THE TECHNOLOGY SINGULARITY, ADAPTING TO NEW WAYS OF WORK

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Dedication

To my husband, Kevin, whose unwavering love, patience, and tolerance have carried me through every challenge of this journey. You have been, and always will be, my knight in shining armour. To my children, Shreya, Thia, and Kian, who kept me company through sleepless nights, offering laughter, encouragement, and boundless energy. You are the future and the embodiment of hope, continuity, and possibility. This work is dedicated to you, for you will carry forward the legacy of resilience and agility into the generations to come. To my life role models, Vasie Chetty, the uncle whose counsel has guided so many of my life decisions, and Savy Chetty, the guiding light whose encouragement and belief have shown me that anything is possible.

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ABSTRACT
THE TECHNOLOGY SINGULARITY, ADAPTING TO NEW WAYS OF WORK.

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Technological advances have transformed human history across successive industrial revolutions, with recent breakthroughs in artificial intelligence accelerating society into a new cognitive age. The possibility of a technological singularity, a point at which technological systems may evolve beyond human capability, could fundamentally reshape work, skills, and organisational structures. In such volatile, uncertain, complex and ambiguous (VUCA) (Johansen & Euchner, 2013) conditions, research is needed to understand the challenges and opportunities this transformation presents for the workforce.

History shows that technological revolutions disrupt existing jobs and create new forms of work, often widening divides between those who are able to adapt and those who could get left behind. The rise of AI increases this divide, highlighting the urgent need for new approaches to

recruitment, skills development, and workforce planning that prioritise adaptability, resilience, and future readiness.

This study investigates how past industrial revolutions have influenced job roles and skill requirements, examines organisational responses to technological disruption, and, in doing so, suggests a strategic framework to guide future workforce planning. Using a qualitative research design, the study incorporates a systematic literature review as well as semi-structured interviews with industry experts, and thematic inductive content analysis following Braun and Clarke's phases. SWOT analysis and the TOWS framework were used to synthesise strategic insights and strengthen the link between empirical findings and organisational application.

The review has highlighted that while technical skills are essential, the long-term workforce readiness actually depends on agility traits that help individuals navigate uncertainty, unlearn outdated practices, and collaborate with emerging technologies. These insights led to the development of the Agility triad, the study's main conceptual contribution, offering a theoretically grounded and actionable framework for organisations to build sustainable talent strategies amid accelerating technological change.

The study concludes with recommendations aligned with the three agility domains, providing organisations with a roadmap to strengthen learning ecosystems, foster psychological and organisational resilience, and enable hybrid human–machine collaboration. Although limited by its qualitative scope and the rapidly evolving technological landscape, the research provides a sturdy foundation for future practical testing and longer-term longitudinal exploration. Overall, the study offers new theoretical insight and practical guidance for workforce planning in an era defined by complexity, disruption, and the emerging technological singularity.

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CHAPTER I:

INTRODUCTION

1.1 Introduction

History has shown that technological advances over time, through the various industrial revolutions, have been exponential and fundamentally altered human history. Over time, the successive industrial revolutions have deeply transformed the nature of work, the skills people need, and the structure of the global economy (Groumpos, 2021; Melnyk et al., 2019). The onset of the First Industrial Revolution marked a dramatic shift from agrarian and handicraft-based livelihoods to an economy driven by mechanised manufacturing, particularly in industries such as textiles, mining, and transportation. This era displaced many traditional craftspeople but also created new roles in factories, requiring basic mechanical skills and prompting mass migration to urban areas. The Second Industrial Revolution further intensified this transformation by introducing oil, electricity, and new technologies such as the internal combustion engine, which enabled large-scale mass production. Workers had to adapt once again, moving from small workshops to massive factory floors, learning to operate machines, and functioning within highly organised industrial systems (Hobijn & Kaplan, 2024a; Mokyr & Strotz, 2003). The subsequent Third Industrial Revolution, also often referred to as the Digital Revolution, replaced many manual and mechanical tasks with information technology, computers, and automation. This wave significantly affected middle-skilled jobs, requiring workers to develop new digital competencies, such as computer literacy, data handling, and technical troubleshooting (Smith, 2001). While each revolution is often viewed as distinct, its impacts have been cumulative, with each building on the technological and social changes of the previous era. Together, they have progressively shifted the workforce from manual labour to

machine operation, and eventually to digital and knowledge-based work, reshaping job roles, employment patterns, and the essential skills needed to thrive in the modern economy.

In line with this, a Fifth Industrial Revolution is quickly looming towards us. Recent technologies such as quantum computing, the Internet, and big data will be combined with artificial intelligence (AI) learning and reasoning in a way similar to the way a human brain works, ushering in the era of the cognitive age. As technology evolves intelligently, it will continue to build better versions of itself, potentially to the point where humans no longer control or understand it (TerKonda et al., 2024), a scenario often referred to as the Technology Singularity. In times of change bringing volatile, uncertain, complex, and ambiguous (VUCA) impact, there exists a critical need for comprehensive research to comprehend the challenges and opportunities stemming from this revolution (Johansen and Euchner, 2013b) and the impact thereof on the human workforce. The term VUCA has been used to describe a way of thinking that helps with complex problem-solving in unpredictable situations, such as a potential technology Singularity event, and can be used to understand the drivers of chaos to leverage opportunities that may arise from this (Wing, 2025).

Considering the impact of previous industrial revolutions, this transformation could disrupt the business with potential job loss or disruption in current workforce models. However, it also presents new business models as well as human and technology augmentation opportunities brought about by innovation. A Singularity scenario brings some trends that pose potential disruptions and opportunities for organisations and their human resources to adjust. In line with trends across various industrial revolutions, it is apparent that a trajectory towards a Technology Singularity will significantly impact the workforce globally (Gaviola, 2024; Patel, 2023). The emergence of AI is transforming this impact into a critical divide from a workforce perspective.

These transformations and revolutions are milestone periods in human history where innovations lead to new ways of doing things, creating efficiencies and reducing costs (Daemmrich, 2017).Each revolution reshapes how we live, work, and relate to our environment, and there is an urgent need to realign the workforce's skill base to adapt to these changes. These changes demand greater adaptability and resilience among the future workforce, as well as the development of these skills. The question of skills and workforce planning as we transition into the next technological transformation has become imperative and is beginning to receive appropriate attention in research communities.

To begin with, this study will examine how technology has impacted entire societies, specifically the workforce, over time, and will attempt to understand how such technological trends will affect the workforce in the future. It is anticipated that a deep understanding of past industrial revolutions will assist in predicting a trend in the impact of technology on the workforce. This study aims to understand the impact of a technology singularity phenomenon across the workplace and provide frameworks to guide organisations in ensuring that their workforce planning aligns with adapting to such events and future-proofing the workforce from singularity effects. To evaluate suitable frameworks, this study will critique the human resource management processes currently in place to facilitate the recruitment of appropriate workforce competencies to meet future demand. In such a changing environment, it is of utmost importance to conduct sufficient research to stay apprised of the existing workforce, new entrants, and new recruitment methods. This review is necessary because it allows businesses to respond appropriately to threats and opportunities to the workforce planning process posed by the evolution of technology and the potential future Singularity scenario.

1.2 Research Problem

History has shown us that each revolution brings deep-seated societal challenges and economic progress. As we see the increasing reach of technology's exponential evolution, it becomes critical to ensure that we are adequately prepared with an appropriate workforce to embrace this revolution.

It is becoming increasingly clear that transformative technologies such as AI are quickly changing how business operates and, in many cases, already replacing or augmenting tasks previously performed by a human workforce (Bonney et al., 2024). These changes will continue to evolve business operations as technology evolves, potentially displacing the workforce in its current form. An empirical study reviewing the evolving relationship between technology and human skills suggests that investment in human capital is crucial to an organisation's success, and producing skills that complement technology as opposed to being displaced is critical for long-term growth (Autor, 2014). Therefore, it becomes imperative that businesses are equipped to enable the workforce of the future to build skills that enable innovation and transformation of industries, leveraging the benefits of technology rather than becoming obsolete (Excell and Earnshaw, 2016).

In December 2024, Salesforce head Marc Benioff announced that the company would no longer be hiring any software engineers in 2025 (Martin, 2024), Marc Benioff further explained that they had seen a 30% boost in company productivity due to the use of AI (Artificial Intelligence) technology to increase the velocity of software engineering, reducing the need to hire new engineering skills. Marc Benioff went on to explain that while they were not planning to hire new engineering talent, they would likely need to increase the number of salespeople to ensure

sales of these new software capabilities. In the USA, software developer jobs peaked in 2019 and have been in a steady decline since, with research indicating that the emergence of AI has improved efficiency and productivity significantly (Nezaj, 2024).

Other, more right-wing, controversial views speculate that if technology were to evolve in such a manner without human control, there would remain a risk that it would make decisions on our behalf, leading to unethical and unintended consequences. This brings with it the reality of current science fiction, dystopian society possibilities, highlighting the fact that the technological singularity could be blind to human values (Nicolescu, 2017), if not closely matched with human skills that can ensure we leverage appropriately.

The concept of the 'Singularity' presents a pivotal moment that could exacerbate economic inequality. It envisions a future where only a privileged few reap the rewards of rapid technological progress, leaving others vulnerable to displacement and unemployment (Gibbons, 2021). However, it also holds substantial innovation potential, promising broader economic growth and an enhanced quality of life for those who can leverage its opportunities. This rapid progress in AI and the advancement of technologies will outpace the establishment of ethical and regulatory frameworks needed to address severe concerns about misuse or unintended effects (Nicolescu, 2017). However, amid this uncertain terrain, there are increasing opportunities arising that could address global challenges such as climate change and disease. These rapidly growing technologies have the potential to provide companies with a competitive edge and at a faster rate, 24/7 operations with fewer errors and potentially far cheaper costs than humans would (Gao & Wang, 2024). Progress brought about by technology singularity could significantly improve living standards and productivity and enable wealth creation by substituting or supplementing nearly all human tasks (Makridakis, 2017). This could lead to a

scenario of job inequality, or it could potentially lead to a scenario where humans are free of work, leading to more leisure time. A scenario which allows humans the much-needed freedom to evolve within their own choices, allowing innovation and culture to flourish, prioritising human well-being. The key lies in navigating this complex revolution to ensure that benefits as well as risks are effectively managed (Gao and & Wang, 2024).

1.3 Purpose of Research

This research study explores recent technological changes and their impacts on today's business workforce planning models. Based on an in-depth investigation, the long-term objective is to propose relevant training and recruitment frameworks that would help businesses build an optimal workforce in line with the changes that a technological singularity may bring.

The objective of this study is to comprehensively review the current literature and industry practices in workforce management and to outline a framework for workforce planning that supports an evolving business in alignment with technological advancements. The sub-objectives of the study are as follows:

1. To provide a comprehensive review of technological evolution over history and the impact on the workforce;

2. To provide a review of workforce management practices' evolution over history and their current application;

3. To review current technological trends and their impact on the workforce;

4. To outline a conceptual workforce framework for training and recruitment that support the workforce development proposal.

In doing so, the study aims to answer the question, "How have industrial revolutions historically influenced job roles and skill requirements, and what implications do these shifts have for future workforce planning in upcoming industrial revolutions? Additionally, how can a strategic framework be developed to support skills development and recruitment in alignment with technological evolution?"

The results of this study will provide valuable guides and frameworks that enable businesses to evolve workforce management practices in line with the impact that technology may have on the workforce. In such a changing environment, it is of the utmost importance to conduct enough research to keep appraising the existing workforce in relation to new ones and new ways of recruitment. This appraisal is necessary because it allows businesses to respond appropriately to the threats and opportunities that may occur because of the evolution of technology and the potential future Singularity scenario.

1.4 Significance of the Study

Technological advances are rapidly converging on a pivotal moment in which the spread of technologies such as artificial intelligence and quantum computing is solidifying the idea that a technological singularity is becoming increasingly feasible. The analysis of this literature review confirms that while nearly all scenarios of the previous technology revolutions have shown a significant impact on business and society in general, the impact on the workforce has been radically reshaped over the years (Humayun and Arabia, 2021; Daemmrich, 2017; Groumpos, 2021).

As technology continues to evolve, the overall impact of the technology singularity on the workforce, specifically how industries and employees must adapt, remains unclear. While previous industrial revolutions followed predictable cycles of job displacement and creation, AI and automation are advancing at an unprecedented pace, introducing complexities that challenge traditional workforce models. The lack of clarity on the exact workforce evolution necessitates a deeper exploration into how skills must evolve and how businesses should reshape their recruitment and workforce planning strategies to remain competitive.

Historically, technological advancements have raised concerns about mass job losses, yet they have consistently led to net job creation, often through the emergence of new industries, professions, and skill demands. However, the speed at which AI and automation are transforming job functions today creates uncertainty around whether the workforce can reskill and transition quickly enough to keep pace with technological disruptions (Excell and Earnshaw, 2016). Unlike previous shifts, where changes were gradual, today's rapid advancements are reducing the demand for certain high-skilled cognitive roles and increasing reliance on machine learning-driven systems, making workforce adaptability and continuous learning more critical than ever (Gaviola, 2024).

Despite numerous studies emphasising the importance of reskilling, research remains fragmented and lacks concrete frameworks for businesses to effectively support employees in transitioning to new roles. Many existing studies focus on broad skill development but fail to provide specific strategies that can ensure long-term workforce sustainability. Additionally, there is limited research on how recruitment models should evolve to prioritise hiring in alignment with a skills shift towards adaptability and predictive workforce planning. Organisations require scalable and evidence-driven frameworks that enable them to redesign job

roles, shift talent pipelines, and proactively anticipate emerging skill gaps, rather than reacting to workforce disruptions as they unfold.

To bridge this research gap, this study aims to highlight how businesses can shift from traditional experience-based recruitment models to hiring frameworks leveraging dynamic competency assessments with proper workforce analytics. Without proactive workforce planning, businesses risk encountering talent shortages, skill mismatches, and economic stagnation, making strategic workforce transformation an urgent priority.

1.5 Structure of the Study

The study explores the profound impact of technological evolution across industrial revolutions and its implications for workforce adaptation, addressing how historical shifts in technology have influenced job roles and skill requirements. By examining past industrial revolutions, this research aims to uncover patterns of workforce transformation that provide insights into future workforce planning. It also seeks to develop a strategic framework that aligns skills development, talent acquisition, and recruitment strategies with ongoing technological evolution.

Chapter 1 introduces the research context, outlining the critical relationship between technological advancements and workforce adaptation. The chapter defines the objectives of the study, which include analysing workforce transitions in previous industrial revolutions and identifying predictive indicators for future skill demands. It discusses the significance of understanding workforce evolution, enabling organisations and policymakers to plan for upcoming disruptions proactively.

Chapter 2 presents a comprehensive literature review, exploring the historical progression of technology (2.1) from early mechanisation to artificial intelligence. The chapter examines how technological shifts have reshaped workplace dynamics (2.2) by altering employment structures, job responsibilities, and productivity models. It then discusses emerging skill requirements (2.3) required for industries to remain competitive, emphasising adaptability, digital proficiency, and problem-solving capabilities. Additionally, the chapter assesses the evolving nature of work environments (2.4), including flexible work arrangements, remote employment, and the integration of automation. Finally, it investigates talent acquisition strategies (2.5) that align recruitment with evolving technological landscapes, ensuring workforce readiness for digital transformation.

Chapter 3 outlines the research methodology, focusing on a multi-dimensional approach that includes historical workforce analysis, expert interviews, and predictive workforce modelling. This chapter aims to answer key questions, such as how past technological disruptions have shaped employment trends and what skills are required to ensure long-term workforce resilience. The study adopts a comparative analysis to evaluate workforce shifts across multiple periods of the various Industrial Revolutions, identifying frameworks that enhance recruitment adaptability.

Chapter 4 presents findings, offering evidence-based insights into workforce transformations and the effectiveness of different adaptation strategies. The chapter explores case studies through semi-structured interviews and literature reviews, highlighting how organisations have successfully integrated workforce planning with technological advancements.

Chapter 5 discusses implications, conclusions, and recommendations, highlighting actionable strategies to create future-proof workforce models. These strategies include highlighting core skills required in the future, redefining talent pipelines, and proposing enhancements to current recruitment tools. The chapter underscores the necessity of continuous learning and re-skilling initiatives, ensuring employees remain adaptable in evolving technological environments. Additionally, it emphasises the role of industry leaders in fostering an inclusive workforce capable of navigating future industrial revolutions.

1.6 Summary

Chapter 1 lays the groundwork for this study by examining how technological revolutions have shaped the workforce. From the mechanisation of the First Industrial Revolution to the digital transformation of the Third, each period has reshaped job roles, demanded new skills, and altered organisational structures. The emerging Fifth Industrial Revolution, powered by artificial intelligence, quantum computing, and big data, marks the beginning of a cognitive age in which technology could surpass human control, often referred to as the technological singularity.

The chapter highlights the volatility, uncertainty, complexity, and ambiguity (VUCA) of this transformation, noting both the risks of displacement and inequality and the opportunities for innovation and human advancement. The problem statement emphasises the urgent need to prepare the workforce for rapid technological change. The research objectives are to analyse historical trends, assess current workforce practices, and propose strategic frameworks for recruitment and skills development.

Chapter 1 frames this study as a response to the global challenge of futureproofing the workforce against the effects of technological singularity. By connecting lessons from past revolutions with forward-looking strategies, the chapter introduces adaptability, resilience, and collaboration as essential qualities for workforce sustainability in a time of rapid technological change. By integrating historical workforce trends with contemporary recruitment frameworks, this study aims to bridge the gap between past lessons and future workforce demands, providing a comprehensive strategy for skills development and talent acquisition that aligns with technological evolution.

CHAPTER II:

REVIEW OF LITERATURE

The swiftly evolving advancement of technology is converging on a pivotal moment in which the spread of technologies such as artificial intelligence and quantum computing is solidifying the idea that a technological singularity is becoming increasingly feasible. According to Gale et al. (2019), following Moore's Law, it is speculated that technology will progress rapidly and exceed human capacity to comprehend or control it (Excell Earnshaw, 2016). Vernor Vinge first introduced the term "technological singularity" in 1983, proposing that the development of an intelligence superior to human intelligence would result in an exponential transformation of both technology and society (Nicolescu, 2017).

Geoffrey Hinton is renowned for his groundbreaking contributions to artificial intelligence, particularly in neural networks and deep learning. He is therefore often referred to as the "Godfather of AI" for his pioneering work in machine learning. In his 2024 CBS (Columbia Broadcasting System) interview, Geoffrey Hinton warned that AI could lead to Industrial Revolution-style job disruptions (Novak and Silva-Braga, 2025). He predicted that up to 50% of jobs could be displaced by AI within the next decade, particularly in creative industries and physical-labour sectors. He expressed concerns that AI’s rapid advancement might make average human intelligence less valuable, leading to significant shifts in employment (Gaviola, 2024). By 2025, Hinton’s stance had become even more urgent and in his latest April CBS interview, he stated that AI had developed faster than expected, with AI agents now capable of performing tasks in the real world, making them more dangerous than AI that simply answers questions. He warned that AI could take control from humans, estimating a 10% to 20% risk that AI might surpass human oversight. His concerns had shifted from job displacement to AI

potential autonomy, emphasising the need for stronger regulation and global cooperation to prevent catastrophic outcomes (Nolan, 2025; Novak and Silva-Braga, 2025).

We are already seeing a rapid shift in the technology workforce and how jobs are changing, with multiple companies announcing cuts in the number of software engineer roles as technology is starting to replace humans. Microsoft CEO Satya Nadella recently revealed that AI contributes to approximately 30-40% of code in some of the company's repositories(Halverson, 2025). Speaking at Meta's LamaCon event, Nadella discussed how AI is increasingly used to write new code rather than modify existing material. Meanwhile, Meta CEO Mark Zuckerberg shared that AI-driven coding is becoming more prevalent at Meta, suggesting that eventually up to half of software development could be automated, bringing a major shift where machines increasingly replace work traditionally done by human developers(Vanian, 2025).

In May 2025, Microsoft announced significant job cuts, eliminating around 6,000 positions, which make up about 3% of its global workforce. The layoffs primarily affect software engineers, project managers, and technical program managers, reflecting the company's increasing reliance on AI-driven development(Westfall, 2025). The Microsoft announcement follows a similar announcement earlier this year when Salesforce also made significant cuts to its staff base (Dotan, 2024), and a month later, Salesforce CEO Marc Benioff announced that the company will not be hiring engineers this year due to the success of AI-driven agents replacing traditional roles. He emphasised that businesses are entering an era of hybrid human and digital workforces, marking the last generation of exclusively human-led management. This decision follows significant workforce restructuring, including over 1,000 job cuts, while simultaneously hiring employees to support sales-related initiatives(Jetha, 2025).

This trend is seen across the technology industry, with leaders from Microsoft, Salesforce, Google, Shopify, and Duolingo indicating greater reliance on AI for coding and other functions, supporting a broader move towards AI-driven development that may eventually displace many human roles.(Halverson, 2025; Vanian, 2025).As this trend continues, it becomes important to understand how previous technological revolutions have impacted the job market and the lessons they offer. This review would underpin the establishment of a framework for the future workforce to adapt more easily to changes arising from the current VUCA environment related to the next industrial revolution and the impending Singularity.

