monnin, 2013; Wyman, 2015; Guy & Lowe, 2011; Mhadhbi, 2014). For example,

CHAPTER 5

Introduction to Blockchain Technology: Applications, Opportunities, and Challenges

Mamta^{1,*}, Sonal Trivedi² and Gurpreet Singh³

¹ Chitkara Institute of Engineering and Technology, Chitkara University, Rajpura, Punjab, India

² School of Business, Manav Rachna University, Faridabad, Haryana, India

³ School of Computer Science and Engineering, Lovely Professional University, Jalandhar, Punjab, India

Abstract: This chapter explains how “blockchains” function. A distributed database known as a blockchain that maintains an ever-expanding list of records preserved from modification, even by the individuals who manage the data store's endpoints. It can be a communal record of all previous transactions. As completed blocks are added to earlier blocks to form a chain, it keeps expanding. Significantly, blocks are included in the blockchain technology in a series, in a symmetrical manner. The Blockchain it receives provides precise, comprehensive data on the physical addresses and the amounts they have remaining, starting with the initial block and ending with the most recent block. This study includes a thorough analysis of academic literature on blockchain technology. We first took into account 200 articles before narrowing the list to 150. This led us to develop a classification structure with three categories for blockchain-enabled advantages, difficulties, and functionality. This study identifies consequences for the upcoming blockchain-related study and practice.

Keywords: Blockchain, Distributed technology, Data integrity, Decentralization, Scalability, Transparency.

INTRODUCTION

The Bitcoin whitepaper, released in October 2008 by a person or organisation using the alias Satoshi Nakamoto, is where the idea for blockchain first appeared. In the “Bitcoin: A Peer-to-Peer Electronic Cash System” whitepaper, a decentralized electronic cash system based on the cutting-edge blockchain method was outlined.

* **Corresponding author Mamta:** Chitkara Institute of Engineering and Technology, Chitkara University, Rajpura, Punjab, India; E-mail: Mamta.2325@chitkara.edu.in

The blockchain methodology was introduced as a solution to the long-standing problem of double-spending in digital currencies, where a digital token could be duplicated and spent more than once. All transactions made with Bitcoin are recorded in a publicly accessible, secure, and transparent database called the blockchain.

While Bitcoin popularized blockchain technology, the idea of using a decentralized and tamper-resistant ledger can be traced back to earlier concepts. In the 1990s, researchers and cryptographers explored the concept of a secure chain of blocks to maintain timestamps of digital documents. However, it was the combination of various existing technologies and the introduction of the consensus mechanism called proof-of-work that made blockchain practical and successful.

Since the creation of Bitcoin, blockchain technology has evolved beyond cryptocurrencies. It has found applications in a number of sectors, like finance, logistics, medical care, *etc.* There have been several blockchain platforms and cryptocurrencies created, each with unique characteristics and applications, contributing to the advancement and widespread adoption of the blockchain system.

A decentralised, distributed ledger system that enables many parties to record and verify transactions securely and transparently, blockchain technology is a ground-breaking idea that has attracted substantial interest in recent years.

At its core, Blockchain is a network of interconnected blocks, each of which keeps a record of money transfers. By connecting these blocks using encrypted hash values, an unalterable record of each exchange that has ever taken place on the internet is produced. Due to its decentralised structure, blockchain is immune to manipulation and fraud because changing one block would also change all subsequent blocks, which is practically impossible due to the computational power required.

This chapter explains:

- Meaning of a blockchain system
- Development of a blockchain system
- Architecture of the blockchain system
- Key features of the blockchain system
- Application of the blockchain system
- Challenges and opportunities of the blockchain system

LITERATURE REVIEW

The overview of blockchain technology is provided in the following section.

Meaning of Blockchain Technology

According to Trivedi, S. (2023), the blockchain is a distributed ledger that stores transactions across multiple devices simultaneously. The initial blockchain was created by Satoshi Nakamoto, a pseudonym, who also described and executed it. (The Financial specialist, 2015).

A distributed P2P (peer-to-peer) repository that is built on a network is also known as a digital ledger. It consists of a series of blocks, including transactions that are time-stamped, verified by the organization's local region, and safeguarded by public-key infrastructure (PKI). A component of the blockchain cannot be adjusted following its inclusion in the blockchain. Likewise, it keeps a long-lasting record of prior activities (Zachariadis, Hileman, and Scott, 2019). Moreover, Blockchain is anticipated to launch a modern business insurgency while also advancing global financial growth. To begin with, blockchain generates a secure code within a digital structure by encrypting data with a private key. This allows users to confirm transactions without revealing sensitive information. Since blockchain records are immutable, the process is decentralized and completed with certainty. (Chang *et al.* 2020).