2.1.The evolution of technology and the singularity

The singularity, a term coined by John von Neumann in 1958, describes a theoretical future point where the intelligence of technology exceeds human intelligence. History has shown that from the First Industrial Revolution to the present, technological advances have been exponential and fundamentally changed the course of human history (Groumpos, 2021). These advances have brought significant Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) across the environment. VUCA is a term used to describe a state of constant unpredictable change (Johansen & Euchner, 2013). The fifth industrial revolution is quite possibly the fastest in history. It is because of advances in artificial intelligence, which are rapidly evolving to rival human learning and reasoning, that we are ushering in the cognitive era. As technology continues to evolve, it holds the potential to enhance itself, possibly surpassing human control and understanding over time (TerKonda et al., 2024). Technological revolutions have the potential to disrupt both positively and negatively. The impact on the workforce and the adaptation of workforce practices is of crucial consideration.

The impact of technological progress on the workforce and the economy as a whole has been a topic of interest for many years. Russian economist Nikolai Kondratiev's work postulated that technological innovations drive cyclical shifts in the economy(Malyarets&Lebediev, 2023). This theory of long waves, also known as Kondratiev Waves, posits that technological innovations and economic shifts occur in long, cyclical patterns. His work suggests that periods of rapid technological innovation led to economic booms, followed by times of stagnation or slower growth. These cycles, which typically last 40 to 60 years, are driven by major technological advancements that reshape industries and economic systems(Dickson, 1983).Kondratiev's theory highlights how each wave of innovation demands new skill sets, reshaping the labour market. For instance, the Industrial Revolution required mechanical skills, while the digital age emphasises coding and data analysis. Malyarets and Lebediev (2023) argue that the rapid pace of technological evolution in the current wave creates a skills gap, as education systems and training programs struggle to keep up. This gap risks leaving portions of the workforce unprepared for emerging job roles, and while the authors identify these challenges, they offer limited actionable strategies to bridge the skills gap or support workforce transitions. Given Kondratiev's theory's consistency over the various technology revolutions, reviewing their impact is a key indicator for forecasting technology's future impact on the economy and workplace.

2.1.1 The 1st Industrial Revolution

The First Industrial Revolution was a important turning point in human history, bringing about considerable change. In a research study on the first industrial revolution, Mahajan (2019) refers to this period as “the creation of a new global era". In the late 18th century in England, rapid technological advancements shifted the workforce from humans and animals to machines.

These innovations propelled the textile, chemical, iron, and steel industries, leading to the formation of factories that enabled the bulk production of goods. While these advancements began in England, technological progress quickly spread worldwide, resulting in shifts in economic and social classes (Mohajan, 2019).The unintended consequences of these rapid changes also resulted in negative aspects, which included poor living conditions as people moved away from rural areas into cities looking for jobs, as factories promised a better life. Without proper plans, these cities grew overcrowded with poor sanitation, resulting in adverse health impacts and a housing crisis. Machinery without proper safety measures or thought to human impact resulted in severe injuries to the workforce, all contributing to a degradation in lifestyle, while the disparity between the lower, middle, and higher classes became wider and wider(Dimanov, 2024).

2.1.2 The 2nd Industrial Revolution

While the first industrial revolution was primarily driven by coal and steam power, the Second Industrial Revolution, in the late 19th to Early 20th Century, was known as the technological revolution (Sharma & Singh, 2020), with people experimenting with innovative technologies to revolutionise manufacturing and communications. This period brought groundbreaking innovations such as the internal combustion engine, electrical power, and the chemical industries. Vaclav Smil, a Czechoslovakian-Canadian scientist, referred to this period of rapid invention as “The Age of Synergy” (Mohajan, 2020). These advancements led to the rise of new industries, such as automobile manufacturing, telecommunications, and petroleum refining. While some traditional roles have disappeared, new jobs in steel, oil, and electrical sectors have emerged, requiring workers to learn new skills. Technological breakthroughs such as the telephone, the light bulb, and the internal combustion engine also created entirely new

industries and employment opportunities(Groumpos, 2021). The increase in opportunities for mass production resulted in an increase in factories with decreased costs, and factory work increased due to assembly lines. However, the tasks were often repetitive and lacked mental stimulation. As factories grew, more people moved from the countryside to cities in search of work. This quick urban growth often led to crowded and poor living conditions, and cities became centres of industry, business, and new job opportunities(Turner, 2024). Although there were more jobs, many workers faced lengthy hours, low pay, and unsafe working conditions. This led to the rise of labour unions and worker protests. Over time, these efforts helped improve workers' rights and laws (Mohajan, 2020; Turner, 2024). Ultimately, the Second Industrial Revolution changed how people worked and lived. It helped build modern industries and sparked the fight for fair treatment in the workplace, shaping the job market we know today.

2.1.3 The 3rd Industrial Revolution

The Third Industrial Revolution occurred shortly after World War 2 and introduced technologies that automated tasks without the need for human intervention and is often referred to as the “Automation Revolution” (Groumpos, 2021). This revolution, beginning in the 1950s, marked a significant move from mechanical and analogue electronics to digital technology. Unlike the earlier industrial revolutions, which were primarily focused on human labour and mechanical processes, the third Industrial Revolution was driven by advances in digital electronics, information technology (IT), and biotechnology. Innovations shaping this period, such as nanotechnology, artificial intelligence (AI), robotics, and 3D printing, reformed industries and societies globally.

During the first two industrial revolutions, technological advances such as the steam engine, the spinning jenny, and electricity led to the growth of industrialised economies in Western Europe and the United States, but the third Industrial Revolution expanded development to nearly every corner of the globe(Turner, 2024). The world's wealth increased dramatically, and economic development spread rapidly, with millions of jobs created across diverse industries. Businesses flourished, especially in sectors such as electronics, IT, and the automotive industries, where digital and automation technologies played a crucial role(Kumar, 2021).

The transition from mechanical systems to digital technologies enabled more efficient processes, increased production speeds, and the invention of entirely new business models. The advent of robotics and automation revolutionised manufacturing, while 3D printing opened new possibilities for custom production. AI and biotechnology have unlocked new frontiers in fields like healthcare and materials science, fostering a more interconnected and high-tech global economy(Groumpos, 2021).

The Third Industrial Revolution also significantly improved the standard of living and life expectancy worldwide. Advances in transportation, communication, and healthcare technologies have led to better access to goods, services, and information and to healthier, longer lives for many people. Global connectivity increased, making the world more interdependent and fostering international trade and collaboration(Kumar, 2021; Sharma and Singh, 2020).

Rapid industrialisation and technological growth have brought multiple environmental challenges, including air and water pollution, greenhouse gas emissions, and global warming. The increasing use of plastics, chemicals, and other materials contributed to biodiversity loss,

habitat destruction, and the degradation of natural resources. These issues have raised concerns about sustainability, leading to increased focus on environmentally friendly technologies and environmental protection (Groumpos, 2021; Kumar, 2021).

The Third Industrial Revolution brought about groundbreaking technological advancements that significantly reshaped the global economy and society. It created vast wealth and new job opportunities while simultaneously raising important environmental and social challenges that continue to influence the modern world(Kumar, 2021).

2.1.4 The 4th Industrial Revolution

The Fourth Industrial Revolution signifies the rapid and transformative changes occurring in the 21st century, in which emerging technologies are deeply integrating into every aspect of human life. Klaus Schwab, founder of the World Economic Forum, describes a world where the boundaries between the physical, digital, and biological spheres are becoming increasingly blurred and uses the term “Fourth Industrial Revolution” to describe this era in human history(Ross & Maynard, 2021). Unlike previous revolutions that focused on mechanisation, electricity, or digital systems, this current wave is characterised by a fusion of technologies such as artificial intelligence, biotechnology, robotics, quantum computing, and the Internet of Things (IoT). These tools are enabling individuals to seamlessly move between digital environments and physical reality, by using connected technologies to manage everything from daily tasks to healthcare and work(Xu et al., 2018a).

The Fourth Industrial Revolution has overwhelmingly transformed the way we live, work, and interact by merging physical, digital, and biological systems through technologies such as artificial intelligence (AI), automation, robotics, biotechnology, and the Internet of Things (IoT)

(Mhlanga, 2022). The impact is evident across sectors, from healthcare and manufacturing to education and finance, fundamentally reshaping industries and the global economy. Traditional jobs are being automated, leading to the displacement of routine roles, while at the same time, entirely new kinds of work are emerging, demanding advanced digital skills, adaptability, and continuous learning(Arntz et al., 2017). This revolution is accelerating connectivity, driving personalised services, and generating massive amounts of data, but it also raises pressing concerns regarding privacy, cybersecurity, and the ethical use of these technologies. Economically, it creates opportunities for innovation and efficiency, but risks widening inequalities between those with access to digital tools and training and those without (Mulero & Theophilus, 2021).

The Fourth Industrial Revolution is unprecedented in its speed and scale of technological change and its global impact. This revolution is reshaping how we interact with technology and generating vast amounts of personal data, raising new challenges around privacy, ethics, and digital literacy(Mhlanga, 2022).The Fourth Industrial Revolution is redefining industries, economies, and societies and requires a fundamental rethink of how we approach skills, education, and work in a hyper-connected, technology-driven world. It marks a shift toward a faster, more connected, but also more complex and uncertain world, where human skills and adaptability are more important than ever.

Ray Kurzweil predicts that artificial intelligence (AI) will surpass human intelligence by 2029 (TerKonda et al., 2024). While past technological revolutions have significantly impacted business and society, the potential implications of a singularity remain uncertain. Despite the speculative nature of this event, the challenge lies in humans determining how to harness it and mitigate associated risks (Excell & Earnshaw, 2016).

2.2 Technology Revolutions and the Workplace

Historically, technological advancements have profoundly influenced the workplace, both positively and negatively, leading to rapid shifts in workforce dynamics. While these advancements have generally acted as a creator of jobs, it is important to note that these new jobs come with significant changes, including a call for new skillsets and adaptation to a changing working environment (Mckinsey, 2018)

2.2.1 The 1st Industrial Revolution

The First Industrial Revolution brought a rapid shift from human-led labour to machine-driven work; this radical change affected workforce skills, necessitating adaptation. The rapid expansion of profit-driven factories led to a significant increase in working hours, with labourers often working much longer than they had a century earlier (Mohajan, 2019). During this period, studies indicate that the typical work schedule ranged from 10 to 12 hours per day, totalling 60 to 80 hours per week, corresponding to approximately three hundred working days per year. In contrast, during the pre-industrial period in Western Europe, people generally worked only about 150 to 200 days per year(Dimanov, 2024).A gap remains in understanding the productivity, social, and psychological impacts of these changes and how they affected the workforce as a whole.

The skills base prior to the first industrial revolution was highly specialised, with human-focused skills such as farming and craftsmanship with specialised skills in areas like weaving, blacksmithing, carpentry, and other trades, creating goods by hand using basic tools(Dimanov, 2024; Mohajan, 2019). With the advancement of technology, the demand for relatively unskilled factory worker jobs increased, replacing handmade items with mass-produced goods.

The shift from rural, agrarian work to urban factory jobs was dramatic, and working conditions were often harsh and unregulated. Job losses within the skilled working class caused an uprising, notably a group of people opposing these technological advancements, known as the Luddites, were notorious for threats, breaking machinery and even attacking factory workers in an attempt to revert back to pre-industrial revolution ways(McGowan & Geobey, 2022). While the Luddites fought to retain an old way of life, the principles of their dilemma remain an important lesson for the importance of skills development and proper change management as we further progress towards technology revolutions that fundamentally change the workforce. While the number of middle-class skilled jobs declined, there was still the creation of new jobs that required niche new skills, and the number of high-skilled jobs increased to service roles that could not be mechanised, or those engineers specialised in the production of machinery. These highly skilled jobs were serviced through niche apprenticeships, which increased with innovation (Feldman and van der Beek, 2016).

2.2.2 The 2nd Industrial Revolution

The First Industrial Revolution replaced hand labour with machines, disrupting traditional crafts, while the second created entirely new job types and industries, requiring reskilling and offering more technical and office-based roles(Turner, 2024).New technologies like the internal combustion engine, electricity, and chemicals led to the creation of industries such as car manufacturing, telecommunications, and oil refining. These industries needed more skilled workers, including engineers, machine operators, and managers. Henry Ford was one of the first to introduce assembly lines in the manufacture of cars. This made production faster and cheaper, but it also meant workers did the same task over and over(Mokyr & Strotz, 2003).

As industries moved from steam power to electricity, many old jobs disappeared, and new ones took their place. Jobs like blacksmiths, weavers, and other skilled artisans became less needed as factories began making goods quickly and cheaply using machines. In factories, workers were often assigned one task on a production line. This made work faster but reduced the need for workers to have a wide range of skills. Workers now had to learn how to operate and fix machines powered by electricity and knowledge in areas like electrical systems, mechanics, and chemistry became important (Mhlanga, 2022).

Innovative technologies and industries meant workers had to learn new skills to stay employed. Further to technical jobs, the growth of businesses required more people for office roles like clerks and managers. These jobs needed people who could read, write, and stay organised. This shift affected people's careers, the types of jobs available, and how much they could earn (Turner, 2024). Many people with traditional skills lost their jobs and found it hard to adjust while those who learned new skills could find better-paying jobs in new industries like oil, steel, and telecommunications.

In the late 19th century, during the Second Industrial Revolution, new machinery and automation created many jobs but also reduced the number of middle-skilled positions that had previously offered stable careers (Turner, 2024). Using U.S. census data, researchers found three main trends: as demand for middle-skilled factory work dropped, many workers moved into lower-skilled jobs; older workers often ended up doing unskilled, physical labour; and younger workers were more likely to shift into new types of jobs created by emerging technologies(Hobijn & Kaplan, 2024). The Second Industrial Revolution rewarded workers who could adapt and learn new skills. Those who could not often face unemployment and tough times(Mohajan, 2020; Mokyr and Strotz, 2003).

2.2.3 The 3rd Industrial Revolution

The transition from the Second Industrial Revolution (1870–1914) to the Third Industrial Revolution (1960s–2000s) marked a significant shift in technology and its impact on the economy, moving from mechanical and electrical industries to digital and automated systems. This transformation had a significant impact on the skills required by the workforce, as workers had to adapt to entirely modern technologies and industries.(Smith, 2001).

In the Second Industrial Revolution, workers were primarily engaged in operating machinery on assembly lines. By the time the Third Industrial Revolution began, the focus had shifted towards digital tools and automated systems. During this period, workers needed to transition from hands-on mechanical tasks to using computers, software, and automated technologies (Humbert, 2007). One of the most significant changes was the introduction of computers, telecommunications, and digital networks. As these technologies began to dominate industries, workers needed to acquire computer literacy, learn to code, and develop skills in data management. The demand for knowledge in areas such as software development, networking, and cybersecurity skyrocketed, as IT became integral to most businesses and industries. This shift required a complete change in skill sets, with workers now needing proficiency in digital tools and the ability to navigate complex systems(Sharma & Singh, 2020).

The increase in automation and robotics during the Third Industrial Revolution fundamentally altered the manufacturing process. Robotic systems and automated assembly lines replaced many manual jobs, creating a need for workers who could program, maintain, and repair these new systems. The need for specialised knowledge in robotics, automation programming, and systems integration grew rapidly, marking a shift away from traditional factory labour, and the economy increasingly moved toward service-based industries, particularly in finance,

technology, and professional services (Smith, 2001). With this shift, there was a growing demand for analytical thinking, problem-solving, and communication skills. While manual labour decreased, the need for workers who could engage in critical thinking, data analysis, and project management became crucial, as industries sought to harness the power of information and technology(Kumar, 2021; Sharma and Singh, 2020). The efficiency brought by automation and mass production during the Third Industrial Revolution meant that many low-skill, manual factory jobs were no longer necessary. This decline in traditional manufacturing roles created opportunities for engineers, technicians, and IT specialists to assume responsibility for managing the new, more complex technologies that are driving industries forward. These shifts in skill requirements fundamentally changed the job market, with an increasing need for a highly skilled, tech-savvy workforce(Smith, 2001).

As automation and digital systems took over many manual roles, workers in traditional factory jobs faced significant displacement. Many had to reskill or transition into new industries that were more reliant on digital technologies. This process of workforce adaptation was critical, as workers sought new roles in industries such as technology, telecommunications, and finance and saw the rise of white-collar jobs in office settings (Kumar, 2021). Positions in fields like business management, marketing, finance, and administration grew, and many of these roles required computer literacy and an understanding of business systems. As industries increasingly depended on digital technologies for their operations, the demand for workers skilled in data analysis, digital communication, and project management surged(Kumar, 2021; Taalbi, 2019).

Electronic communication technologies, such as email, video conferencing, and cloud computing, have enabled a new era of global collaboration. Work was no longer limited by geographical location, and remote work became more common. As a result, outsourcing and

global supply chains expanded, requiring workers to have cross-cultural communication skills and the ability to manage projects across different time zones and locations(Kumar, 2021).

The Third Industrial Revolution fundamentally transformed the job market by shifting industries towards digital technologies, automation, and information processing. Workers had to adapt to this rapid change by acquiring new skills, particularly in IT, robotics, and knowledge-based work. While traditional manufacturing jobs declined, opportunities increased in fields such as technology, business, and the service industries (Taalbi, 2019). This shift in skills and job structures has had a lasting impact, shaping the workforce we see today.

2.2.4 The 4th Industrial Revolution

The transition from the Third Industrial Revolution, the Digital Revolution, to the Fourth Industrial Revolution marks a major shift in the workplace and the skills required in order to succeed in this new era (Ross & Maynard, 2021). While the Third Industrial Revolution focused on digital automation and the widespread use of computers and electronics, the Fourth is defined by intelligent, interconnected systems powered by artificial intelligence (AI), machine learning, robotics, and big data systems (Daemmrich, 2017). This leap in technological capability is fundamentally altering not only how work is done, but also who does it, and what skills are needed to remain relevant in the workforce.

According to a recent report (World Economic Forum, 2025), on average, workers can expect two-fifths (39%) of their existing skill sets to be transformed or become outdated over the 2025-2030 period. In the past, digital literacy, such as the ability to use basic computer software and navigate the internet, was a critical skill; however, it is no longer enough, and the Fourth Industrial Revolution demands advanced digital proficiency, particularly in areas like AI

development, data analysis, and machine learning. Understanding how to work with and interpret large datasets, train algorithms, or oversee AI-driven systems has become essential across industries(Mulero & Theophilus, 2021).

The widespread use of automation and robotics is transforming operational roles. Subsequently, tasks that were once performed manually or even digitally are now handled by autonomous systems, prompting a shift in human roles toward robotics programming, automation oversight, and cybersecurity (Bindra et al., 2021). Workers must now understand not just how systems function, but also how to protect them and optimise their performance.

As machines take over technical and repetitive tasks, human-centric skills have become more valuable than ever. Qualities such as creativity, emotional intelligence, critical thinking, and collaborative communication are in high demand, particularly in roles that require working alongside machines or making complex ethical decisions that algorithms cannot resolve. In this new landscape, uniquely human capabilities are essential to complement advanced technologies(Arntz et al., 2017; Mulero & Theophilus, 2021).

The junction of the digital, physical, and biological domains has driven demand for interdisciplinary knowledge. For instance, professionals may now be expected to understand elements of software engineering, biotechnology, and business strategy simultaneously. This blending of disciplines is creating new job types and educational pathways to prepare for them. One of the most defining skill shifts in the Fourth Industrial Revolution is the need for continuous learning and adaptability(Li et al., 2017; Mulero & Theophilus, 2021). As technology evolves rapidly, the concept of a fixed career path is being replaced by lifelong

learning, in which individuals must regularly update their skills and adopt new tools and methods to remain competitive.

Technological advancements are transforming the global job market, presenting both positive and disruptive changes. Although many repetitive or routine jobs are vanishing, entirely new positions are emerging in sectors such as AI development, cloud computing, cybersecurity, and green technology. This ongoing job transformation requires both workers and employers to foresee future demands and prioritise reskilling and training investments(Arntz et al., 2017).

The Fourth Industrial Revolution is more than just technological progress; it signifies a transformation of humanity. People and machines are forming a partnership, with human judgment, empathy, and innovation playing crucial roles in unlocking the potential of intelligent systems. Those who prioritise lifelong learning, adaptability, and interdisciplinary approaches will find themselves best equipped for success (Bindra et al., 2021). As we undergo this transition, it is vital to prepare the workforce with new skills to create inclusive and resilient economies.

The rise of digital connectivity and cloud-based platforms is enabling remote work, global collaboration, and more flexible work arrangements. This shift is not only changing workplace dynamics but also creating new challenges, such as managing virtual teams and ensuring digital security across borders (Humbert, 2007; Ross & Maynard, 2021). Another critical area of impact is the growing importance of ethics and regulation. As AI and automation systems influence decisions across sectors such as healthcare, finance, and criminal justice, workers must understand data ethics, privacy rights, and compliance laws to navigate these environments responsibly.

In line with trends across previous industrial revolutions, it is apparent that a trajectory toward technological singularity will significantly impact the global workforce. The emergence of AI transforms this impact into a critical divide from a workforce perspective, as seen in a recent study of twenty-four countries from 2005 to 2021(Guliyev, 2023). Empirically, the paper closely examines how the Google Trends Index (GTI) for highly technologically advanced countries in AI relates to the unemployment rate across countries, spanning more than 17 years during which interest in AI was gaining momentum. The countries chosen were those of complex developed economies. Further to the impact of AI, the prominence of Data Science and Machine Learning was also investigated. The unemployment effect of AI was measured using dynamic panel data. The control variables for unemployment were inflation, economic growth, and government spending, while the interest variables, GTI, were those related to artificial intelligence, machine learning, and data science(Guliyev, 2023). Contrary to other studies(Kolade & Owoseni, 2022).This study indicates a negative relationship between these revolutionary technologies and unemployment. The study finds that AI reduces unemployment levels in high-tech developed countries, with the "displacement effect" of AI, where automation replaces human jobs, being validated; the overall impact is mitigated by the formation of new opportunities in AI-driven industries. The research highlights the importance of considering the dynamic nature of unemployment, as the effects of AI adoption evolve over time. The outcome infers a displacement effect between technology and employment, much like in previous industrial revolutions, where technologies displaced existing jobs but gave rise to new ones (Groumpos, 2021; Xu et al., 2018).