Blockchain can be defined as the “cutting-edge Web” and “a new essential innovation” due to its capacity to restore financial transactions, shape how people engage in the economy, and transform the economy (Zachariadis, Hileman, and Scott, 2019).

Blockchain is expected to drive a new business revolution and support global financial growth. It works by securing data with encryption. Transactions can be confirmed without sharing personal information. Since blockchain records cannot be changed, the process is secure and decentralized.

Similar to this, Blockchain is a distributed system for value exchange, supported by decentralised hubs, that serve as a safe data store (Ertz and Boily, 2019). Ultimately, Blockchain is a groundbreaking concept that has drawn the interest of organisations and governments all around the world. In general, “circulated record innovation” refers to a variety of interactions and data documented through a system of disseminated data and observed in sequential order (Rashideh, 2020).

CHAPTER 6

Emerging Vuca Challenges for Innovation and Creativity

Gurpreet Kaur^{1,*}, Robin Atwal² and Kunal Singh¹

¹ School of Management & Commerce, Manav Rachna University, Faridabad, Haryana, India

² Chitkara Business School, Chitkara University, Rajpura, Punjab, India

Abstract: The pandemic era has ruined business operations and exposed them to a VUCA environment. There is an urgent need to build business resilience by elevating creativity, enabling them to withstand the VUCA environment and ensure future growth (Burn *et al.*, 2021). The present study examines how the VUCA environment creates barriers to entrepreneurial creativity/growth and suggests measures to mitigate its effects. The author conducted a review-based study to provide better insights into patterns of creativity and innovation in the presence of VUCA challenges. The study revealed that there is a strong need for business personnel to use divergent thinking when dealing with situations by implementing a holistic management system. Future researchers could work on developing such a strategy. The present study is beneficial for academicians, regulators, decision-makers, and policymakers in framing policies that will motivate personnel to develop creativity even in the presence of VUCA challenges. By highlighting the crucial role of creativity and innovation, the chapter contributes to combating the effects of turbulent environments in organizations.

Keywords: Business resilience, Challenges, Creativity, Innovation, VUCA.

INTRODUCTION

Sustainability is an important model for a fast-developing global environment. However, in the presence of a high level of uncertainty, it is very difficult for the business to sustain itself in the long run without bringing in creativity and innovation, as demands are increasing. Resistance to change will be an obstacle for the business and will make its survival difficult (Trivedi, 2024).

Besides this, the presence of a dynamic environment, VUCA, characterized by volatility, uncertainty, complexity, and ambiguity, is commonly used to depict the

* Corresponding author Gurpreet Kaur: School of Management & Commerce, Manav Rachna University, Faridabad, Haryana, India; E-mail: phd.gurpreet@gmail.com

vigorous changes in the external environment that affect businesses. It defines the ongoing scenario of unpredictable change that occurs in the corporate sector and industries, which further exposes them to varied types of risks. They must be dealt with rigorously to ensure smooth functioning (Glikhova, 2020).

VUCA acts as a double-edged sword for innovation and creativity: on one end, turbulent innovation, and on the other hand, driver of innovation (Trivedi & Malik, 2022). A VUCA environment creates hurdles in planning the future course of action. It cripples innovation and creativity, negating business growth. (Johanna, 2022).

Business is a risk-taking commercial activity that involves managing turbulence and uncertainties. Since the government proclamation of social distancing and the outbreak's implementation in numerous nations, the pandemic has decimated commercial activities across all sectors. COVID-19 suddenly invaded the entire planet and increased the exposure to volatility, uncertainty, complexity, and ambiguity across the business environment.

Numerous firms had to shut down as they were unable to handle the pandemic's effects of volatility, uncertainty, complexity, and ambiguity, or VUCA. In the face of VUCA, only robust businesses can survive. Therefore, business resilience is the only solution that could ensure the long-term viability of a company.

Previous VUCA researchers identified that the environmental conditions were neglected. VUCA has led businesses to focus on bringing resilience by altering their structures. Besides this, understanding the perspective of VUCA at an early stage in business is essential, as it leads to innovation.

Moreover, in the state of growing competition and the presence of VUCA elements at the global level, the survival of businesses is of great concern. The business is faced with the situation of “innovate or die”; hence, innovation and creativity have become imperative tools for survival. These can have long-lasting effects on the survival of the business.

It is mostly noticed that these two terms are used interchangeably, but there is a difference between creativity and innovation. Creativity involves the generation of unique and new ideas for business expansion, whereas innovation relates to starting something better in the business, which can bring in growth for the business. Creativity is generation, and innovation is creation.

Businesses that are engaged in creativity and innovation keep identifying enhanced horizons for opportunities. They are able to scan the environment and

hence mitigate the impact of VUCA. Thus, it can be said that creativity and innovation act as key drivers in business, motivating entrepreneurs to grow.

Therefore, the present study is focused on the need for creativity and innovation in order to bring resilience to the business and deal with VUCA challenges. The study is divided into different sections. Section 1 gives the introduction and background of the study, Section 2 describes the review of literature, Section 3 outlines the research methodology, and Sections 4 and 5 present the discussion, suggestions, and conclusion. Section 6 enumerates the implications of the study, and Section 7 provides the references.

REVIEW OF LITERATURE

Usually, it is perceived that the opportunities in the VUCA environment arise only if one is flexible, adaptable, and insightful. These traits, along with a creative mind and innovative skills, would help adjust to the crisis period. Despite conducive environmental conditions, a good vision and passion of the entrepreneur, as well as innovation and creativity, will always be the most important factors for the success and long-term survival of the business.

The literature provides a path for management to deal with the VUCA world. The study suggests that management should be more insightful and discover varied ways to sustain themselves in an unpredictable environment.

Many researchers in the past have studied how innovation is helpful in thriving in the VUCA world. Shalender & Sharma (2024) stressed the vital role of internal and external forces in bringing innovation in the VUCA world.

Mer & Viridi (2024) and Zu (2023) examined the hurdles faced by entrepreneurs in creativity and innovation in the presence of VUCA parameters.

According to Pregmark (2022), for success in the new era, management needs a vigorous approach. To do this, businesses should consistently indulge in creating new ways. Hanine & Dinar (2022) provided insights on how VUCA segments are obstacles to human creativity. Further, they suggested that human capital management should be properly managed so as to grab all the opportunities.

Trott *et al.* (2022) discussed the challenges of VUCA in the context of innovation and concluded that VUCA elements should be prevented in order to bring innovation and creativity to businesses. Maria (2022) states that the success of any business depends on its workforce and suggests that a leader must have a high degree of sincerity and consistency in creating/innovating new ways to prosper in

Leadership Role in Managing Risk in a Vuca Environment

Gurpreet Kaur^{1,*} and Simranjeet Kaur²

¹ School of Management & Commerce, Manav Rachna University, Faridabad, India.

² Chitkara Business School, Chitkara University, Rajpura, Punjab, India

Abstract: An important paradigm in this fast-growing global environment is sustainability. However, the high degree of uncertainty leads to many obstacles, which further expose the business to VUCA, *i.e.*, volatility, uncertainty, complexity, ambiguity (Fridgeirsson *et al.*, 2021). Therefore, there is a dire necessity for implementing an effective and comprehensive approach to examining and managing risk. The present study is a conceptual approach that describes the role of leaders in managing risk in an unpredictable environment. The study describes the strategies that will be helpful in mitigating business risk. Further, it reveals that a risk management system will help in providing necessary information on the overall risk faced by businesses so as to reduce complexity and ensure business success in the long run (Kuznik, 2016). The present paper is an attempt to examine various alternatives for the detection, prevention, and reduction of future risk. The paper will be helpful for decision makers in formulating such effective policies, which will help sustain the business and ensure its survival in the long run. The study provides a conceptual map that will contribute to empirical research and be helpful to management and leaders in dealing with a turbulent scenario.

Keywords: Business, Leaders, Risk management, VUCA world.

INTRODUCTION

Businesses in the 21st century are adversely affected by VUCA. VUCA, characterized by volatility, uncertainty, complexity, and ambiguity, is commonly used to depict the vigorous changes in the external environment that affect businesses (Simkova, 2021; Pearse, 2017). It defines the ongoing scenario of unpredictable change that occurs in the corporate sector and industries, which further exposes them to varied types of risks (Trivedi, Mehta & Sharma, 2021).

* Corresponding author Gurpreet Kaur: School of Management & Commerce, Manav Rachna University, Faridabad, India; E-mail: phd.gurpreet@gmail.com

VUCA is the finest way to describe the world's dynamic nature. Unpredictable market competition, an inconsistent business environment, and increased complexities in the business often expose businesses to risks and create hurdles to continued operations (Nindiani *et al* 2022). VUCA plays a dual role in the organization (Trivedi, 2024). Firstly, it provides a chance for the business to regenerate its strategies for sustaining the economy. Secondly, it facilitates leaders in exploring their skills and abilities (Trivedi, 2024). A VUCA environment prepares managers for restructuring, rethinking, and formulating policies that will help in continuing the business.