By concentrating on developed countries, Hasraddin Guliyev (2023) sheds light on how advanced economies adapt to AI-driven changes in the labour market, however study's focus on

high-tech developed countries limits its applicability to emerging economies or regions with lower levels of technological adoption in which there remains very little focus currently and broader examination of how different regions experience and respond to AI-driven workforce changes would enhance the study's relevance. Historically, technological advances have led to the information age in which traditional industries have moved towards an economy centred around information technology. These industrial revolutions are milestone periods in human history where innovations lead to new ways of doing things, creating efficiencies and reducing costs (Daemmrich, 2017), with each revolution reshaping how we live, work and relate to our environment with a rapid need to reskill the workforce to adapt in line with these changes(Groumpos, 2021). The study confirms this theory, validating that technologies can enhance the working experience by reducing mundane tasks that require human skills(Guliyev, 2023).While the study also highlights the need for new skills, it lacks actionable recommendations for education systems, governments, or organisations to bridge the skills gap and does not propose concrete frameworks to support workers and businesses during transitions caused by AI adoption, such as reskilling programs and workforce planning support. This is a critical aspect of transition.

Supporting this view of a displacement effect is a study by McKinsey Global Institute (2018), the article "What can history teach us about technology and jobs?" reflects that while technological advancements have historically displaced certain jobs, they have also created new opportunities and industries. The authors highlight that fears of mass unemployment due to automation have emerged repeatedly throughout history, yet overall employment has continued to grow (Figure 1). The article emphasises that technology increases productivity, lowers costs, and stimulates demand, leading to job creation in emerging sectors. However, the article

acknowledges that transitions can be disruptive, requiring reskilling and policy interventions to ensure workers adapt to new roles. The article serves as confirmation that while AI and automation are likely eliminate some jobs, AI is also likely to generate new jobs, making adaptability and education crucial for the workforce.

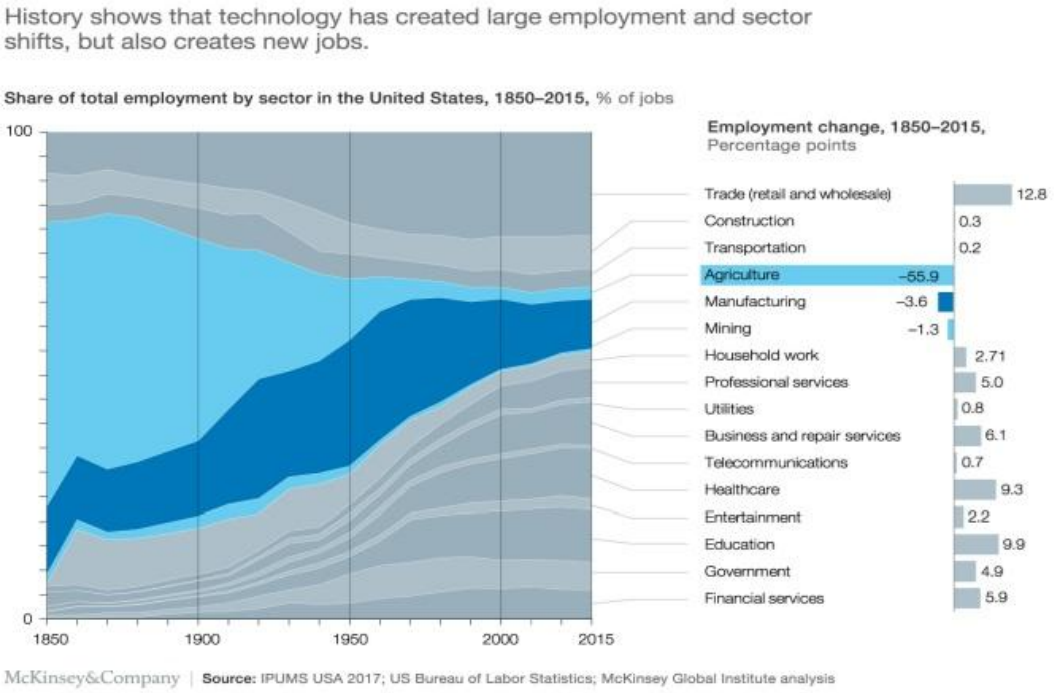

Figure 1: Evolution of employment sectors

Despite the potential to enhance and reshape the workplace (Daemmrich, 2017), there remains significant concern and fear that technologies like AI and others leading to the singularity will bring mass job loss and displacement of the job market, with radical terms like the "Robo-Apocalypse" being referred to (Willcocks, 2020). A study conducted at the University of Huddersfield, UK, by Araz Zirar, Syed Imran, and Nazrul Islam performed a thematic analysis of technology and worker coexistence across articles from three electronic database sources, identifying four related themes (Zirar et al., 2023). While the study highlighted a gap in research in underdeveloped countries, the thematic analysis of existing research, mainly from

developed countries, highlighted that workers' distrust in technologies such as artificial intelligence (AI) originates from perceiving these technologies as threats to job security. The study goes on to explain the promise of AI in augmenting the skills of the human workforce instead of completely eliminating all jobs. The study by Zirar (2023) categorises the skills required for worker-AI coexistence into three groups of: Technical Skills such as programming and data analysis, which are essential for workers to interact effectively with AI systems; Human Skills such as interpersonal abilities, creativity, and emotional intelligence remain critical, as these skills complement AI's capabilities and Conceptual Skills such strategic thinking and problem-solving which are necessary to leverage AI for innovation and decision-making. This call for more technical, human, and conceptual skills to be acquired means reskilling and upskilling will be continuously required, and while the study identifies necessary skills, it does not offer concrete strategies for education systems or organisations to facilitate reskilling and upskilling. This view is supported by other studies emphasising the criticality of upskilling the current workforce (Rampersad, 2020). The 2020 study by Rampersad, Flinders University, South Australia, provides valuable insights into how workforce innovation can mitigate job displacement risks, particularly through education and skill development initiatives. The longitudinal research approach, which measures student capabilities before and after work-integrated learning (WIL) placements, strengthens the study's empirical foundation. However, the article primarily focuses on individual skill development rather than addressing systemic workforce challenges, such as organisational restructuring and recruitment surrounding AI-driven employment shifts. Additionally, while the study highlights the importance of adaptability, it does not sufficiently explore the shaping of equitable workforce transitions. The study confirms that critical thinking, problem-solving, communication, and

teamwork have significant impacts on the development of innovation, but it fails to highlight how a workforce can transition towards this, which indicates a gap for further study.

2.3 Future skills and the workplace

Advancements towards a Singularity, driven by advancements in artificial intelligence, automation, robotics, biotechnology, and digital technologies, make the need to understand and plan for workforce shifts imperative. The rapid pace of technological change is reshaping industries, creating new types of jobs while rendering others obsolete(Mckinsey, 2018). This transformation makes the study of skills and workforce planning critical to ensuring that workers and economies can adapt successfully.

Historically, industrial revolutions have displaced many jobs but also created new ones. However, the emergence of digital technologies in the current revolution poses a unique challenge: the pace of displacement may outpace workers' ability to reskill or upskill(Dickson, 1983). Therefore, research into workforce planning has become imperative for understanding how to bridge the skills gap and ensure that workers are equipped with the right tools for the jobs of tomorrow(Sharma & Singh, 2020). This focus helps identify where educational institutions, businesses, and governments need to align their efforts to provide continuous learning opportunities, update curricula, and create policies that support workers during times of technological upheaval, but without proper workforce planning, millions of individuals, especially in low-skill and routine jobs, may be left behind. By anticipating future workforce needs, investing in education and training, and supporting workers through transitions, we can ensure that this technological revolution benefits society as a whole, rather than leaving behind those who cannot keep up. The research underway today will serve as the blueprint for a

sustainable and inclusive future, in which technological progress and human capability evolve hand in hand.

2.3.1 The 1st Industrial Revolution

The First Industrial Revolution began in the late 18th century and offers several important lessons about how societies and workers can navigate significant technological and economic changes. As we face our own transformation today, driven by AI, automation, and digital tools, the experiences of the past provide valuable insights into what is needed to manage change successfully(Sharma & Singh, 2020).

Technological change can displace traditional skills, but it also creates new ones.

Before the First Industrial Revolution, most people worked in agriculture or as skilled craftsmen in trades like weaving, carpentry, and blacksmithing. However, the advent of machines such as the Spinning Jenny and the Power Loom revolutionised these industries, enabling the mass production of textiles at a faster, cheaper rate. As a result, many traditional craft jobs were displaced, leading to widespread job loss and economic insecurity. But with the rise of factories came the creation of new roles, such as factory workers, machine operators, and mechanical jobs that required new skills (Groumpos, 2021). This highlights a key lesson: while modern technologies often replace older skills, they also create opportunities for workers to learn and take on new roles, emphasising the importance of reskilling to keep pace with technological change.

Adaptability and the willingness to learn new skills became essential.

During the First Industrial Revolution, those who were able to adapt to the changing job market tended to fare better. Many workers left rural areas to move into cities where factories offered new opportunities. They learned how to operate machinery and embraced industrial work. Those who resisted change or failed to learn new skills were left behind (Groumpos, 2021). Today, we are facing a similar need for adaptability as digital tools and automation reshape modern workplaces. Being open to learning modern technologies and staying flexible in the face of change is just as crucial now as it was in the past.

The lack of training and education deepened the divide between the "winners" and "losers."

One significant challenge during the First Industrial Revolution was the lack of education and training for workers displaced by automation. Many workers had no way of acquiring the new skills needed for industrial work, and as a result, they were often stuck in low-paying, dangerous factory jobs. This inequality highlights the importance of offering workers the resources and opportunities to reskill during times of economic upheaval (Mohajan, 2019). In today's world, with industries such as retail and manufacturing facing job cuts due to automation, providing accessible education and retraining programs is just as important. Without such support, workers in declining industries risk being left behind.

Social unrest can follow when workers are left behind.

As modern technologies replaced old jobs, many workers felt the pain of losing their livelihoods. The famous Luddite movement, in which workers destroyed machinery they believed was taking their jobs, serves as a clear example of how technological change can lead

to social unrest. These protests were not simply a fear of technology but a response to real hardships and a lack of support(Humbert, 2007). Today, we see similar concerns around automation and AI displacing jobs, and without adequate support systems, we risk growing inequality and social unrest. This serves as a reminder that societies must ensure a fair transition for all workers, providing the resources they need to thrive in a changing economy.

Long-term progress depends on investing in people, not just machines.

While the First Industrial Revolution spurred incredible economic growth, the benefits were not shared equally. The working conditions in factories were often meagre, with wages being low, and child labour being common (Groumpos, 2021). Over time, governments and reformers had to introduce labour laws, public education, and worker protections to address these issues and help workers adapt to industrial life. These investments in people were essential for long-term social and economic stability (Humbert, 2007). Today, as we face a new wave of technological disruption, the same principle applies, where technological progress must be accompanied by investments in education, worker protections, and social safety precautions to ensure that the benefits of social progress are distributed more evenly.

In summary, the First Industrial Revolution teaches us that technological change brings both challenges and opportunities. For societies to thrive, technological progress must be accompanied by efforts to support workers through education, reskilling, and social safety nets. Without these efforts, we risk leaving behind those who are most vulnerable to disruption, increasing inequality, and making progress unsustainable. As we face our own technological revolution, these lessons are more relevant than ever.

Lessons from the first industrial revolution serve as a learning for the future and how we manage the workforce. The increased demand for unskilled workers during this period shifted towards factory workers, forcing a shift towards women and child labour, and as the demand for child labour grew, so too did the decrease in demand for compulsory education (Dimanov, 2024), which, in turn, widened the skills gap and the social class divide. Exacerbating the skills gap issue was the notable lack of thinking required in these new jobs. Factory workers, unlike agricultural labourers or artisans, were confined to monotonous, repetitive tasks that stunted their intellectual growth. One can argue that over time, workers never face the challenges that spark creativity or critical thinking, and this routine not only diminishes their ability to engage in complex problem-solving and meaningful conversations at work, but it also erodes their capacity in everyday life (Dimanov, 2024; Feldman & van der Beek, 2016). These remain critical factors to consider when evaluating the development of a workforce to service the future.

2.3.2 The 2nd Industrial Revolution

The Second Industrial Revolution offers valuable lessons on how workers and societies can adapt to major changes in the job market, lessons that are especially relevant today as we face the rise of automation, artificial intelligence, and other digital technologies.

Adaptability is essential.

In the late 19th century, the introduction of electricity, automation, and mass production reshaped industries, requiring workers to take on entirely new roles. For example, skilled artisans like blacksmiths and weavers had to transition to factory work or learn to operate new machinery. Today, similar shifts are happening as AI and robotics change how tasks are

performed (Hobijn & Kaplan, 2024a). Just as workers once had to embrace new tools, today's workforce needs to remain flexible and be willing to learn and adapt to rapidly evolving technology in areas such as data analysis, coding, and digital platforms.

Reskilling and upskilling play a leading role in economic survival and growth

During the Second Industrial Revolution, individuals who learned mechanical or electrical skills found better opportunities in emerging industries like steel, chemicals, and telecommunications. Similarly, those who upgrade their digital and technical skills today, through training programs, online courses, or workplace development, will be better equipped for careers in tech, green energy, and other growing sectors. Investing in education and continuous learning is just as critical now as it was then (Hobijn & Kaplan, 2024b).

Mid-level jobs are especially at risk during periods of technological change.

In the past, many middle-skilled roles, such as machine operators or craftsmen, were replaced by machines that could do the same work faster and cheaper. This resulted in workers being pushed into either low-paid manual labour or highly skilled technical jobs (Hobijn Kaplan, 2024). Today, we are seeing the same pattern, with automation replacing clerical, retail, and manufacturing jobs. This highlights the need for proactive retraining strategies to prepare workers before their roles are affected.

Younger generations tend to lead the shift toward new industries.

Just as young workers in the 1800s were more likely to move into newly emerging technical fields, today's younger people are often quicker to adopt modern technologies and enter modern

industries. However, this also underlines the importance of making lifelong learning accessible to older generations so that no one is left behind in the transition (Bindra et al., 2021).

Social and institutional support is critical.

During the Second Industrial Revolution, many workers who could not adapt or access new training were left behind, often working in poor conditions for low pay. This sparked the rise of labour movements and prompted governments to enact basic labour protections. In the modern era, it is essential for governments, businesses, and educational institutions to provide support systems, such as upskilling programs, career guidance, and safety nets, to help individuals navigate the changing job landscape (Dimanov, 2024).

Overall, the history of the Second Industrial Revolution reminds us that ***embracing change, building new skills, and supporting workers*** through transitions are key to ensuring no one is left behind during major economic shifts.

2.3.3 The 3rd Industrial Revolution

The Third Industrial Revolution driven by digital technologies like computers, automation, the internet, and AI, offers several key lessons about skills shifts that are still highly relevant today as we navigate the current era of rapid technological change. Some of these lessons include:

Embrace of Digital Literacy and Technology

The Third Industrial Revolution demonstrated that digital literacy became essential as the world shifted to computers, software, and the internet. Jobs in traditional industries were replaced or transformed as machines and automation took over many tasks. Workers who could adapt to modern technology, such as learning to use computers or operate digital systems, were the ones who succeeded (Mohajan, 2019). In the present day, the shift toward artificial intelligence (AI), robotics, and automation continues to require workers to learn new tools and systems. Digital skills are now foundational, and the lesson is clear: being proficient with technology is crucial for career sustainability.

R***eskilling and upskilling are critical***

Many traditional manufacturing jobs have been automated, leading to a shift in skill sets. Workers have had to reskill to take on roles in IT, customer service, and new industries like data science and digital marketing. Today, we see a similar need for upskilling and reskilling as technologies like AI, machine learning, and data analytics replace old roles and create new ones (Makridakis, 2017). For example, as automation continues to take over routine tasks, workers

will need to learn to work alongside AI, understand data systems, and master digital tools in a rapidly evolving job market.

Importance of lifelong learning and a growth mindset

The rapid pace of technological change during the Third Industrial Revolution highlighted the need for lifelong learning. Workers who adapted to modern technologies and industries were able to thrive, while those who did not risked becoming obsolete. The future Industrial Revolutions will bring even more rapid change, particularly in the fields of artificial intelligence, robotics, and advanced manufacturing (Humbert, 2007). This teaches us that learning should not stop after formal education; instead, it should be a continuous, lifelong process to stay competitive in a constantly evolving labour market.

Shift from Routine Manual Jobs to Knowledge-Based Roles

The Third Industrial Revolution saw a decline in many manual and routine jobs due to automation, while knowledge-based roles in IT, engineering, and communications flourished. The rise of software development, network management, and cybersecurity is an example of industries that have emerged, providing higher-value opportunities for skilled workers. Today, we see similar shifts as more roles are being replaced by machines, but at the same time, there is an increased demand for workers with problem-solving skills, creativity, and expertise in complex technical fields like data analysis, AI, and cloud computing (Smith, 2001). Workers need to be prepared for these changes by focusing on developing critical thinking, adaptability, and specialized knowledge.

The Need for Collaboration and Soft Skills

While the Third Industrial Revolution focused heavily on technical advancements, it also highlighted the importance of collaboration and soft skills, like communication, leadership, and teamwork, in new work environments. As digital technologies such as automation and AI transform industries, workers are increasingly required to collaborate with both machines and humans in complex, dynamic environments. Creativity, emotional intelligence, and leadership are critical skills for managing change and working effectively in tech-driven environments (Makridakis, 2017). The lesson is clear: technical skills alone are not enough; soft skills are essential for thriving in the digital age.

Globalisation and the Need for Cross-Cultural Skills

The Third Industrial Revolution was marked by the globalisation of technology, particularly through the Internet, which allowed businesses and workers to connect around the world. This created new opportunities but also meant that workers had to compete globally. As we move further into the next Industrial Revolution and the Singularity, cross-cultural understanding, communication, and the ability to work in diverse teams will be essential (Smith, 2001). Workers prepared to interact with international colleagues or manage cross-border projects will be in high demand.

The Role of Government and Business in Supporting Skills Development

The Third Industrial Revolution showed that when workers were displaced by technology, they often lacked the training or education needed to transition into new roles. Governments and businesses are key in investing in education and training programs to ensure that workers can adapt to modern technologies. Public-private partnerships to fund reskilling initiatives and

make lifelong learning accessible will be crucial in today's tech-driven world. The lesson here is that society must support workers through education, retraining, and job placement programs to ease transitions during times of rapid technological change (Kumar, 2021).

The Third Industrial Revolution teaches us that adaptability, lifelong learning, and reskilling are crucial in navigating periods of rapid technological change. To stay competitive in a world increasingly dominated by automation and AI, the focus must be on digital literacy, specialized skills, and soft skills (Smith, 2001). As we continue to advance into the Singularity, these lessons remain highly relevant, emphasising the need for individuals, businesses, and governments to invest in education and support to ensure that the workforce are prepared for the future of work.

2.3.4 The 4th Industrial Revolution

The Fourth Industrial Revolution is fundamentally reshaping the job market by embedding technologies such as artificial intelligence, automation, robotics, and big data across nearly all industries (Ross & Maynard, 2021). Unlike previous industrial revolutions that replaced manual labour with mechanical or digital tools, the Fourth Industrial Revolution is creating intelligent, self-learning systems capable of making decisions, optimising processes, and adapting in real time. This rapid technological advancement is transforming the nature of work and, more importantly, the skills individuals need to succeed in the modern workforce (Li et al., 2017).

One of the most critical shifts is the need for AI and data literacy. Workers are no longer just users of digital tools, but they must now understand how to work alongside intelligent systems. This includes knowing how machine learning models function, how to analyse and interpret big data, and how to automate complex tasks(Xu et al., 2018b). These skills are essential not only

for technology professionals but also for workers in healthcare, marketing, logistics, and finance.

The reliance on digital infrastructure has made cybersecurity and digital ethics key areas of knowledge for nearly every employee. Understanding how to protect data, respect privacy laws, and navigate the ethical implications of AI use is now part of a responsible digital skillset. From protecting customer information to avoiding biased algorithms, workers across industries need to be informed and vigilant (Ross & Maynard, 2021).

Another key change is the increasing importance of interdisciplinary thinking. The blending of digital, biological, and physical technologies means that many roles now require skills from traditionally separate domains. For example, someone working in the development of wearable health tech may need to combine knowledge of engineering, software development, and biology. This fusion creates exciting opportunities and the need for broader educational and professional development pathways. Similarly, as machines take over routine or repetitive tasks, human-centric skills have become critical success factors. Traits such as creativity, empathy, collaborative problem-solving, and emotional intelligence are what give humans a competitive edge in roles involving leadership, innovation, and communication (Li et al., 2017; Turner, 2024). These skills are currently difficult for machines to replicate and are increasingly recognised as critical to the success of individuals and teams in the modern workplace.

The paper "Towards a 4th Industrial Revolution" by Philip Ross and Kasia Maynard (2021), University of Sheffield, Sheffield, UK, examines the transformative effects of emerging technologies associated with the fourth industrial revolution, such as Artificial Intelligence (AI), the Internet of Things (IoT), and autonomous systems, on jobs and skills. The paper emphasises

the need for adaptability and specialised technical expertise as automation reshapes industries and employment. The paper highlights that the fourth industrial revolution is expected to displace certain traditional roles while creating new opportunities in technology-driven fields. With the revolution, there will also be a skills evolution, and the paper highlights the growing demand for digital literacy, advanced technical skills, and the ability to work in smart ecosystems. Workers must continuously upskill to remain relevant in a rapidly changing job market. Jobs requiring creativity, problem-solving, and human interaction are likely to thrive. While the paper provides valuable insights into the evolving landscape of jobs and skills, it has some notable gaps, lacking detailed recommendations on how education systems and organisations can effectively prepare workers for these changes (Li et al., 2017). The integration of intelligent systems into workplaces is redefining job roles and expectations, requiring employees to adapt to collaborative environments with machines and AI, bringing about a massive potential for workforce displacement. The paper briefly mentions workforce displacement but does not explore how or propose solutions to bridge the skills gap, and there is limited discussion on how businesses and governments can implement policies to support workers during this transition. The paper offers an optimistic view of the Fourth Industrial Revolution's potential but could benefit from a deeper exploration of strategies to address workforce challenges and ensure equitable access to opportunities.

Similarly, there is a critical gap across multiple papers (Arntz et al., 2017; Bindra et al., 2021; Humbert, 2007; Li et al., 2017; Ross & Maynard, 2021). While theoretical insights are strong, most studies lack real-world implementation evidence of workforce adaptation strategies and provide insufficient details on scalable workforce reskilling models that industries can adopt. This suggests a need for further research to enhance the transition of skills as we move into a

future workforce scenario, through robust frameworks that facilitate recruitment and workforce planning. The workforce requires continuous learning and adaptability. With new tools, platforms, and systems emerging rapidly, today's skills can become outdated in just a few years. To remain employable, workers must adopt a lifelong learning approach, whether through formal education, micro-credentials, on-the-job training, or self-directed learning.

The shift toward intelligent automation and smart technologies is significantly impacting people's careers and lives. Many traditional roles are disappearing, especially those involving repetitive, rules-based tasks in sectors like manufacturing, retail, and administrative services (Makridakis, 2017; Ross & Maynard, 2021). For example, automated checkout systems and AI-powered customer service "bots" are replacing jobs that once required human labour. While some jobs vanish, entirely new ones are being created. The rise of positions like data analyst, machine learning engineer, cybersecurity specialist, and digital ethicist shows how the job landscape is evolving. These roles often come with better pay and working conditions, but they also demand higher levels of education and technical expertise, which not all displaced workers currently possess.

The spread of remote and flexible work, made possible by cloud computing and digital collaboration tools, also transforms workplace culture and expectations. While this has created more opportunities for global collaboration and work-life balance, it has also led to new challenges, such as digital fatigue, blurred boundaries between work and home life, and a need for strong self-management and communication skills (Mhlanga, 2022; Ross & Maynard, 2021).

As with every industrial revolution, this transformation brings ethical and social challenges. Data privacy, algorithmic bias, and unequal access to technology are becoming increasingly pressing issues (Sharma & Singh, 2020). Workers must now engage with these questions as part of their professional responsibilities, and organisations must prioritise ethics as a core competency.

The Fourth Industrial Revolution should not be seen as machines replacing people; it is about how humans and intelligent systems collaborate to create better, more efficient, and more innovative solutions. Workers who can blend technical knowledge with human insight will be in the strongest position to thrive (Popkova et al., 2019). Embracing flexibility, lifelong learning, and cross-disciplinary skill sets will be key to navigating this fast-moving world of work and ensuring that technological progress translates into shared prosperity.

The question of skills and workforce planning as we transition into the next technological transformation has become imperative and is beginning to receive appropriate attention in global research circles. In a recent study conducted at Comenius University in Bratislava, Slovakia, researchers explored the importance of soft skills in the modern world from a global perspective. The study advocates a people-centric approach to workforce planning (Poláková et al., 2023). Through an extensive literature review, the study aimed to understand the application of workforce skills in line with the evolution of technology (Industry 5.0) and their potential categorisation of the skills. The researchers gained valuable insights into the high-demand categories of soft skills by analysing job postings on a Slovak job portal over five years. While the authors acknowledge the need for further studies which include a more diverse global population, the outcomes indicate an increasing demand for soft skills in the job market. These skills included common themes of: Communication, Teamwork, Leadership, Creativity,

Analytical and Critical Thinking, Flexibility, Initiative and Engagement, Learning Skills, Well-being Focus, Taking Responsibility, Emotional Intelligence, and Persistence (Poláková et al., 2023). This review of Industry 5.0 emphasises the integration of human reasoning with machine intelligence. This shift underscores the irreplaceable value of human skills, particularly in roles requiring emotional intelligence, ethical decision-making, and innovation. While the study effectively highlights the need for these soft skills, the study lacks detailed strategies for integrating soft skills training into education systems or workplace programs or how workforce planning needs to factor these into recruitment practices.

Further studies by Hasanuzzaman Tushar and Nanta Sooraksa from the National Institute of Development Administration, Bangkok, Thailand, and the International University of Business Agriculture and Technology, Dhaka, Bangladesh, review global employability skills in the 21st-century workplace. The semi-systematic literature review of employee skills spanning over 30 years (Tushar &Sooraksa, 2023) has revealed a steady shift in employee skill requirements from numeracy and manual labour skills towards communication, problem-solving, and teamwork as critical recruitment criteria. The study identifies a gap between employer expectations and graduates' actual competencies but does not propose specific strategies to bridge this divide and while focuses on skill identification, does not assess how employability requirements have evolved in response to technological and economic shifts. The main outcomes of the study are that it confirms the rapid shift in skills required in the workforce and the pervasive mismatch between employee expectations and the skills of graduates entering the workforce.

This is further supported by a study conducted by the McKinsey Global Institute that details a similar set of common skills required by the workforce of the future, which include cognitive

skills and complex information processing as well as social and emotional skills alongside deep technology skills (Bughin et al., 2018). The outcomes of this study, as well as others (Guliyev, 2023; Kolade & Owoseni, 2022; Poláková et al., 2023)This indicates the need for employees to reshape their recruitment processes to target skills as we transition towards a rapidly evolving workplace.

2.4 Workplace of the Future

As technology evolves, the workplace is facing unprecedented volatility, uncertainty, complexity, and ambiguity (VUCA). VUCA is a term initially coined by the US Army and popularised by economists to describe complex, unpredictable scenarios (Wing, 2025). The complex relationship between organisational change and technological evolution is aptly captured by Martec's law as illustrated in Figure 2, which holds that while technology advances rapidly, organisational change struggles to keep pace (Brinker, 2013). This makes it essential for workforce planning for the technological singularity to focus not just on adopting new tools but also on building flexible skills. This way, human systems can keep pace with technological evolution.

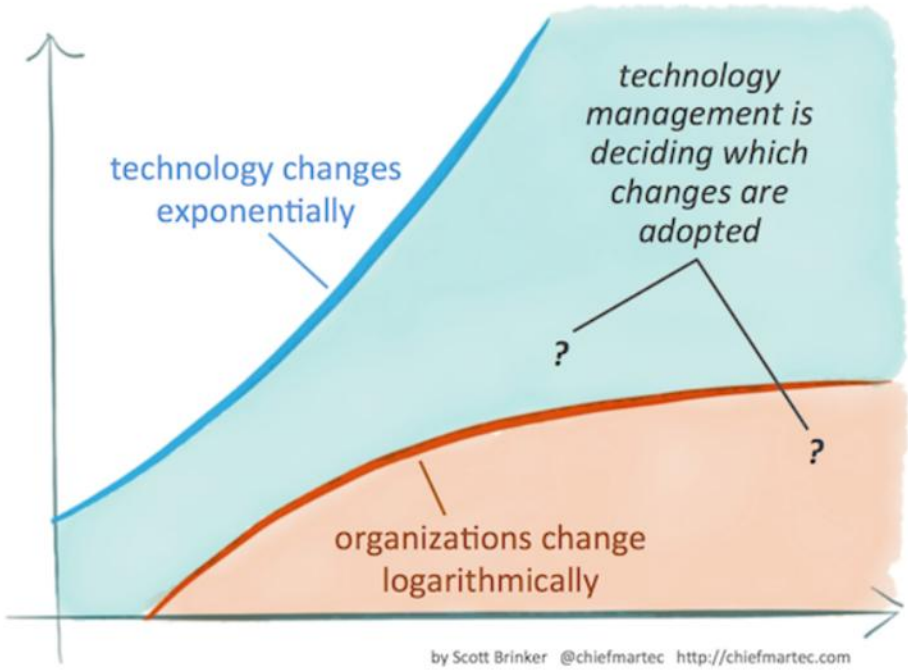

Figure 2: Martec's Law

A World Economic Forum study analysing senior leaders' survey results examines the evolution of the workforce over the next five years (Zahidi, 2023). According to employers, 44% of workers' abilities would be disrupted over this period due to technology. This indicates that corporate transformation will be driven mainly by technology adoption, as confirmed by the 2023 Future of Jobs report. The report indicates that while employers are confident in developing the existing workforce, they are doubtful about the availability of suitable talent with crucial analytical and creative thinking skills. Consequently, the future workforce is expected to be innovative, providing unique and creative solutions to transform industries and address global challenges (Rampersad, 2020). Humans are uniquely positioned to use cognitive logic to identify new data, experiment, and solve problems in ways that differ significantly from technology's data-based predictive methods. An example of such human-driven decision-making is the Wright Brothers' attempts to create a method of flight, which defied existing data and beliefs about the impossibility of human flight. Their success was driven by conviction and experimentation rather than by reliance on backwards-looking data, whereas AI's data-driven predictive strength lies in refining and optimising within established frameworks but struggles to innovate in the absence of precedent. This highlights the value of human belief-driven experimentation versus data-driven prediction (Felin & Holweg, 2024), which is the difference between how humans and AI approach decision-making and innovation.

The article "Paving the way for research in recruitment and selection" by Kristina Potočnik and colleagues (2021) explores recent advancements, challenges, and future directions in recruitment and selection research. The article assesses findings from forty meta-analyses to highlight key trends, including the validity of selection methods, applicant reactions, and the role of technology in hiring processes. The study's strength lies in its broad synthesis of

research over a 10-year period of various sources; however, its future recommendations could benefit from a deeper engagement with global hiring trends and diversity challenges. The literature review of meta-trends of recruitment and selection research has revealed that recruitment processes, while diverse, have evolved significantly over the past ten years (Potočnik et al., 2021), There is limited exploration of the long-term impact of technological advancements on the workforce, implying that further work is required to adapt these practices to the future workforce, given the evolving nature of technology's influence in the workplace (Doll, 2022; Pasban and Nojedeh, 2016; Zahidi, 2023)

As we approach a singularity scenario, ensuring that the future workforce is recruited and trained with the appropriate skills becomes critical. Innovation remains the heart of the future workforce, and therefore, the skills required to drive innovation become a critical focus to build.

The article "Innovation for an Era of Artificial Intelligence" by Giselle Rampersad (2021) examines the transformative effects of AI on innovation, skills, and the workforce labour market, particularly in the context of Industry 4.0. The study conducted at Flinders University, South Australia, in 2021, highlights the challenges and opportunities AI presents for workers and organisations, emphasising the need for adaptability and creativity in the workforce. A quantitative study was conducted at an Australian university with a group of students to determine the critical factors associated with innovation (Rampersad, 2020). Questionnaires were performed before and after placement in a project-based industry learning programme. While the study was localised to an Australian university and should be extended to a broader population, the longitudinal study provided critical insights into the importance of problem-solving, communication, and teamwork in critical thinking for driving innovation, again validating the need for these skills in the future workforce. In line with other articles referenced

in this review, the author, like many others, highlights the need for critical skills but lacks tangible practices or frameworks that would enable such a transition.

Technological advancements and evolving business models are creating a significant shift in workforce skill requirements. The study "How companies are reskilling to address skill gaps" was conducted by McKinsey & Company in 2020, a global consulting firm specialising in business strategy and workforce development. The research was based on a McKinsey Global Survey that gathered insights from executives and managers across various industries. The study examined how companies are addressing skill shortages through hiring, reskilling, and workforce training. It found that 87% of respondents reported existing or anticipated skill gaps within the next five years. The methodology involved analysing workforce trends, automation impacts, and reskilling strategies to determine how businesses are adapting to evolving skill demands (McKinsey, 2020). The study suggests that up to 375 million workers worldwide may need to transition into new occupations in the coming decade to align with changing company needs as automation frees employees to focus on more value-driven tasks. Despite the growing awareness of workforce transformation, only one-third of surveyed companies feel adequately prepared for these disruptions. Many organisations are addressing potential skill gaps through hiring, while others have initiated reskilling programs. However, the study reveals that a structured approach to workforce skill development remains largely inconsistent. The demand for specific skill sets is increasing, particularly in data analytics, IT management, and executive leadership. Advanced data analysis and mathematical skills were identified as areas with the most significant skill mismatch. The study highlights the growing concern among organisations about potential skill gaps arising from technological and market changes. Nearly all respondents agree that addressing skill shortages is a priority, yet only a third report that their organisations

are prepared to manage workforce disruptions effectively. A major challenge is the lack of visibility into current workforce skills and the roles most likely to be affected. Fewer than half of organisations have a clear understanding of their employees' competencies, and only 41% recognise which roles may face disruption (McKinsey, 2020).

To tackle these challenges, organisations are using multiple approaches, including hiring contract workers, redeploying employees, and initiating reskilling efforts. Over the past five years, hiring has been the most common strategy, cited by two-thirds of respondents, followed by skill-building programs cited by 56% (McKinsey, 2020). Re-skilling programs are increasingly recognised as an effective solution for closing skill gaps. Organisations that invest in skill-building report higher preparedness for workforce disruptions compared to those relying on hiring. Nearly half of the respondents believe reskilling will be the most effective approach in the next five years, compared to 31% who favour hiring. Current reskilling efforts focus on key competencies like critical thinking, leadership, and advanced data analysis skills projected to be in high demand.

The study "Generative AI and the Future of Work in America" (2023), was conducted by the McKinsey Global Institute (MGI), McKinsey & Company's research arm. It examines how generative AI is reshaping the U.S. labour market, focusing on automation's impact on different job sectors. The study analysed labour market trends from 2019 to 2022, tracking occupational shifts and the adoption of automation. The study used economic modelling to predict how AI could automate up to 30% of work hours by 2030. It also incorporated survey data from businesses and policymakers to assess how industries are adapting to AI-driven changes. According to this study by the McKinsey Global Institute (2023), "*When machines take over dull or unpleasant tasks, people can be left with more interesting work that requires creativity,*

problem solving, and collaborating with others". The study further illustrates that technology is a fundamental driver of workforce transformation, with generative artificial intelligence (AI) emerging as a key innovation to enhance the efficiency and productivity of knowledge-based labour.

As an illustrative example, Figure 3 shows how a software developer's role may change over the next few years as technologies such as AI become pervasive.

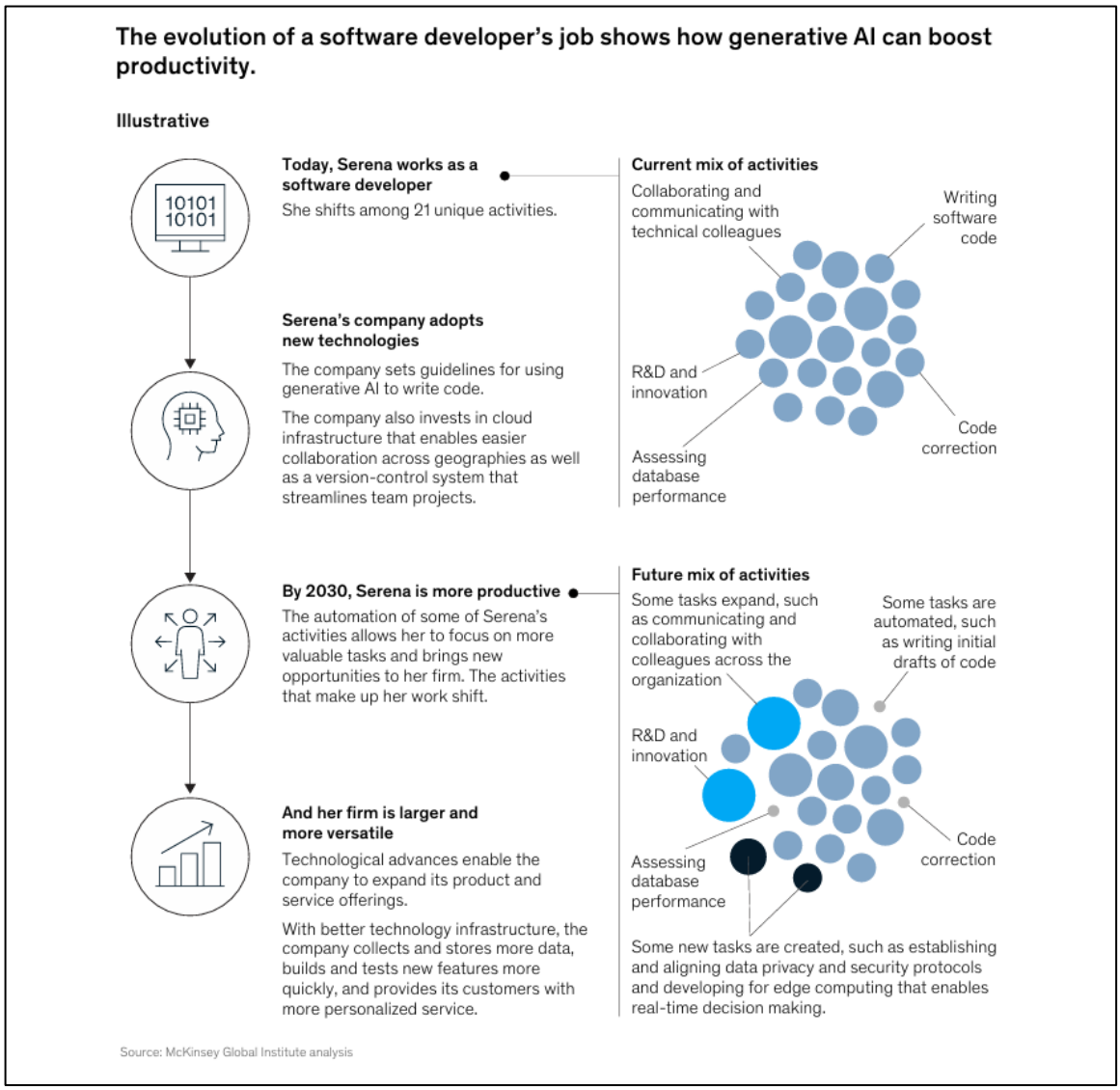

Figure 3: Evolution of a software developers' role as influenced by technology

The illustration in Figure 3 confirms that as AI continues to automate routine tasks, organisations must implement strategic workforce planning to facilitate employee transitions toward acquiring the skills needed to operate effectively in an AI-driven environment. To remain competitive, workers must develop proficiency in future skills, leveraging automation to reallocate their time toward higher-value activities(Ellingrud et al., 2023). This shift enables employees to engage in strategic thinking, innovation, and long-term business resilience, ensuring they can contribute meaningfully to organisational success. By automating administrative and reporting functions, professionals can focus on analytical decision-making and forward-looking strategies, reinforcing the importance of continuous skill development and adaptability in the evolving technological landscape.

Despite the promising outlook, several gaps in reskilling strategies remain. Many organisations struggle with program design, particularly in creating strong incentives, effective communication plans, and engagement strategies for external stakeholders. While most organisations can identify employees needing reskilling, fewer than half demonstrate strong capabilities in curriculum development. Additionally, balancing reskilling initiatives with ongoing business operations and measuring their impact are major challenges(Bughin et al., 2018; Ellingrud et al., 2023; McKinsey, 2020).

Successful reskilling programs tend to have strong leadership support and high employee engagement. Organisations fostering a culture of lifelong learning are more likely to achieve effective workforce transformation (McKinsey, 2020). Furthermore, companies with strong skill-management practices are significantly better prepared to address future disruptions than those with weaker frameworks.

2.5 Talent and recruitment frameworks

An organisation's human capital processes, including talent management and recruitment, are critical to establishing a solid foundation for the organisation's workforce(Pasban & Nojedeh, 2016). In support of this is the workforce planning process, which analyses data to identify gaps and forecast the organisation's workforce demands and develop solutions to meet these demands (Doll, 2022). Furthermore, the resource planning process ensures that an organisation have appropriate skills, as required, to align employee skills and proficiencies with current and future company objectives(Mansaray, 2019).

An empirical study by the National Bureau of Economic Research in Cambridge, reviewing the evolving relationship between technology and human skills, suggests that investment in human capital is crucial to an organisation's success, and producing skills that complement technology rather than being displaced is critical for long-term growth (Autor, 2014). The study explores the evolving relationship between automation and employment, particularly in the context of labour market polarisation. The study is grounded in Polanyi's Paradox, which suggests that humans possess tacit knowledge and skills that are difficult to define or automate explicitly. Autor (2014) argues that while automation has displaced specific routine jobs, it has also created new employment opportunities in high-skill and low-skill sectors, leading to a polarised labour market. The study examines how AI and robotics struggle to replicate human adaptability, judgment, and creativity, reinforcing the complementarity between human labour and technology rather than complete substitution. The study provides valuable insights into automation's role in shaping employment growth, strengthening the complementarity between human labour and technology rather than complete substitution; however, while the study acknowledges AI's limitations, it does not explore how emerging AI advancements (such as

generative AI) might alter workforce dynamics in the long term. Furthermore, the study focuses on current skill demand but does not assess how soft skill requirements have evolved over time or predict future workforce trends and importantly identifies soft skills as critical but does not explore how organisations can effectively cultivate these competencies through training programs or policy interventions.