Businesses are exposed to a high level of risk, especially if they are dealing at a multinational level (Trivedi, 2024). The implementation of an adequate system of risk management will be helpful in dealing with risk despite an increased degree of uncertainty and volatility (Trivedi & Malik, 2022). Therefore, a risk management strategy should be formed in accordance with the requisites of the VUCA world. Besides this, a risk management strategy should be developed in a simple, easy-to-understand way to attract different businesses and minimize complexities.

The traditional approach of risk management, which starts with identification, evaluation, response, and monitoring, is inadequate to withstand risk in business (Trivedi & Malik, 2022). Therefore, there is a dire necessity to bring about resilience to survive in this dynamic environment. Moreover, businesses need to be adaptive to these unexpected disruptions, which will not only make businesses successful but also ensure long-term sustainability.

Well-structured strategies for managing risk will be effective not only in proactively mitigating and preventing risk but also in speeding recovery from unprepared risk, which leads to disruption in the organization (Trivedi & Malik, 2022).

Although VUCA may appear unavoidable in some sectors of the economy, working at the individual level will definitely help reduce overall risk (Trivedi, 2023). Understanding VUCA and recognizing volatile, uncertain, complicated, or ambiguous circumstances are essential for managing risk in the business environment (Trivedi, 2023). The present study is an attempt to get better insights into how risk can be mitigated in the VUCA environment. The study focuses on the important role of leaders in managing risk in the VUCA world. The study is segregated into the following sections. Section 1 gives the background and introduction of the study, Section 2 presents the literature review, Section 3 presents the literature analysis, Sections 4,5, and 6 deal with the discussion,

conclusion and future scope of the study, and Section 6 deals with the bibliography for the study.

REVIEW OF LITERATURE

In the present study, a literature analysis has been carried out to provide insight into what strategic approaches firms might use for identifying and managing risk to endure and prosper in a VUCA world. This study serves as a platform for businesses dealing with frequent changes that require managers and staff to make decisions quickly and without a solid scientific foundation. VUCA refers to a set of challenges that everyone in business must deal with, including people, teams, supervisors, and organizations. Many organizations have adopted VUCA leadership to help with everything from crisis management and disaster recovery to leadership and strategy development.

The literature indicates that in a world that is more unpredictable, management should be prepared to manage a lot more, act quickly, and deal with many interrelated information. The regulators of business can change their perspective from depending on predetermined outcomes to considering all alternatives in a difficult setting with the help of a VUCA leadership style (Trivedi, 2023).

To ensure success in new circumstances, management and leadership require a fresh perspective. One must survive for oneself in the VUCA world. To put it another way, people must learn to be more considerate of individuals and their needs (Da Silva Lopes, 2022). To do this, everyone must comprehend psychology and cultivate empathetic behavior. Business operations place a strong emphasis on meaning and purpose.

Wolanin (2022) emphasized the importance of competencies in the framework for managing risk in the organization and concluded that knowledge based on intangible resources and virtual networks is the best driver of competitiveness, leading to creative management while taking advantage of emerging opportunities and competencies of people and the organization (Trivedi & Malik, 2021). This will allow us to successfully predict the growing complexity of the environment. In another study, Nowacka and Rzemieniak (2022) describe how the VUCA world has led to the development of high competencies in system analysis and risk management. It further concluded that businesses need to adapt the competency model and should focus on their strengths as an essential element in the VUCA approach.

Maria (2022) states that the success of any business depends on its workforce and suggests that a leader should have a high degree of sincerity and consistency,

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Sonal Trivedi

Dr. Sonal Trivedi is an Associate Professor, Manav Rachna University. She has more than 13 years teaching experience. She has published 2 Books in National publication and 13 edited books Scopus indexed. She has 61 Scopus indexed documents including books, research papers and book chapters. She has 7 Patents granted. She has received two best paper awards. She has 22 research papers in UGC approved journals and 15 papers presented in International and National conferences. She has acted as conference chair in five international conferences. She is reviewer of 4 reputed journals. She has done her Ph.D. in Management (Finance) 'A study on risk management tools and techniques in life insurance industry in India' from University of Kota (Rajasthan) in 2017. She has also worked as Teaching Assistant in S.V. National Institute of Technology (NIT), Surat (Institute of National Importance under Ministry of Human Resource Development (MHRD), Government of India). Her areas of interest are Blockchain, finance, Banking and insurance. She has been active member of college committees like training and placement, admission, examination cell, NAAC inspection, UGC cell, news and events cell, PRO cell and inter college competitions.