The recruitment process is crucial to ensuring an organisation's competitive advantage from an employee perspective and, therefore, the foundation for future growth (Chungyalpa, 2016a).

A comprehensive review of recruitment and selection research done through the University of Edinburgh, consolidating findings from approximately forty meta-analyses and literature reviews conducted over the past decade, highlights recent developments in selection methods, emphasising their validity, applicant reactions, and impression management techniques (Potočnik et al., 2021b). While the review brings together existing literature, it lacks case studies demonstrating the practical application of recruitment innovations. The study explores how structured interviews, cognitive ability tests, and personality assessments remain widely employed, while also acknowledging the growing role of AI-driven selection tools and gamification in contemporary hiring processes. Additionally, the research discusses challenges such as bias in selection methods, expands the criterion space beyond traditional assessments, and highlights the need for more sophisticated theoretical frameworks. The authors call for future research to address political, cultural, and technological influences on selection practices, ensuring that recruitment strategies remain effective and equitable in evolving workforce environments. The study underscores the increasing complexity of recruitment and selection, particularly in volatile, uncertain, complex, and ambiguous (VUCA) environments shaped by COVID-19, gig economy trends, and AI-driven hiring platforms. The authors emphasise the

necessity for evidence-based recruitment strategies that align with changing labour regulations and technological advancements. The study discusses current trends but does not provide long-term projections on how recruitment and selection will evolve in response to automation, remote work, and global labour shifts, highlighting that this remains a significant gap in workforce planning.

Woods et al. (2020) provide a comprehensive literature review of research published post-2011 on the evolution of digital selection procedures (DSPs). The article evaluates the validity of digital hiring methods and applicant reactions to these innovations, offering a roadmap for future research. The study reviewing the selection processes involving digital technologies examines five key digital selection methods: online applications, psychometric testing, digital interviews, gamified assessments, and social media screening (Woods et al., 2020).The authors' review highlights the benefits of various testing methods, such as psychometric testing used to assess cognitive abilities and personality traits; digital interviews offering flexibility and cost-effectiveness, though they may reduce interpersonal engagement; gamified assessments that enhance candidate engagement and evaluate problem-solving skills but require validation for predictive accuracy; and social media screening, which provides insights into candidates' professional behaviour but raises ethical concerns regarding privacy and bias. The article provides clear insights into DSPs, highlighting both their potential benefits and ethical concerns. However, limitations in empirical evidence, practical implementation strategies, and applicant diversity leave room for further investigation. Future research should address these gaps to ensure that digital selection methods are both practical and equitable in diverse hiring contexts.

Most organisations use previous work experience as a predictor of job success when recruiting candidates (Abbas et al., 2021), and the typical recruitment selection approach includes a series of interviews as well as reference checks. It is now becoming apparent that a broader selection criterion is necessary, and the use of psychometric testing and engagement through gamification and interactive assessments is becoming increasingly relevant in the context of an evolving workplace(Iradat Abbas et al., 2021). The benefits of these approaches are apparent in the recruitment of graduates who have extraordinarily little experience but are selected on the premise of future impact (Caballero and Walker, 2010).

A systematic literature review study conducted through Deakin University critically evaluates existing research on graduate recruitment and selection practices(Caballero and Walker, 2010). The study highlights that work readiness is increasingly valued as an indicator of long-term job performance and career advancement(Caballero and Walker, 2010). The table below summarises the key findings of the study, which highlight the need to ensure that measurement of critical softer skills is brought into the workforce selection process:

Table 1: Summary of literature related to work readiness and related concepts

Table 1. Summary of the Literature Examining Work Readiness and Related Concepts

Reference	Construct terminology	Breakdown of skills/attributes
(Gardner & Liu, 1997)	Workforce readiness	Skills and Competencies: Speaking and listening, Reading, Writing, Mathematics, Thinking and Reasoning, Organisational, Analysing data, Job Skills, Personal Skills
(Casner-Lotto, Barrington & Wright 2006)	Workforce readiness	Applied Skills Critical thinking/problem solving, Oral communications, written communication, teamwork/collaboration, diversity, information technology application, leadership, creativity/innovation, lifelong learning/self-direction, Professionalism/Work ethic, Ethics/Social responsibility
(Hart, 2008)	Work preparedness	Teamwork, Ethical judgement, Intercultural skills, Social responsibility, Quantitative reasoning, Oral communication, Self-knowledge,, Adaptability, Critical thinking, Writing, Self-direction, Global knowledge
(Hambur, Rowe & Luc, 2002; Stewart & Knowles, 1999)	Graduate transferable skills & qualities ("Graduateness")	Personal Attributes Motivation, Organisational ability, Teamwork, Interpersonal/social skills, Leadership Communication Written, Verbal and non verbal skills Problem-Solving Initiative, Creativity, Decision Making
(Gabb, 1997)	Graduate transferable skills & qualities	Motivation, Enthusiasm, Interpersonal skills, Teamworking, Flexibility, Adaptability, Oral communication, Initiative, Proactivity, Problem-solving
(Stewart & Knowles, 2000)	Graduate transferable skills & qualities	Motivation, Initiative, Creativity, Organisational Ability, Communication Skills –Verbal, Communication Skills – Written, Teamworking, Interpersonal/Social, Problem Solving, Leadership, Numeracy, Information Technology
(Atlay & Harris, 2000)	Graduate employability	Information retrieval and handling, communication and presentation, planning and problem solving, social development and interaction
(Knight & Yorke, 2003)	Aspects of Employability	Personal Qualities Malleable self-theory, self-awareness, self-confidence, independence, emotional intelligence, adaptability, stress tolerance, initiative, willingness to learn, reflectiveness. Core Skills Reading effectiveness, numeracy, information retrieval, language skills, self-management, critical analysis, creativity, listening, written communication, oral presentations, explaining, global awareness

Caballero, C., & Walker, A. (2010). Work readiness in graduate recruitment and selection: A review of current assessment methods. *Journal of Teaching and Learning for Graduate Employability*, *1*(1), 13 – 25. 18

While the study highlights the need for critical skills for work readiness, current industry selection methods lack rigour and construct validity, making it difficult to measure work readiness effectively. The article critiques the varied definitions of work readiness used by employers and academics, arguing for a more standardised approach. It emphasises that graduate assessment should systematically evaluate transferable skills, competencies, and adaptability, rather than relying solely on traditional selection methods such as interviews and academic qualifications. The study calls for the development of specific work readiness measures to improve hiring decisions and predict long-term job success. It identifies significant inconsistencies in how work readiness is defined and evaluated, highlighting the limitations of current assessment methods and proposing the need for standardised measurement tools.

Traditional hiring models often rely on outdated criteria, such as rigid educational qualifications or years of experience, which may overlook candidates with transferable skills, adaptability, and potential, and may also ignore requirements related to the evolving workplace. The evolving workplace calls for a re-evaluation of what "work readiness" means and a shift in how employers evaluate talent, emphasising "softer" skills rather than static credentials (Abbas et al., 2021).

Recruiters must predict candidate job performance reliably, and cognitive ability tests offer one of the most robust methods for doing so. These assessments evaluate core mental skills such as reasoning, verbal comprehension, numerical manipulation, spatial awareness, problem-solving, and learning agility, providing measurable indicators of how candidates are likely to perform in real-world roles. Unlike personality or interest inventories, cognitive tests focus on the fundamental mental processes that underpin adaptability and knowledge acquisition, making them especially valuable in dynamic work environments. Their efficiency in sifting large applicant pools, coupled with their strong correlation with on-the-job success, has made them a cornerstone of evidence-based recruitment practices(Salgado et al., 2003; Schmidt and Hunter, 1998)

The theoretical rationale for cognitive testing is grounded in psychological research on general cognitive ability, often referred to as *g*. Rooted in Spearman's (1904) theory of a general intelligence factor and supported by decades of psychometric evidence, *g* reflects the capacity to learn, reason, and solve novel problems, skills that transfer across occupational contexts. Meta-analytic studies have consistently confirmed the predictive validity of cognitive testing. Schmidt and Hunter's (1998) landmark review, for example, demonstrated that general mental ability correlates at approximately 0.51 with job performance across thousands of studies,

outperforming most other selection methods. More recent analyses reinforce these findings, showing that cognitive ability not only predicts immediate job performance but also long-term outcomes such as training success, leadership emergence, and career progression(Bertua et al., 2005; Ones et al., 2012).Cognitive assessments are developed using rigorous psychometric methods such as classical test theory and item response theory, ensuring reliability, fairness, and comparability across candidates (Deary, 2013). They typically include subtests that measure distinct but related domains, which together provide a composite score reflecting overall cognitive aptitude. The predictive strength of these tests is expressed through correlation coefficients, which often range from 0.4 to 0.6, substantially higher than those of many alternative selection tools, such as unstructured interviews or reference checks (Schmidt et al., 2016). This means that candidates with higher cognitive test scores are significantly more likely to learn job tasks quickly, adapt to new challenges, and demonstrate sustained performance over time.

This study aims to explore and determine the effects of recent technological developments on contemporary business workforce models. It also aims to suggest relevant recruitment frameworks that will enable positive and beneficial change in workforce recruitment practices, ensuring that organisations recruit appropriately for the evolving needs of the business. This is significant as we enter the era of the next industrial revolution, leading up to a technological singularity that might occur in the near future.

2.6 Bridging the Research Gap in Workforce Planning for Technological Advancement

The increasing pace of technological evolution, particularly in artificial intelligence (AI) and automation, has introduced unprecedented complexities in workforce planning and adaptation. Unlike previous industrial revolutions, which followed relatively predictable cycles of job displacement and creation, the acceleration of AI-driven automation challenges traditional workforce models. This disruption necessitates a more structured approach to workforce planning, recruitment, and reskilling strategies to ensure long-term organisational sustainability (Chungyalpa, 2016). However, existing research remains fragmented, lacking comprehensive frameworks that equip businesses with the tools necessary to future-proof their workforce in alignment with upcoming technological transformations.

Historical trends indicate that technological advancements have raised concerns about mass job displacement while at the same time creating new industries and skill demands. The rapid automation of cognitive roles and machine learning presents uncertainty about whether the current workforce can reskill at a pace sufficient to match emerging demands (Ajayi et al., 2024). The transition from gradual technological adoption to algorithm-driven automation underscores the urgent need for workforce adaptability, continuous learning, and evidence-based strategic planning.

Despite the growing emphasis on reskilling in existing literature, a noticeable gap remains in industry-specific workforce frameworks that offer practical guidance for skill development and recruitment in the context of rapid technological disruption. While many studies highlight the importance of lifelong learning, few provide scalable models for organisations to redesign job

roles, shift talent pipelines, and proactively address skill shortages. Furthermore, limited research exists on evolving recruitment models that prioritise future skills-based hiring. The absence of structured workforce planning frameworks leaves businesses in a reactive position rather than enabling proactive talent development strategies (Caballero & Walker, 2010; Iradat Abbas et al., 2021; Potočnik et al., 2021b). To address this research gap, organisations must transition from conventional experience-based hiring models to future skills-centred recruitment frameworks, integrating dynamic competency assessments. Without a structured and predictive workforce planning approach, industries face risks of talent shortages, misalignment in skill demands, and limited growth.

A comprehensive and interdisciplinary understanding of workforce adaptation is essential to ensure businesses can develop effective strategies for navigating technological disruption. By addressing this gap, industries can enhance workforce resilience, optimise recruitment strategies, and ensure sustainable growth as we transition towards the next technology revolution and singularity scenario.

2.7 Summary and Conclusion

This chapter examined how technological revolutions have influenced society, the economy, and the workforce. From the impact of the First Industrial Revolution on the workforce to today's rapid technological evolution, each wave of innovation has altered work, required skills, and human-machine interactions.

The concept of the technological singularity, introduced by Vinge (1983) and later expanded by Kurzweil (TerKonda et al., 2024) and Hinton (Nolan, 2025; Novak & Silva-Braga, 2025), highlights the potential for artificial intelligence to surpass human intelligence. The literature

identifies both opportunities and risks of such an occurrence. While technological progress has promoted prosperity and efficiency, it has also caused displacement, inequality, and ethical challenges. Recent publications highlight the need for regulation, global cooperation, and proactive workforce adaptation to address the risks of autonomous AI systems that the current rapidly evolving technology will bring.

Historical frameworks such as Kondratiev's long-wave theory (Malyarets & Lebediev, 2023) show that technological innovation drives recurring cycles of economic growth and disruption. Each revolution has created new industries and opportunities while displacing traditional roles and increasing social inequalities. Examples from previous eras, such as the rise of labour unions in the Second Industrial Revolution (Turner, 2024) and the globalisation of digital work in the Third (Kumar, 2021), highlight the need for reskilling and education reform during these transitions.

This section highlights that technological revolutions are closely linked to workplace transformation. The First Industrial Revolution moved labour from agriculture to factories, often under harsh conditions (Dimanov, 2024). The Second created technical and office roles, benefiting those who reskilled and marginalising others (Mokyr & Strotz, 2003). The Third introduced digitalisation, automation, and global connectivity, increasing demand for IT and analytical skills while reducing manual labour (Sharma & Singh, 2020). The Fourth Industrial Revolution accelerates these changes, requiring advanced digital skills in AI, robotics, and cybersecurity, while also increasing the value of creativity, emotional intelligence, and ethical judgment (World Economic Forum, 2025; Mulero & Theophilus, 2021).

The current Industrial Revolution is unique in its speed and scope. It is not only transforming industries but also redefining human identity and capability in a volatile, uncertain, complex, and ambiguous (VUCA) environment (Johansen & Euchner, 2013). As technologies take on more technical and repetitive tasks, human capabilities become essential complements to advanced technologies.

In conclusion, technological revolutions present both significant progress and ongoing disruption. Chapter 2 shows that understanding historical patterns and current warnings is essential for preparing the future workforce. The singularity could be the most transformative moment in human history. The challenge is not to resist change, but to shape it responsibly and ensure technology serves humanity.

CHAPTER III:

METHODOLOGY

3.1 Introduction

The rapid evolution of technology through industrial revolutions, from mechanisation in the First Industrial Revolution to the current advancements in artificial intelligence and automation, has continuously reshaped workforce dynamics, job roles, and skill requirements. While technology drives economic progress and operational efficiencies, it also presents significant challenges for the workforce, including job displacement, skills gaps, and the need for adaptable workforce management strategies (Groumpos, 2021; Humbert, 2007).

Despite extensive literature examining the historical impacts of industrial revolutions on jobs and skills, there remains a lack of comprehensive frameworks that guide businesses in workforce planning aligned with technological advancements. Organisations struggle with workforce strategies that offer frameworks for recruiting appropriate skills and ensuring the ongoing development of the current workforce, leading to inefficiencies in employee skill development, talent retention, and adaptability in an evolving market.

This study aims to (1) systematically review existing research on industrial revolutions and their effects on workforce dynamics, (2) analyse industry practices in workforce management in response to technological shifts, and (3) develop a structured framework for workforce planning that ensures business sustainability while fostering workforce resilience. By addressing gaps in the literature and industry best practice, the study will provide a strategic model for businesses to proactively adapt their workforce strategies to align with future technological transformations.

This study seeks to examine the implications of technological advancements on the workforce, particularly considering the potential emergence of a "Technology Singularity". In doing so, it answers the question, ***"How have industrial revolutions historically influenced job roles and skill requirements, and what implications do these shifts have for future workforce planning in upcoming industrial revolutions? Additionally, how can a strategic framework be developed to support skills development and recruitment in alignment with technological evolution?"***

In line with this, the study will review:

- Historical Analysis: What patterns emerge in workforce transformation across past industrial revolutions?
- Future Workforce Implications: How will emerging technologies (AI, automation, digitalization) redefine skill demands in future industrial revolutions?
- Framework for Adaptability: What strategies can organisations implement to ensure effective workforce planning, skill development, and recruitment in evolving industries?

This study aims to comprehensively review industrial revolutions, focusing on job and skill impacts while outlining a workforce planning framework for future industrial revolutions using a mixed-methods research approach. This would combine qualitative insights from historical analysis and expert perspectives with quantitative data to examine current trends and perceptions of skills and recruitment practices.

This study will include a comprehensive approach encompassing a diverse array of methodologies to probe the impact of future scenarios. The following sections outline the

methodological framework, data collection methods, and analytical strategies that guide this study.

3.2 Research Design

This research design integrates literature review, systematic research, interviews, and thematic analysis to analyse past trends, assess current industry perspectives, and forecast future developments. The literature review systematically examines historical workforce shifts and technological advancements, providing a foundation for understanding long-term patterns. Systematic research applies a structured, unbiased approach to evaluating existing studies, ensuring a comprehensive synthesis of empirical findings (Knafl & Howard, 1984). Interviews with industry experts and professionals capture real-time insights into workforce adaptability, skill evolution, and organisational strategies in response to technological change. Using thematic analysis, qualitative data from interviews and literature are coded to identify recurring themes, relationships, and emerging trends. Combining retrospective analysis with contemporary expert viewpoints enables predictive modelling to anticipate future workforce demands, technological disruptions, and skill development needs, ensuring alignment with evolving industry practices and strategic workforce planning.

A literature review is a structured synthesis of existing research that provides a historical and conceptual foundation for a study, identifying trends, gaps, and key theories related to workforce transformation across industrial revolutions (Snyder, 2019). In this research design, the literature review will examine past and present studies on job evolution, skills adaptation, and workforce management strategies, forming the basis for understanding future trends. It will be supported by a systematic review, which ensures transparency and rigour by critically

evaluating relevant empirical studies while minimising bias. Additionally, thematic analysis will be applied to both literature and interview data, identifying recurring patterns and insights that shape future workforce planning. Together, these methods create a comprehensive framework for assessing technological advancements and their long-term effects on workforce adaptability and recruitment strategies.

A systematic literature review is a research method used to identify, evaluate, and synthesise relevant studies in a transparent and reproducible manner. Initially developed in medical science, it is increasingly being applied in business research to minimise bias and provide reliable conclusions (Snyder, 2019). The process involves collecting empirical evidence that fits predetermined criteria to answer a research question or hypothesis. Statistical methods such as meta-analysis can be employed to integrate findings and compare patterns and relationships across multiple studies. However, challenges arise when studies use different methodologies, requiring qualitative systematic reviews to assess research quality (Knafl & Howard, 1984). Systematic reviews contribute valuable insights by identifying consistent effects across studies, highlighting research gaps, and determining future research directions (Lame, 2019). This also helps evaluate how findings vary across cultural or contextual settings, such as the various Industrial Revolutions, making it ideal for evidence-based decision-making in academia and industry (Snyder, 2019).

Thematic analysis is a qualitative research method used to identify, analyse, and interpret patterns within textual data. It involves systematically coding data, grouping similar codes into themes, and refining them to ensure coherence and relevance (Braun & Clarke, 2013, 2006). In this research design, thematic analysis will be applied to both the literature review and the interviews, providing a structured approach to identifying recurring themes related to workforce

transformation, skills evolution, and technological adaptation. Extracting insights from historical trends and contemporary expert opinions will help forecast future workforce shifts and inform the development of a strategic framework for workforce planning. Thematic analysis will provide a deeper understanding of the relationship between industrial revolutions and evolving skill demands, ensuring that findings are grounded in both empirical evidence and real-world perspectives (Braun & Clarke, 2013). Thematic analysis was instrumental in this study as it encouraged the exploration of different perspectives from various participants, highlighting similarities and differences across experiences.

While the choice of thematic analysis provides a broad view of themes, a more specific form of thematic analysis, called Thematic Inductive Content Analysis, is a compelling option for researchers seeking to explore qualitative data in a flexible and unbiased manner (Gheyle & Jacobs, 2017). This approach allows themes to emerge naturally from the data rather than imposing preexisting categories, which is invaluable when delving into novel or underexplored topics. It fosters a deep, iterative engagement with the material, uncovering subtle patterns and rich insights that might be overlooked with more rigid frameworks (Jowsey et al., 2021).

A thematic inductive content analysis is particularly well-suited to addressing the multifaceted research question in this study, as it allows for the exploration of complex historical and contextual narratives that a quantitative approach might overlook (Gheyle & Jacobs, 2017; Jowsey et al., 2021). Instead of reducing change to mere numbers or trends, thematic inductive analysis delves into qualitative sources such as research materials, expert commentaries, and historical accounts to uncover how industrial revolutions reshaped job roles and skill requirements over time. This method permits themes to emerge organically from the data, offering insights into the nuanced perceptions, social dynamics, and institutional shifts that

drive workforce evolution. By focusing on the underlying narratives and meanings (Knafl & Howard, 1984) , this approach provides a more comprehensive understanding of the implications these transformations have for future workforce planning. It captures the subtleties of why and how specific changes occurred rather than merely quantifying the changes, which might result in oversimplification. Furthermore, developing a strategic framework that supports skills development and recruitment requires a deep understanding of historical context and forward-looking insights, needs that are better served by inductive qualitative analysis (Vears et al., 2022).

In contrast, a quantitative study would primarily focus on counting or measuring aspects of the change (Sadan, 2017), potentially missing the deeper reasons and relationships that are essential for creating a robust, contextually grounded strategy in response to technological evolution. This study's focus is qualitative, primarily because quantitative analysis is not well-suited for answering the research question. Quantitative analysis tends to focus on numerical trends and statistical correlations (Sadan, 2017), which often fail to capture the historical context and nuanced dynamics of industrial revolutions. The evolution of job roles and skill requirements involves complex socio-economic, cultural, and technological transformations that cannot be reduced to numbers. Quantitative methods might highlight changes in employment rates or skill gaps, but they often overlook the underlying mechanisms and causal narratives (Braun & Clarke, 2013)that drive these shifts. Additionally, developing a strategic framework for future workforce planning requires a deep understanding of emerging trends, stakeholder perspectives, and the qualitative impact of technological evolution insights that a purely numerical approach cannot provide. Therefore, a methodological approach that embraces qualitative, thematic

analysis (Vears et al., 2022)is essential for comprehensively addressing the multifaceted nature of these historical and future challenges.

This design enables a robust exploration of the workforce implications of technological changes, providing a comprehensive view of trends, individual experiences, and the adaptation of workforce strategies. These would lead to a subsequent definition of a conceptual framework, focusing on technological evolution and its impact on the workforce over time. The framework will be defined through the study parameters and variables identified through the systematic reviews and their potential relationships (Gaviola, 2024; Vears et al., 2022). The conceptual framework aims to guide workforce planning in the context of the technology singularity.

The review of current studies is segmented into the following elements:

- Evolution of technology: Review of technological advancements throughout history and their impact on the workforce.
- Technology Revolution and the workplace
- Future skills and the workplace
- Workplace of the future
- Talent and recruitment frameworks

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3.3 Data Collection

Qualitative approaches will be used, drawing on insights from multiple disciplines. Data for this study will be collected through a mixed-methods approach, integrating a systematic literature review, expert interviews, and thematic analysis to ensure a comprehensive understanding of workforce transformation across industrial revolutions.

3.3.1 Literature review

The literature review for this study will be conducted using a structured, systematic approach to ensure a comprehensive analysis of workforce transformation across industrial revolutions. First, a scoping review will be performed to identify key concepts, theories, and trends related to job roles, skill evolution, and workforce management strategies. This will be followed by a systematic search of academic databases, including Google Scholar, Scopus, and Web of Science, as well as industry reports from organisations such as McKinsey and the World Economic Forum. Predefined inclusion and exclusion criteria will be applied to refine the selection of high-quality studies, ensuring relevance while minimising bias (Snyder, 2019). The selected sources will undergo content analysis, categorising findings into key themes such as workforce adaptability, technological disruptions, and recruitment strategies. Additionally, comparative analysis will be used to assess differences in workforce transitions across industrial revolutions, highlighting emerging trends. By integrating both historical and current perspectives, this literature review will establish a solid foundation for understanding workforce evolution and guide the development of a strategic framework for future workforce planning (Lame, 2019; Snyder, 2019).

3.3.2 Semi-structured interviews

Qualitative interviews involving in-depth conversations to gather rich, nuanced data about individuals' experiences, perspectives, and opinions (Dunwoodie et al., 2023) on the evolution of technology and the impact on the workforce. Semi-structured interviews will be conducted with industry professionals and business leaders to capture real-world insights on workforce adaptability and future planning. Industry experts, HR professionals, and business leaders will be identified using purposive sampling, ensuring relevant insights. A structured interview follows a fixed set of questions, while a semi-structured interview is more flexible, allowing new questions to emerge based on the interviewee's responses, and the interviewer in a semi-structured interview works within a framework of themes rather than a strict question list(Mashuri et al., 2022) .

The semi-structured interviews will explore workforce challenges, skills transformation, and recruitment strategies in evolving industries. Data collection through these interviews will yield valuable qualitative data; profound insights into human perspectives and experiences with technological evolution and workforce impact are expected.

The number of interviews conducted will be determined through an iterative process, starting with an estimated range of between 10-15 interviews and continuing data collection until saturation is empirically observed (Guest et al., 1995). According to the article "Sample sizes for saturation in qualitative research: A systematic review of empirical tests" by Hennink and colleagues (2022), there is no universal "best" sample size for qualitative research; instead, it depends on factors such as research objectives, population characteristics, and the required depth of insight. However, the review found that code saturation, the point at which no new

themes or codes emerge, was typically reached within 9 to 17 interviews (Hennink & Kaiser, 2022). This research sample size will reflect the open-ended, exploratory nature of the study, allowing for themes to emerge from the data rather than being pre-defined (Vears et al., 2022).

3.3.2.1 Materials

This qualitative research study gathered data through in-depth semi-structured interviews, with an interview schedule constructed that contained open-ended questions to allow participants to highlight further points.

The following question schedule will be used as a base for the interviews:

Current Skill Trends

1. What are the most in-demand skills in your industry today, and how have they changed in recent years?
2. Which technical and soft skills do you see as essential for employees to thrive in the current workforce?

Future Skills Evolution

3. What emerging technologies do you believe will have the biggest impact on skill requirements in the next 5–10 years?
4. How do you anticipate jobs evolving—will the workforce require entirely new skill sets, or will existing ones be adapted?
5. In your experience, what differentiates those employees who succeed in the workplace as it evolves versus those who struggle with change?

Education and Workforce Preparedness

6. Do current education and training programs adequately prepare workers for the evolving skill landscape? If not, what changes need to be made?
7. Have you found that some employees are just unable to adapt to the evolving requirements of their role over the past few years?
8. What advice would you give to professionals looking to future-proof their careers in the face of rapid technological change?

Recruitment and Employment Impacts

9. How has your approach to hiring changed due to evolving skill demands? Are you looking for different qualifications now compared to five years ago?
10. In your experience, what recruitment or hiring tools have been most useful in recruiting successful candidates and why?

3.4 Data Analysis

This qualitative study will answer this complex question using thematic inductive content analysis as a framework, with thematic analysis techniques used to derive themes. The analysis initially begins by familiarising with a wide range of qualitative data sources, including research articles, industry reports, and expert interviews, related to industrial revolutions, job roles, and skills evolution. Next, engage in systematic coding by reading through the data to identify and label relevant segments without imposing any preconceived categories.

Then, group these codes into emerging themes that illustrate the impact of each industrial revolution on workforce dynamics, noting both broad trends and nuanced shifts using thematic

analysis to identify and extract key themes, patterns, and relationships within the systematic review of literature and interview results (Braun & Clarke, 2006). The literature review will provide historical insights into job transformation and skill adaptation across industrial revolutions, while interviews with industry leaders will capture contemporary challenges and strategies for workforce resilience. Using thematic analytical techniques, qualitative data from both sources will be coded (Knafl & Howard, 1984)into recurring themes that reflect shifts in workforce management, technological disruptions, and evolving skill demands. By mapping these trends, the study will develop predictive insights, allowing for the forecasting of future workforce transformations. This approach ensures that workforce planning strategies are anchored in both historical evidence and real-time industry perspectives, supporting a structured framework for skills development and recruitment in alignment with technological advancements.

Thematic analysis involves a systematic coding approach to identify patterns, themes, and relationships in qualitative data from both literature and interviews (Braun & Clarke, 2006). As guided by Braun and Clark (2013), the structured thematic analysis process used for this study is listed below:

1. Data Familiarisation:

Before coding, all collected data (literature findings and interview transcripts) will be carefully reviewed to gain an overall understanding of key workforce trends, skill evolution, and industry practices.

2. Generating Initial Codes

- Texts will be broken down into meaningful units (key phrases, concepts, or ideas).
- Open coding will be used initially, allowing all potentially relevant themes to emerge

without preconceived categories.

- Each segment of data will be assigned preliminary codes based on recurring terms related to workforce adaptation, technological shifts, and recruitment strategies.

3. Identifying Themes

- Codes will be systematically grouped into broader themes that reflect workforce trends across industrial revolutions.
- Themes may include technological impact on job roles, emerging skill demands, recruitment shifts, workforce adaptability strategies, and future employment patterns.

4. Reviewing and Refining Themes

- Themes will be assessed for consistency and coherence, ensuring they accurately capture patterns in both literature and interviews.
- Data will be cross-referenced to validate insights by comparing historical trends with contemporary expert perspectives.
- Any overlapping or redundant themes will be merged or refined for clarity.

5. Interpretation and Prediction

Identified themes will serve as the foundation for predictive insights, helping to forecast workforce transformations and skill demands in future industrial revolutions.

After identifying initial themes, review and refine them to ensure they accurately capture the historical context and its implications. The next step is to define and clearly name each theme, linking them directly to the research question, particularly regarding changes in job roles, skill requirements, and future workforce challenges.

Lastly, a SWOT analysis and TOWS framework will be used to organise and synthesise early insights from the literature review and interview data. The SWOT analysis identifies internal workforce strengths and weaknesses, as well as external technological opportunities and threats, providing an initial strategic overview of the workforce landscape during rapid technological change. The TOWS matrix then translates these findings into strategic actions by determining how to leverage strengths, address weaknesses, capitalise on opportunities, and manage threats. This approach will inform and refine the thematic review by highlighting the most significant conceptual and practical areas. It will combine these insights into a strategic framework that not only explains the historical impact of industrial revolutions but also informs future skills development and recruitment strategies in response to ongoing technological change. This will result in a comprehensive report and framework that addresses the key question: "How have industrial revolutions historically affected job roles and skill requirements, and what implications do these shifts have for the future workforce in upcoming industrial revolutions? Furthermore, how can a strategic framework be created to support skills development and recruitment in line with technological evolution?"

3.5 Ethical considerations

Ethical considerations in this study ensure responsible research practices, participant protection, and data integrity. Confidentiality and privacy will be maintained, particularly during interviews, with participants' identities and responses anonymised. Informed consent is essential, and all participants must fully understand the study's purpose, their role, and the voluntary nature of participation. Bias mitigation will be applied to ensure that the systematic literature review and thematic analysis are conducted objectively, without selective inclusion or exclusion of studies that could distort findings.

Data transparency ensures that sources used for systematic research are credible and that findings are reported with accuracy and integrity. It is also a key consideration to ensure that respect for diverse perspectives is upheld when analysing workforce trends across industries and regions, avoiding assumptions or generalisations that may misrepresent realities.

Ethical approval and approval of the study questions will be obtained from the study supervisor and, if necessary, the Swiss School of Business Management review board before the study commences. Informed consent will be obtained from all participants, ensuring they are fully aware of the study's purpose, their rights, and the confidentiality of their responses. Participants will retain the right to withdraw from the study at any time without penalty. Academic integrity will be upheld throughout all phases of this research.

3.6 Limitations

This study faces several limitations, including reliance on existing literature, which may contain gaps or outdated perspectives, and potential bias in expert interviews due to subjective viewpoints. Workforce transformation varies across industries and regions, making universal applicability of findings challenging. Additionally, the rapidly evolving technological landscape challenges the long-term generalisability of the findings. Restricted access to proprietary organisational data could affect the comprehensiveness of workforce planning insights. To mitigate these challenges, the study will expand the literature review to include interdisciplinary perspectives, ensure diverse expert participation to balance biases, and incorporate cross-industry comparisons for broader applicability. Predictive accuracy will be refined using historical trends, expert insights, and data-driven forecasting techniques. Ethical considerations

will guide workforce predictions, ensuring fairness and reliability. These strategies will enhance objectivity, credibility, and the relevance of findings for workforce planning in alignment with technological evolution. To improve the study's robustness, the study will focus on triangulating data sources and strive to incorporate a broader perspective whenever feasible. This approach will help to strengthen insights and provide a more comprehensive understanding of the topic.

3.7 Summary

Chapter 3 establishes the methodological foundation of this study within a qualitative paradigm, emphasising depth, context, and interpretive analysis over numerical generalisations. The research design integrates a systematic literature review, semi-structured interviews, and thematic inductive content analysis to ensure methodological triangulation and strengthen the credibility and validity of the findings. The literature review provides historical and conceptual context for workforce transformation, while expert interviews offer current perspectives on organisational practices and workforce adaptability. Thematic analysis, using SWOT and TOWS frameworks, synthesises these data sources into coherent themes and actionable strategies.

The chapter addresses ethical considerations by ensuring participant confidentiality, informed consent, and academic integrity. It also acknowledges limitations, including challenges in generalising findings across industries and adapting to rapid technological change, and proposes solutions to address these issues.

In summary, Chapter 3 presents a rigorous methodological framework that is both theoretically grounded and practically oriented. It enables the study to generate insights into the relationship between technological revolutions and workforce transformation and provides a structured

approach to developing strategies that support skills development, recruitment, and organisational resilience. This foundation prepares the way for subsequent chapters, where empirical findings and thematic analysis will clarify the implications of technological disruption and inform future-ready workforce strategies.

This study will be conducted between January 2024 and January 2026.

CHAPTER IV:

RESULTS AND DISCUSSION

4.1 Introduction

This chapter shares the study's findings on how the workforce is changing as modern technologies emerge and industrial revolutions continue. The research employs a combination of methods, including a literature review and expert interviews, along with a thematic analysis of the data, to gain a deeper understanding of how technology and the concept of technological singularity are transforming the workforce. Leveraging the outcomes of the thematic analysis, a brief discussion is provided that lays the foundation for the next chapter 5, which focuses on recommendations and the conclusion.

The literature review examines how technology is transforming the workforce, drawing on sources from business, technology, and organisational studies spanning various industrial revolutions. The literature review also includes content analysis across recent developments in artificial intelligence and other emerging technologies. As the pace of change and technology advances accelerate, the way we work, the skills we need, and how companies hire are all shifting. The review combines studies, industry reports, and theories to identify trends in skill changes, workforce readiness, and organisational responses. Similarly, qualitative methods were employed to gather expert views on recruitment, skill development, and adapting to work through in-depth, semi-structured interviews with industry experts. The data was analysed to identify common themes, differences, and new traits that demonstrate an understanding of the impact of technological changes and how prepared the workforce currently is for rapid change.

This analysis aims to recommend how companies can adapt their recruitment models to prepare for these changes.

4.2 Results from Literature Review

Using a structured qualitative approach of thematic analysis, this review aimed to uncover how organisations and individuals are adapting to the challenges and opportunities posed by successive industrial revolutions and, from this, inform the skills required for organisations to adapt to the anticipated singularity. The findings provide a foundation for understanding future workforce readiness and are presented in the format of four key themes and their corresponding subthemes, extracted from the literature.

4.2.1 Theme 1: Acceleration Toward Technological Singularity and Workforce Disruption

The literature review consistently highlights an accelerating trajectory toward a technological singularity, driven by rapid advancements in artificial intelligence (AI), quantum computing, and related technologies. Technology industry leaders, such as Geoffrey Hinton (Godfather of AI) and Satya Nadella (CEO of Microsoft), all emphasise the disruptive potential of AI, with Hinton warning of both job displacement and the risk of AI quickly surpassing human capabilities. Recent interviews in public media and industry announcements (e.g., Microsoft, Meta, Salesforce) have announced that AI is already automating significant portions of software development, with estimates that up to 50% of jobs in specific sectors could be replaced within the next decade.

Multiple sources of recent public announcements have reported large-scale layoffs in technology companies, particularly among software engineers and technical managers, as AI-driven automation becomes increasingly prevalent across industries. It is also worth noting that these disruptions are often accompanied by the emergence of new roles, particularly in sales, AI development, and the management of hybrid human-digital workforces.

4.2.2. Theme 2: Skills Evolution

A review of the literature showed common themes in the four Industrial Revolutions. Each revolution introduced both technological innovation and job loss, along with new skill requirements. The analysis is based on Kondratiev's theory of long waves. This theory suggests that economic changes happen in cycles driven by technological progress.

During the First and Second Industrial Revolutions, skilled artisans in niche areas were replaced by factory workers. This led to an increase in technical and office jobs. Key skills for survival were the ability to adapt as well as the ability to learning new skills. When support systems failed to keep pace with technological advancements, social unrest and inequality emerged.

The Third and Fourth Industrial Revolutions gave rise to the digital and automation revolutions, which significantly changed employee skill requirements to focus on technology, robotics, and knowledge-based work. The Fourth Industrial Revolution, characterised by AI, IoT, and big data, demanded robust digital skills, interdisciplinary knowledge, and a commitment to ongoing learning. The impending Singularity will bring with it a further shift in skills requirements.

4.2.3. Theme 3: Workforce Planning Challenges

A persistent skills gap exists because education and training systems struggle to keep pace with technological changes. Studies show a mismatch between what employers expect and what graduates can do, highlighting the need for structured programs to help people reskill and upskill for the future.

The review of recent literature shows a clear division of future workforce needs into three categories of technical skills, such as programming and data analysis; human skills, including creativity and emotional intelligence; and conceptual skills, including strategic thinking and problem-solving. Conceptual problem-solving skills are a critical success factor, with the importance of soft skills becoming increasingly recognised, especially in positions that require working with intelligent systems.

We see that lifelong learning and adaptability are essential for workforce resilience. The rapid pace of change brought about by technological evolution means that flexible, skills-based career paths need to replace traditional, fixed ones.

4.2.4. Theme 4: Recruitment and Selection Evolution

Recruitment and selection practices are evolving due to technological advancements and need to quickly adapt to align with changing needs. Psychometric testing, gamified assessments, and AI-driven selection tools are now crucial to the hiring process, which has traditionally prioritised experience and qualifications as primary recruitment requirements. There is a greater emphasis on measuring work readiness, transferable skills, and adaptability, rather than relying solely on fixed credentials.

Studies indicate the need for evidence-based recruitment strategies that keep pace with evolving labour regulations and technology. However, gaps still exist in the practical implementation and creation of standardised assessment tools.

The literature highlights a lack of thorough and scalable models for workforce planning and talent development. Organisations are responding to immediate skill shortages for technical skills and future technical needs, rather than being proactive in their recruitment efforts to attract the right skills for the future, which balances the need for both technical and softer skills in staff.

4.2.5 Summary of Literature Review Findings

The qualitative synthesis shows that the mix of technological singularity, workforce disruption, and changing skill needs is reshaping the future of work. Historical patterns offer useful lessons on adjusting and retraining, but the rapid and complex changes we see today call for innovative approaches to workforce planning, hiring, and ongoing learning. The literature stresses the importance of technical, human, and conceptual skills, but it also points out ongoing gaps in education, policy, and organisational strategy. Closing these gaps is crucial for creating an inclusive, strong, and innovative workforce in the age of AI and automation.

4.3 Results from Interviews

The results are organised into four overarching themes based on the interviews:

- Acceleration toward Technological Singularity and Workforce Disruption,
- Skills Evolution,
- Workforce Planning Challenges,
- Recruitment and Employment Impacts.

Each theme is supported by subthemes and illustrative quotes that reflect the lived experiences and strategic insights of participants. The chapter refrains from providing recommendations, instead focusing on presenting the data as a foundation for the discussion of conclusions and recommendations that follow in Chapter 5.

4.3.1. Theme 1: Acceleration Toward Technological Singularity and Workforce Disruption

The first theme from the interview process highlights the major shifts in workforce skills needed to handle the changes brought on by rapid technological transformation. The findings indicate a mix of fast technological change, developing technical skills, and the lasting significance of human-focused abilities.

4.3.1.1. Sub-theme: Rapid Technological Evolution and Skill Transition

Participants consistently highlighted the rapid pace of technological change, which has led to a major shift in workforce skills over the past decade. Traditional coding and infrastructure management skills are being replaced by platform thinking, integration knowledge, and data-

driven decision-making. *"There is a strong demand for digital fluency across the board, especially in the data analytics, cloud technologies, API and AI integration".*

The shift from on-premises systems to cloud-based architectures has been particularly influential, requiring proficiency in cloud technologies, API integration, and advanced data analytics. This view was stated by multiple participants and as articulated by the following statement: "*So, I believe software engineering and software engineers have been in demand since the dawn of computing. However, I think this demand has been amplified to some extent by the advent of cloud computing, because everything in the cloud is somewhat software-defined."*

4.3.1.4 Sub-theme: Automation, AI, and Agentic Systems

Automation has become a significant force for change. Organisations are integrating intelligent systems into their operations. Beyond traditional automation, the growth of Artificial Intelligence (AI), Generative AI, and Agentic AI has changed how we think about productivity, decision support, and innovation. These technologies are not just improving existing roles; they are also creating new positions that require knowledge of AI frameworks, ethical use, and flexible system integration. One participant supported this view in the following statement: *"We're seeing a massive shift toward Agentic AI - autonomous systems that actually make decisions and adapt on their own, not just follow scripts."*

4.3.1.5. Deep Technical Expertise in Emerging Domains

Despite the growing availability of technology, the demand for strong technical skills remains high. Skills in engineering, data science, and cybersecurity are seen as essential. Participants

highlighted the importance of data analysis, solid engineering knowledge, and security improvements. This is especially relevant as organisations prepare for the possibility that quantum computing will change how AI enhances human-driven processes and came through as a common theme by multiple participants, these can be noted from the following statements from participants which referred the need to a shift in skill requirements: "*End-end broad and deep skills*" and *" There is a clear shift from traditional coding skills to platform thinking, integration expertise, and data-driven decision-making."*

4.3.1.6. Vendor Reliance and SaaS Ecosystems

A notable trend is the increasing reliance on vendor-managed solutions, particularly Software-as-a-Service (SaaS) platforms. Participants noted that: *"Skills all along were more traditional tech focused such as ERP (SAP, Oracle….)… shifted to SaaS some years ago (Salesforce, Workday, etc.) and Cloud focus (PaaS… MAAG) now shifting to AI.* "This shift has increased the need for skills in vendor management, interoperability, and the strategic integration of third-party solutions. The ability to evaluate, configure, and improve SaaS offerings is now seen as an essential skill. These abilities rely on strong interpersonal skills needed to manage the complexities of these roles. This highlights the rising importance of understanding context and conceptual skills rather than just isolated technical knowledge.

4.3.1.7. Emergence of New Technology Paradigms

The findings also highlight the emergence of new paradigms, including blockchain, low-code/no-code platforms, and quantum-enhanced security. Participants noted the emergence of modern technologies impacting the workspace as can be seen in the following statement: "AI and Generative AI, Blockchain, Low-Code / No-Code platforms, security optimisation through

quantum computing, etc.“ These technologies are changing the limits of technical work. They lower barriers for non-specialists but also demand new rules, structures, and ethical standards. Being adaptable and willing to learn continuously are crucial traits for handling these changing environments.

4.3.1.8. The Value of Soft Skills

While technical skills dominate the discourse, soft skills were consistently identified as equally, if not more, critical. Multiple participants emphasised the need for skills and noted: *“But here's what's interesting: the soft skills matter more than ever because you're literally working alongside autonomous agents. You need analytical thinking (70% of companies demand it), but also resilience and creative problem-solving.* “Communication, collaboration, flexibility, and ethical reasoning are becoming more important in hybrid and cross-functional teams. As technology becomes more involved in decision-making and service delivery, the ability to lead change, encourage inclusive innovation, and handle complexity with human judgment has become more significant.

4.3.2. Theme 2: Future Skills Evolution

The results indicate that the AI revolution and quantum computing will greatly influence future workforce skills. Current skills must evolve or face redundancy. Adaptability, interdisciplinary thinking, and ethical awareness will be the key traits for those who succeed.

4.3.2.1 Technological Catalysts

Feedback from participants shows that Artificial Intelligence (AI) is already changing the workforce by automating routine tasks, improving decision-making, and enabling new forms of productivity. Generative AI, in particular, is entering creative and analytical fields that were once viewed as uniquely human. One participant noted: *"I think you know the AI revolution, as you know, I mean, there's a lot of people coming out and saying, you know, that they can use AI to do multiple different well, different kinds of things, you know, even 5-6 years ago, there was this low code, no code.";* with another participant noting that the use of these technologies are already here: *"AI is already changing how we work, and it's just getting started. Right now, it's helping automate tasks and improve decision-making, but the real shift will come as AI starts working alongside other technologies like smart machines that understand context, quantum computing, virtual and augmented reality, and faster, more connected devices".* At the same time, quantum computing, although still in its initial stages, is expected to accelerate computational power exponentially, enabling breakthroughs across various fields. This standard view was expressed across the participant with one stating that: *"They'll be able to solve for it very quickly, like in a minute with quantum computing, something that would take, like, you know, 15 years to happen right now."*

Together, these technologies are expected to change traditional job structures, reshape problem-solving methods, and require new kinds of computational skills.

4.3.2.2 Skill Adaptation vs. Reinvention

The interview results show that many participants think current technical skills might be replaced or changed. Traditional coding is being replaced by low-code and no-code platforms, as well as AI-assisted development tools. Likewise, data analysis is moving from manual interpretation to AI-driven analytics. This change requires professionals to focus more on oversight, validation, and business benefit.

There seems to be a general view among participants that technologies such as AI will soon become ubiquitous and permeate all aspects of life, disrupting and reshaping how we work. One such participant expressed: *"Agentic AI will become invisible infrastructure - like cloud computing today, nobody talks about "cloud skills" anymore because it's just embedded everywhere. "*

While many participants pointed out how Artificial Intelligence (AI) could disrupt the workforce, there is still significant doubt about how much AI will truly replace human labour. This view highlights that skills are evolving, not disappearing, as technology progresses. However, opinions differ on whether current skills will change or be eliminated. Some participants mentioned that it is still too early to believe that AI will take over jobs. As one participant noted: *"They're going to be replaced by AI, I think the jury's still out. It almost seems as if it's too early to make a call on that front. I don't know. Maybe, you know, I guess we'll learn in the next few years as this kind of acceleration continues whether that holds true or not"*.

This statement shows a careful approach. It suggests that while AI might improve or change some tasks, completely replacing human jobs is still uncertain. Overall, the workforce will need to shift from focused technical skills to thinking in systems, integrating different functions, and using smart technologies.

4.3.2.3 Traits of Successful Adapters

Across the data, a consistent theme emerged. Personality traits, rather than fixed skills, will determine long-term adaptability in the future workforce. While technical skills may change or be replaced with advancing technologies, lasting personal attributes were often noted as the basis for resilience and success. Participants pointed out several key traits:

Cognitive agility refers to the ability to learn, unlearn, and relearn as technologies and contexts change. Instead of depending on fixed knowledge, people with cognitive agility can quickly absorb new information, let go of outdated practices, and adjust to new systems. This trait is especially important in settings influenced by fast technological changes, like AI-driven automation and quantum computing**.** As cited by one participant, *"The brain is a barrier to execution, and we need street fighters, people who can adapt quickly",* The participant emphasized that cognitive rigidity is a big barrier to execution. It limits the brain's ability to respond to new information or changing situations. There is a need for individuals who can show high cognitive agility, the metaphorical "street fighters," to adapt quickly and effectively in dynamic and unpredictable environments.

Beyond technical skills, the findings highlighted the rising importance of analytical thinking and creative problem-solving as key human abilities in a technology-driven workforce. As routine tasks become more automated, the human role is changing. It is moving towards

diagnosing complex challenges, framing innovative solutions, and making decisions in unclear situations. Effective problem solvers stand out because they can connect different viewpoints, merge unrelated ideas, and use both human insight and machine intelligence to produce results that are not only efficient but also creative and relevant to the context.

Participants highlighted that for technologists in particular, problem-solving ability is becoming a critical differentiator. One participant explained: *"For technologists the ability to problem solve becomes more and more important as this ability also allows one to be more agile when dealing with change and to evolve rapidly…. These skills are super rare and being able to join the dots between needs and tech solutions becomes more in demand than tech skills."* This observation underscores the shift from purely technical expertise toward the capacity to translate organizational needs into technological solutions, a skillset increasingly valued in dynamic environments.

Another participant captured the urgency of this trait, noting: *"Those with the ability to solve will be the ones to survive the culling."* This sentiment reflects a broader recognition that adaptability and problem-solving are not optional but essential for workforce resilience. In contexts where technology accelerates change and disrupts established practices, individuals who can navigate complexity, anticipate challenges, and craft solutions will remain indispensable.

Finally, the focus on problem-solving was not just about agility and survival; it also included the quality and direction of solutions. One participant noted, "Think deep to solve problems in out-of-the-box ways, focus on personalization, sustained value." This shows that the future of

problem-solving involves not just speed and flexibility but also depth, creativity, and the ability to provide solutions that are tailored, meaningful, and lasting.

The findings show that change agility is vital for workforce resilience in fast-changing technology and organisational settings. Change agility means the ability to stay flexible and open during uncertain times. It helps individuals handle shifting priorities, modern technologies, and variable market conditions. People who show strong change agility do not get thrown off by disruption; instead, they see it as a chance to grow, change, and keep learning. Participants stressed the need to actively welcome change as a way to grow. One participant said, "I think it's important for people to change roles every year once a year because if you don't do that, you become very, I don't know, stagnant, especially with your technologies." This view highlights how intentionally taking on new roles and responsibilities can prevent stagnation and encourage adaptability in fast-paced environments.

The data also showed the risks linked to low change agility. Several participants pointed out that people who cannot adapt often fall behind. One participant mentioned, "*I think some can't adapt. Yes, definitely. They can't keep up with the changing trends*." Another noted the ongoing resistance, saying, "*People are resistant to change. They just want to keep doing their own thing, even in the new world*." Likewise, the "*inability to let go of control and adapt to new methods*" was seen as a barrier to effective transformation. Overall, these findings indicate that change agility is not just a nice-to-have quality but a key factor in determining if individuals can succeed in times of disruption. Those who view change as a chance for growth can quickly evolve with technological and organisational shifts. In contrast, those who resist or stay the same risk becoming outdated in the future job market.

The findings consistently highlighted collaborative intelligence as being a critical skill for future workforce effectiveness. Participants noted that professionals must work well with both human and machine teams across different fields to be successful. Collaborative intelligence extends beyond traditional interpersonal skills, encompassing the ability to work effectively with AI systems, integrate diverse expertise, and foster inclusive teamwork in hybrid settings.

Participants emphasised the value of soft skills as the real differentiators in this area. As one participant noted**,** *"But soft skills are the real differentiators, communication, emotional intelligence, and the ability to collaborate across diverse teams."*

This perspective highlights the fact that being technically skilled is no longer sufficient. Instead, you need to be able to communicate well, show empathy, and build trust in different situations. These skills are crucial for maintaining collaboration in complex organisational environments.

The data also revealed challenges to collaboration, that particularly existed in the context of siloed working practices. One participant observed: *"Collaboration (requires a degree of empathy) across areas. People tend to work in silos with own needs/wants at forefront. Given the pace of change in the world, greater collaboration is needed."* This points out the conflict between personal or departmental goals and the shared need for unified problem-solving. It demonstrates that empathy and a shared purpose are crucial for addressing fragmentation.

Importantly, collaboration was not seen only as a human-to-human interaction. Participants stressed the need to develop *"deep understanding of how people and machines can work together."*

The feedback from participants demonstrates that more people recognise the importance of collaborating with intelligent systems in shaping future organisational dynamics. Professionals must develop the skill to interpret machine outputs, connect them with human judgment, and collaborate to create solutions that leverage the strengths of both humans and technology.

These findings demonstrate that collaborative intelligence is a multifaceted concept encompassing interpersonal communication, emotional intelligence, empathy, and technological skills. It involves not just working well with others but also coordinating teamwork between humans and machines, across different fields and organisational limits. In times of fast technological change, collaborative intelligence becomes essential for adaptability and innovation.

The findings consistently identified that a learning mindset and curiosity are key traits of adaptability in the future workforce. A lasting willingness to explore, experiment, and continually gain new knowledge was seen as essential for staying relevant in areas where specific technical skills change quickly or become outdated. Curiosity was described as the force that drives individuals to connect with modern technologies, challenge assumptions, and stay proactive in their professional development.

Participants emphasised that individuals with intellectual curiosity naturally gravitate towards enabling continuous improvement in their roles. One participant explained: *"Finding those people will always naturally kind of gravitate to doing these things because there's something intellectually, you know, there's intellectual curiosity. I think that constantly needs satisfying. And this is what they do all the time. They're always wanting to get better."* This observation shows how curiosity drives intrinsic motivation which is sometimes connected to a desire to

overcome perceived limitations, such as imposter syndrome. This internal drive then leads to continuous growth driven by curiosity.

The data also suggested that curiosity is not just a survival tool, but it is a way to thrive in changing environments. As one participant said: "*It's the curious who, who I think really, really kind of, you know, survive or not survive, maybe thrive".* Those who succeed were described as curious individuals who did not limit themselves to organisational boundaries and instead these types of individuals looked for ways to go beyond established norms. The findings highlighted how organisational culture can either support or hinder curiosity. One participant reflected: *"The ground needs to be fertile, I think, for it to happen. I believe you've got to be in a culture that supports or allows this. I think if the culture doesn't, you know, culture, I guess, can be freeing or it can be like smothering."* This suggests that curiosity and a love for learning flourish in environments that encourage experimentation, taking risks, and asking questions. However, these traits may be suppressed in strict or hierarchical cultures and therefore needs to be allowed to grow in an encouraging environment.

Participants also linked curiosity to the emergence of "game changers" within organisations. As one participant observed: *"You know you'll see game changers there. Underneath them you'll always find the people that have a learning mindset and then there's a bit of competition as well in the ranks."* This suggests that individuals with curiosity not only drive their own growth but also influence broader organisational innovation and competitiveness.

Finally, the findings emphasised that curiosity must be coupled with the ability to unlearn and relearn. One participant explained: *"The ones who thrive are open-minded, curious, resilient, and willing to unlearn. They don't wait for change to happen, but they lean into it. They ask*

questions, seek feedback, and continuously invest in their own growth. Those who struggle often resist change, are not willing to unlearn and rely too heavily on past successes and hesitate to step outside their comfort zones." This distinction shows that being adaptable requires curiosity, humility, and the ability to let go of old practices while embracing new ones.

These findings highlight the importance of a learning mindset and curiosity as essential for workforce adaptability. They support the idea of learning agility, which means continuously learning from new experiences and applying that learning in a changing environment. This includes being open to change and having mental flexibility. These traits help individuals succeed in uncertain situations, encourage innovation, and promote organisational transformation, as long as the surrounding culture supports their growth.

The findings on Future Skills Evolution indicate that workforce readiness extends beyond technical upskilling. While being skilled in modern technologies like AI, quantum computing, and blockchain will be essential, the results emphasise that the real keys to success in the future are continuous adaptability and teamwork across different fields.

"The ones who thrive are open-minded, curious, resilient, and willing to unlearn. They don't wait for change to happen, but they lean into it. They ask questions, seek feedback, and continuously invest in their own growth. Those who struggle often resist change, are not willing to unlearn and rely too heavily on past successes and hesitate to step outside their comfort zones."

Individuals who show flexibility and excel in changing environments are often open-minded, curious, resilient, and willing to unlearn old habits. Instead of waiting for change to happen, they actively tackle new challenges, seek helpful feedback, and consistently work on their

personal and professional growth. On the other hand, people who struggle in these situations often resist change, rely too much on past successes, and hesitate to go beyond what they know. These qualities enable professionals not only to survive but to thrive in environments characterised by constant disruption and increasing reliance on autonomous systems.

What emerges is a profound confirmation that technical expertise alone is insufficient in a workforce transformed by intelligent technologies. As one participant observed:

"But here's what's interesting, the soft skills matter more than ever because you're literally working alongside autonomous agents. You need analytical thinking (70% of companies demand it), but also resilience and creative problem-solving. The sweet spot is people who can bridge technical agentic expertise with human leadership skills. "

This view highlights the increasing importance of hybrid skills that integrate human judgment, creativity, and leadership with machine-driven efficiency and precision. The development of future skills is not just about replacing old competencies with new ones. It is about fostering a dynamic interaction between human and technological strengths. Workers who demonstrate cognitive agility, change adaptability, and problem-solving skills, along with a curious learning mindset, will be ready to guide organisations through uncertainty. Those who can blend technical knowledge with teamwork will lead sustainable innovation. As we approach a technological singularity, the findings show that the workforce of tomorrow should be defined less by fixed expertise and more by the ability to adapt, connect, and lead alongside intelligent systems.

4.3.3. Theme 3: Workforce Planning Challenges

The findings on workforce planning challenges show that while significant barriers make it hard to adjust to the changing technological workplace, organisations and individuals can use future-proofing strategies. These strategies include ongoing reskilling, cultural change, and proactive collaboration between humans and machines. They help build resilience and achieve long-term success.

4.3.3.1 Barriers to Adaptation

The findings show that barriers to change in the tech workplace are not just technical. They are intricately linked to mindset, culture, and the ability to unlearn and relearn. Participants highlighted that while technical skills are important, adaptability, resilience, and teamwork based on shared values play a crucial role in who succeeds and who faces challenges. They consistently pointed out a growing gap between the skills employers need and those available in the workforce. The rapid pace of technological innovation, especially in areas like artificial intelligence (AI), cloud computing, and quantum security, has created new skill requirements that many workers have not yet developed. This gap is evident across industries, where companies struggle to hire individuals with the necessary knowledge in emerging technologies.

While companies often prioritise technical skills in workforce planning, many participants warn that these skills alone are not enough for long-term success. Participants noted that being technically skilled does not mean a worker is ready or effective. Employees who focus solely on technical expertise may lack the broader skills necessary to succeed in complex,

interdisciplinary settings. This focus risks creating a workforce that is technically capable but unable to meet the relational, ethical, and collaborative demands of today's organisations.

The data showed that soft skills are essential alongside technical expertise. Skills like communication, collaboration, emotional intelligence, and adaptability were often noted as key for connecting technological solutions to organisational needs. Participants pointed out that being able to turn technical knowledge into practical strategies, promote teamwork, and make decisions in uncertain situations is what really leads to success. Without these skills, even highly skilled technical professionals may struggle to adapt to changing workplace structures.

Participants consistently emphasised that mindset is as important as technical skills when it comes to workforce adaptability. While being skilled in areas like AI, cloud computing, and platform engineering is necessary, it does not ensure success in rapidly changing environments. As one participant explained: *"Yes, and often, it is not just about skills, it's about mindset. I've seen employees who are technically capable but struggle to adapt because they're uncomfortable with uncertainty or fast-paced change. In the platform space, things evolve daily, whether it's the quality of APIs, new use cases for orchestration, or how to monetise them. For some, keeping up with this constant flow of information can feel overwhelming and when they can't turn that information into action or opportunity, it becomes a barrier rather than a benefit."*

This perspective highlights that being adaptable needs both technical skills and the mental flexibility to handle uncertainty. It is important to turn quick changes into opportunities.

The findings indicate that to address skills gaps, it's important to focus on both technical and soft skills development. Workers need to acquire knowledge in advanced technologies, such as

AI integration, data analytics, and cybersecurity, which can withstand the challenges of quantum computing. They also need to develop qualities such as resilience, curiosity, and teamwork to adapt to changing environments. Participants pointed out that organisations that only invest in technical training may neglect the human side of adaptation, which limits their ability to take advantage of technological progress fully. The data showed a clear difference between those who succeed and those who struggle in changing workplaces. One participant noted: *"The ones who thrive are open-minded, curious, resilient, and willing to unlearn. They don't wait for change to happen, but they lean into it. They ask questions, seek feedback, and continuously invest in their own growth. Those who struggle often resist change, are not willing to unlearn and rely too heavily on past successes and hesitate to step outside their comfort zones."*

This shows that being adaptable is not passive; it requires active involvement, curiosity, and the willingness to abandon outdated practices. On the other hand, relying on past successes or sticking to familiar routines can leave individuals vulnerable to becoming irrelevant. Additionally, beyond personal attitudes, fitting in with the culture is essential for the workforce to adapt. Participants mentioned that being technically skilled is not enough if it does not match the organisation's values and teamwork principles. As one participant explained: "*Great tech skills are absolutely key, but cultural alignment with our core values matters more. I've seen brilliant engineers who couldn't mesh with our collaborative culture crash and burn, while solid performers who shared our values of innovation and integrity became our strongest contributors."*

This finding shows that adaptability is not just an individual trait; it is also a relational one. It is shaped by the ability to fit into cultures that emphasise collaboration, innovation, and a shared

goal. These outcomes show that barriers to change are complicated. Skills gaps in modern technologies are still a challenge, but the bigger issues lie in mindset, resilience, and cultural compatibility. Workers who are open-minded, curious, and ready to unlearn are more likely to succeed. Those who resist change or don't connect with company values may face stagnation or exclusion. To be ready for the tech era, the workforce needs a two-part approach: improving technical skills and encouraging flexible mindsets within supportive cultures. In this era of technological change, workforce readiness will rely on strategies that combine technical training with the development of people-focused skills.

4.3.3.2. Future-Proofing Strategies

The findings suggest that future-proofing strategies for workforce readiness in the face of technological change go beyond technical upskilling. Participants highlighted emotional intelligence, curiosity, adaptability, and human-centred collaboration as essential factors for success in a rapidly evolving workplace.

One participant explained: *"Don't get caught up in chasing every tech trend and to steal a line from Bob Dylan 'The times they are a-Changin', and they always will be. Focus on emotional intelligence, networking, and building your personal brand as an attractive commodity that organisations want. Develop the ability to pivot between roles and industries by cultivating relationships and understanding what makes you uniquely valuable. Your EQ will outlast any programming language, and your network will open doors that technical skills alone never could."* This participant's perspective aligns with the sentiments expressed by most other participants, suggesting that strategies for preparing the workforce for technological change extend beyond technical skills.

Participants noted that emotional intelligence, curiosity, adaptability, and teamwork are crucial factors for success in a rapidly changing workplace. In a time of rapid technological change, it is important not to get caught up in chasing every new trend. Instead of focusing only on technical skills, people should prioritise developing emotional intelligence, building strategic networks, and creating a personal brand that meets organisational needs. The ability to shift between roles and industries relies on forming meaningful relationships and clearly expressing one's unique value. In this situation, emotional intelligence will likely be a more lasting asset than any specific programming language. Strong professional networks often open doors that technical skills alone may not.

The findings indicated that a growth mindset and curiosity are essential to survive in the future workplace. Participants emphasised the importance of "*adopting a growth mindset, keep growing*" and to "*stay curious. Make learning a habit, not a reaction."* Developing a portfolio of transferable skills like problem-solving, communication, networking, and digital literacy was seen as a way to stay relevant in the long run. One participant remarked: "*The future belongs to those who can learn, adapt, and collaborate."* This suggests that continuous learning and openness to change are more important than mastering any single technical area. Participants emphasised the importance of maintaining a human element in technology settings. As one participant explained: "*Be more human because behind every tech there will have to be a human*." This view confirms that technology cannot replace empathy, judgment, and teamwork. To prepare for the future, workers must incorporate human values into technological frameworks. This way, innovation stays connected to ethical and social issues. Another recurring theme was the emphasis on deep, creative problem-solving. One participant advised: "*Think deep to solve problems in out-of-the-box ways, focus on personalisation, sustained*

value." This was a common view among participants, indicating that futureproofing involves more than just being adaptable. It also requires the ability to create solutions that are innovative, tailored for long term. Workers who can blend technical skills with creativity and awareness of their surroundings will be those that are more likely to succeed in the future.

Participants also noted that self-reflection and playful exploration are essential for remaining adaptable. One participant reflected: "*To shift these requires introspection and knowing one's areas to focus on. It requires time invested to learn and grow. I do think it also means finding one's inner child – find the joy in playing with things and learning (Lego? Learn what an LLM is about? Set up a new PC? Look at a company's financials and understand this? Etc. etc…) playing allows you to pick up new skills."* This view suggests that curiosity and experimentation, often perceived as playful activities, actually contribute to building resilience and accelerating skill development in dynamic environments.

Overall, the findings show that strategies for futureproofing involve many aspects, such as emotional intelligence, a growth mindset, curiosity, collaboration focused on people, creative problem-solving, and playful learning. While technical skills remain important, participants pointed out that long-term success in a tech-driven workplace will depend on developing adaptive qualities and relationship skills. Therefore, the future workforce should be defined more by the ability to learn continuously, build meaningful connections, and create lasting value along with technology as opposed to static qualifications.

4.3.4. Theme 4: Recruitment and Employment Impacts

The findings show a clear shift in hiring criteria from traditional qualifications and technical credentials towards competencies such as problem-solving, adaptability, and human-centred

skills. Employers increasingly value capabilities, mindset, and lived experience over formal degrees, reflecting the need for a workforce that can thrive in dynamic, technology-driven environments.

4.3.4.1: Evolving Hiring Criteria

Participants consistently highlighted that hiring practices have evolved in recent years, with less emphasis on formal qualifications and greater focus on competencies. One participant explained: "*You know, so it has changed over the past few years because here you're looking for someone you know who doesn't just have an engineering mindset, you know, they really need to have soft skills like problem solving, curiosity and the ability to think out of the box.*" This reflects an understanding that technical expertise alone is insufficient in workplaces shaped by rapid technological change.

The findings emphasised the increasing significance of skills that define our humanity, such as communication, empathy, and creativity. As one participant concisely remarked: *"Focus on skills that make us human."* These abilities were described as vital for bridging the divide between technological systems and organisational requirements, ensuring that workers can collaborate effectively and apply judgment in complex situations.

Several participants observed a shift towards valuing experience and practical skills over academic qualifications. One participant highlighted: "*Experience as opposed to qualifications*." This view suggests that employers are increasingly focusing on demonstrated ability to apply knowledge in real-world situations rather than solely relying on formal degrees as indicators of competence.

Adaptability and cognitive agility emerged as key themes. Participants emphasised that "*Cognitive skills and adaptability are crucial*" for navigating uncertainty and changing technologies. Workers who can learn, unlearn, and relearn are considered better prepared to stay relevant in dynamic environments.

The findings highlighted a broader shift towards capability-based hiring. One participant said, "*We should be hiring for capabilities, not just credentials"*. This common view among the participants indicates a move away from fixed measures of achievement to active assessments of potential, resilience, and problem-solving skills.

Participants consistently emphasised that "*attitude and aptitude are everything*". Employers are increasingly seeking individuals who demonstrate curiosity, adaptability, and a willingness to develop, rather than those who rely solely on past achievements. This shift suggests that most employers believe mindset and learning orientation are essential for long-term success.

A sizeable portion of the participants indicate that evolving hiring criteria are required to create a future-ready workforce. One participant summarised: "*Ultimately, the goal is to build a workforce that's not just ready for today, but prepared to adapt, evolve, and thrive in tomorrow's world of work."* This emphasises that hiring is not just about filling current roles but also about fostering resilience and adaptability for long-term organisational sustainability.

Overall, the findings show a clear shift from emphasising qualifications to focusing on competencies in hiring. Employers now look beyond traditional success indicators, such as degrees and technical skills, to assess problem-solving skills, adaptability, emotional intelligence, and cultural fit. This change aligns to the needs of modern workplaces where rapid

technological changes require the ability to learn, collaborate, and innovate- skills that are more important than fixed expertise.

4.3.4.2: Recruitment and Employment Impacts

A consistent view across most participants indicates that there is a clear requirement to change the current recruitment practices. Employers are moving away from traditional qualifications and technical credentials. Instead, they are focusing on skills like problem-solving, adaptability, and people skills. Employers now value abilities, mindset, and real-world experience more than formal degrees. This shift reflects the need for a workforce that can thrive in rapidly changing, technology-driven environments.

Participants emphasised that effective recruitment processes are essential for preparing the workforce for the future. They ensure organisations attract talent that can excel in rapidly changing technological settings. One participant said, *"I think you need to focus on the recruitment process. It needs significant improvement, and from there, that's the way to stop the bucket from leaking."* This demonstrates that recruitment is not just about filling immediate positions; it also fosters long-term resilience by selecting candidates with adaptability, problem-solving skills, and growth potential.

Several participants pointed out the use of technical testing platforms to assess candidates' skills. For instance, one person explained, "*The test I give my developers when hiring is called HackerRank. It tests not only technical skills but also the ability to solve problems*." Similarly, scenario-based assessments were mentioned as strong methods. One participant recalled, "*AWS uses a strong process… you are given scenario-based questions… I was interviewed for six*

hours straight." These methods show the focus on evaluating not only technical ability but also cognitive flexibility and problem-solving under pressure.

Beyond technical assessments, participants reported using cognitive and personality profiling tools to evaluate adaptability and cultural fit. One participant confirmed this view in the following statement: "*An interview? Maybe there are a couple of interviews. Then we do the CNT because we consider problem solving and cognitive ability*," and another participant indicated: "*We're using Integrative Enneagram as a tool for personality profiling and then we also use IKM's for some of the deep technical roles.*"

Other tools mentioned included STAR interviews, CNT psychometrics, and AI-powered screening systems. These methods were seen as valuable for identifying thinking styles, resilience, and interpersonal skills. These traits are increasingly recognised as necessary for ensuring long-term success. Participants also recognised the growing role of AI screening tools in improving efficiency and finding talented individuals. However, they also pointed out the unique value of human judgment. One participant said, "*AI screening tools have helped us find talented candidates more efficiently. Referrals from trusted sources are still one of my most reliable methods. That said, nothing compares to a well-structured interview. In those conversations, you really see how a candidate thinks, solves problems, manages uncertainty, and works with others*." This highlights the need for a balance between automation and human insight in the recruitment process.

Despite the widespread use of cognitive and psychometric tests, some participants questioned their effectiveness and fairness. One participant shared, "*I don't think they're valuable. I've seen many cases, especially with young Black African developers. You can see their skills and*

how well they perform, but the tests don't reflect that. There's some bias." This view highlights the risk of exclusion and unfairness when standardised tools do not recognise diverse types of talent and ability.

In summary, the findings suggest that making recruitment more resilient requires a varied approach. Technical assessments, scenario-based interviews, and cognitive profiling are valuable tools. However, they should be paired with human judgment, cultural fit, and inclusive practices. While tools like AI screening and psychometrics can improve efficiency, organisations must remain mindful of bias. They need to ensure that recruitment processes identify not only technical skills but also adaptability, emotional intelligence, and teamwork potential.

4.4 Summary and Conclusion

This chapter presents the study's findings on how the workforce changes in response to modern technologies and ongoing industrial revolutions. By examining historical patterns and current shifts, it becomes clear how technology continually reshapes job structures, skill requirements, and the broader environment.

A thematic review of the data from the literature review and semi-structured interviews has indicated consistent support, with findings from the literature review and expert interviews showing clear similarities across the four sets of themes. This highlights how technological change, workforce adaptation, and organisational strategy are connected.

In the first theme, which focuses on the rapid progress toward technological singularity and current technology trends, we observe the swift pace of technological advancement, particularly

in AI, automation, and quantum computing. The review points out disruption as a key aspect. Existing roles are being replaced by new ones, and the common idea is that transformation is unavoidable. Organisations and individuals must expect ongoing changes, rather than viewing them as separate events.

The second theme, which discusses Historical Patterns of Industrial Revolutions and Future Skills Evolution, shows that historical cycles of disruption reflect today's challenges. This indicates that adapting and retraining are ongoing needs. Just as past revolutions required new technical and social skills, the future will need a mix of interdisciplinary, adaptable, and ethically informed skills. Both views emphasise that resilience comes not from fixed knowledge but from the ability to keep evolving.

The importance of having appropriate skills is highlighted in Theme 3, which discusses Skills Gap and Workforce Planning Challenges versus Workforce Preparedness. Both themes point out an ongoing mismatch between the skills that employers need and those available in the labour market. There is a consistent view that technical skill alone is insufficient; soft skills, such as collaboration, problem-solving, and emotional intelligence, are equally important. The shared understanding is that preparedness needs a two-pronged approach: improving technical skills while also fostering a mindset of adaptability, curiosity, and resilience.

Finally, theme 4 highlights the value of effective recruitment and selection processes. There is a clear shift from hiring based on credentials to hiring based on skills and potential. This theme shows the increasing importance of AI-driven tools, psychometrics, and scenario-based assessments, alongside human judgment and cultural fit. The similarity is in viewing

recruitment not just as a way to fill roles, but as a key strategy for building adaptable and future-ready workforces.

The merging of these themes suggests that technological disruption is now a constant force, rather than a rare occurrence. With the emergence of a technological Singularity fast approaching, organisations need to make adaptability a core part of their structures, cultures, and workforce strategies. Success will rely on combining technical skills with human-focused abilities, analytical thinking, creativity, emotional intelligence, and teamwork. Traditional workforce planning needs to evolve to become more flexible and proactive. It should look ahead to modern technologies and build resilience through ongoing learning. Hiring practices need to move from simple transactions to thoughtful investments in adaptability, diversity, and the innovation potential. Recruitment is key to shaping organisational culture and readiness.

In summary, the common threads in these themes convey a clear message that technological disruption and workforce transformation are closely linked, ongoing, and accelerating. The future of success will depend on organisations and individuals embracing adaptability, developing diverse skill sets, and redefining recruitment and workforce planning as forward-thinking, strategic activities. Chapter 5, which follows , will build on a conclusion that provides a recommended recruitment framework for organisations.

CHAPTER V:

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

5.1 Introduction

This study explored how technology and workforce planning have changed through different industrial revolutions. It looked at how rapid innovation and the potential for a technological singularity could reshape the workforce. The research aimed to identify the skills that help people adapt to these changes and to design recruitment frameworks that support the development of a skilled, future-ready workforce.

To do this, the study reviewed both past and current literature and industry practices to see how technology has shaped workforce structures. The research had four main goals: to look at how technological change has affected jobs and skills over time; to assess how workforce management practices have changed and how relevant they are now; to review current technology trends and their impact on workforce skills; and to create a recruitment framework that matches the skills needed for ongoing technological progress.

The central question of this investigation was: ***"How have industrial revolutions historically influenced job roles and skill requirements, and what implications do these shifts have for future workforce planning in upcoming industrial revolutions ? Additionally, how can a strategic framework be developed to support skills development and recruitment in alignment with technological evolution?".***

The research set out to understand how past industrial revolutions changed job roles and skills, and what these patterns mean for planning the future workforce. The findings offer practical

advice for organisations to regularly review and update their workforce skills and hiring practices. This helps them respond quickly to risks and opportunities from rapid technological change, including those related to artificial intelligence and the possible arrival of a technological singularity.

5.2 Summary of findings

The study's literature review and semi-structured interviews highlight four key, related findings:

(1) Rapid technological growth is causing widespread workforce disruption.

(2) Skill requirements are changing in predictable ways that reflect past industrial revolutions, while adding new demands.

(3) Ongoing skills gaps and flaws in workforce planning weaken organisational readiness; and

(4) Recruitment and selection practices are moving toward models based on cognitive skills and potential, as opposed to the current preference of experience and qualifications.

These themes support each other in that technological change reshapes skills, reveals planning gaps, and drives innovation in recruitment.

These key findings indicate that rapid technological change requires a re-evaluation of recruitment practices to ensure that workplaces are prepared for the future. The quick advancements driven by technologies such as AI, generative models, agentic systems, and platforms like cloud, SaaS, and quantum are already automating both routine and some complex tasks. This leads to job losses and the creation of new hybrid roles; however, historical patterns

from the first to the fourth industrial revolutions have shown a trend in which old roles decline while new roles that demand different technical, conceptual, and people skills become increasingly important. Those who can adapt swiftly are most likely to succeed in these times of change. Looking ahead, the focus will shift towards technical expertise, problem-solving abilities, and soft skills such as communication and teamwork. Education, training, and organisational planning are lagging behind technological advancements. This creates a gap between what employers require and the talent available. Lifelong learning and flexible, skills-based career paths have not yet become widespread enough to meet these evolving demands. Hiring practices are moving away from solely emphasising credentials and are increasingly considering adaptability, transferable skills, and job readiness. This involves using psychometric tests, gamified assessments, and AI tools, but standardised and scalable models are still not fully developed.

The data indicate that today's technological disruption is linked to past industrial revolutions, yet it also differs in many ways, requiring an evolved approach to workforce planning. Like earlier industrial revolutions, technological change replaces some jobs while creating new ones. However, the speed, scope, and independence of rapidly evolving technologies such as AI and agentic systems reduce the time available for adaptation, making quick reskilling and cognitive flexibility more crucial. This means organisations do not have the luxury of time to adapt; it is vital to recruit staff with the appropriate skills to enable future transformations.

Analysis of interview data indicates a shift from narrow technical skills to meta-skills, including the ability to learn, unlearn, and connect knowledge across domains. In previous revolutions, specific vocational skills were valued. Today and in the near future, success comes from problem framing, systems thinking, and collaborative intelligence, which involves working

alongside humans and machines. Adaptability is key. Organisations and individuals who develop learning agility, problem-solving skills, and collaborative intelligence will be better equipped to navigate rapid technological change. This changes how we think about workforce development. Training should focus on transferable reasoning and judgment as much as it does on proficiency with technology.

The widening gap between current education and training and industry needs requires a revised approach, from early education methods to recruitment strategies. Education and training systems must emphasise meta-skills and lifelong learning. Courses and corporate training should incorporate interdisciplinary problem-solving, ethical reasoning, and teamwork between humans and machines. Failure to adapt quickly to these evolving demands risks short-term talent shortages that could hinder innovation. Interviews reveal that many organisations respond to immediate technical requirements rather than investing in developing long-term skills. Recruitment is increasingly viewed as a strategic tool rather than merely a transactional activity. Findings indicate that recruitment is shifting towards strengthening organisational resilience. Workforce planning should be proactive and adaptable. Traditional long-term planning is insufficient; companies need dynamic forecasting, flexible training pathways, and continuous skills assessments. Focusing on adaptability, curiosity, and collaborative intelligence during hiring promotes workplace agility. Recruitment practices should prioritise potential and compatibility for hybrid roles involving both humans and AI. Evidence-based assessments should evaluate adaptability and transferable skills alongside technical qualifications, while governance frameworks must ensure fairness and validity.

Technological advances are transforming the nature of work in ways that are consistent with history but operationally novel. Success depends less on maintaining specific technical skills

and more on developing the capacity for continuous adaptation at both organisational and individual levels. Practical responses require coordinated changes across recruitment, training, and planning. These points will form the basis for the study's recommendations and help shape the proposed recruitment framework as a strategic response to an uncertain and rapidly evolving technological landscape.

5.3 Implications

5.3.1 SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis

To better understand how a technological singularity and rapid innovation are changing the workforce, this study uses a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis as a strategic tool. This SWOT analysis presents a clear summary of the findings from Chapter 4. It uses literature and expert interviews to examine the changing dynamics of the workforce in relation to technological singularity. The analysis serves as a framework to understand the internal strengths and weaknesses of current workforce systems. It also examines the external opportunities and threats arising from rapid technological progress. The focus is on workforce adaptability and the skills that will be crucial in the future.

Using this framework, the following can be summarised:

Strengths

One of the main strengths highlighted in the study is the fast pace of technological development, especially in artificial intelligence (AI), quantum computing, and automation. These technologies not only improve productivity and decision-making but also spark innovation across various sectors. Participants noted that these advancements are changing

traditional job roles and creating new forms of value, particularly through the use of intelligent systems in key business functions.

The rise of new technological approaches, such as low-code/no-code platforms, blockchain applications, and Software-as-a-Service (SaaS) ecosystems, was also mentioned as an important factor in workforce transformation. These tools make it easier for non-specialists to get involved, provide broader access to digital skills, and allow for quick implementation of solutions. This change supports a more inclusive and flexible workforce that can manage complex systems without requiring deep technical knowledge across every area.

Another strength is the growing prevalence of hybrid skill sets that combine technical, human, and conceptual abilities. The study found that successful workforce members blend data analytics and digital skills with emotional intelligence, strategic thinking, and ethical reasoning. This blending of skills reflects the changing demands of the Fourth Industrial Revolution and the expected singularity, where adaptability and interdisciplinary thinking are crucial.

Soft skills emerged as key differentiators amid technological change. Communication, collaboration, resilience, and ethical judgment were frequently mentioned by participants as vital for working in hybrid human-machine environments. These skills are especially important in situations where autonomous systems support, rather than replace, human decision-making.

Finally, the idea of collaborative intelligence, which refers to the ability to work well with both human and machine partners, was recognised as a foundational strength for future workforce readiness. Participants stressed the need to integrate diverse expertise, encourage inclusive teamwork, and develop skills to understand and use insights generated by machines. This ability

to work alongside intelligent systems is a significant advantage in an increasingly complicated and connected work world.

Weaknesses

While there are strengths, structural and systemic weaknesses limit the workforce's ability to adapt to technological change. The main challenge is the widening skills gap. Education and training systems are not keeping up with advances in artificial intelligence, automation, and digital platforms. The study highlights an ongoing mismatch between employer expectations and new graduate competencies. This highlights the need for more flexible and responsive learning systems.

A significant weakness is the increasing reliance on vendor-managed solutions, particularly in Software-as-a-Service (SaaS) and cloud platforms. Although these tools provide scalability and efficiency, they also introduce risks to interoperability, data management, and strategic independence. Participants noted that this dependence can limit internal innovation and pose challenges in workforce development, particularly in vendor management and integration skills.

The study also points out unequal adaptability across diverse workforce segments. Resistance to change, rigid thinking, and siloed work practices were often mentioned as obstacles to progress. These behaviours hinder collaboration, delay the adoption of modern technologies, and reduce overall organisational agility. Additionally, the lack of standardised, evidence-based methods for recruitment and workforce planning was seen as a significant drawback. Many organisations still use outdated hiring practices that overlook adaptability, soft skills, and future potential.

Finally, cultural barriers within organisations, especially hierarchical structures and a fear of taking risks, can stifle curiosity, experimentation, and ongoing learning. Such environments may hinder the essential traits, like learning agility and collaborative intelligence, needed to succeed in a fast-changing technological landscape.

Opportunities

The findings identify key opportunities to prepare the workforce for the future. Prioritising recruitment for essential skills and implementing large-scale reskilling and lifelong learning programs are critical. As AI and automation reshape job roles, structured initiatives that promote continuous skill development, interdisciplinary learning, and ethical awareness will help close the gap between current and future workforce needs.

New roles and industries, such as AI ethics, agentic system design, and quantum-enhanced cybersecurity, create additional opportunities to diversify the workforce and drive innovation. These fields require unique blends of technical, conceptual, and human skills, providing paths for inclusive growth and career changes.

Inclusive workforce planning also stands out as a significant opportunity. By combining technical, human, and conceptual skills into recruitment and development strategies, organisations can build more resilient, diverse teams. Participants stressed the need to move beyond traditional qualifications and instead focus on adaptability, problem-solving, and collaborative skills.

Innovative recruitment practices, like using gamified assessments, psychometric tools, and AI-driven selection systems, can help identify and develop talent more effectively. These tools

assist organisations in evaluating readiness for change, cognitive flexibility, and alignment with future skill requirements.

Organisations that invest in adaptability, ethical governance, and collaboration are better positioned to gain a competitive edge in the global economy. Developing a workforce that anticipates and responds to technological change will be essential in the coming decades..

Threats

The study identifies several urgent threats that could weaken workforce resilience and social cohesion. The biggest concern is the risk of widespread job loss due to automation and AI. Participants noted significant layoffs in technology sectors and the possibility that up to 50% of jobs in some industries could disappear within the next decade. Although new jobs may be created, the transition might not be smooth, leaving some people ill-equipped to survive the changes.

The pursuit of technological singularity, in which AI surpasses human intelligence, raises serious concerns. Participants echoed the warnings of leading technologists about misaligned AI, loss of human control, and reduced trust in decision-making systems. These concerns are intensified by the lack of robust governance and ethical safeguards.

Social inequality is another major threat. Without equitable access to training and flexible career paths, technological change may exacerbate existing inequalities, leaving some groups behind. This could lead to increased social unrest, reduced economic opportunities, and diminished trust in institutions.

Organisational fragmentation, resulting from isolated practices and conflicting goals, undermines innovation and adaptability. A lack of collaboration and shared objectives can impede the integration of intelligent systems and limit the success of transformation.

Finally, ethical and governance risks, such as bias in hiring algorithms and the misuse of AI, pose systemic threats that could disrupt workforce ecosystems. Without clear standards, inclusive oversight, and international cooperation, the positive impacts of technological advancement could be undermined by unforeseen consequences.

Table 2: Future Workforce SWOT Analysis

Strengths	**Weaknesses**
• Rapid technological acceleration (AI, quantum, automation) boosts productivity and innovation • New paradigms (low-code, blockchain, SaaS) democratize access to technology • Hybrid skillsets blending technical, human, and conceptual competencies • Enduring value of soft skills: communication, adaptability, ethical reasoning • Collaborative intelligence with humans and intelligent systems	• Persistent skills gap between education and employer needs • Heavy reliance on vendor-managed platforms reduces autonomy • Resistance to change and siloed organisational practices hinder adaptability • Lack of standardised recruitment and workforce planning models • Cultural barriers suppress curiosity and continuous learning
Opportunities	**Threats**
• Large-scale reskilling and lifelong learning initiatives • Emergence of new roles (AI ethics, agentic systems, quantum security) • Inclusive workforce planning integrating technical, human, and conceptual skills • Innovative recruitment methods (gamified, psychometric, AI-driven tools) • Strategic advantage for nations/organisations investing in adaptability and equity	• Job displacement from automation and AI • Risks of technological singularity and loss of human oversight • Widening social inequality without equitable reskilling access • Organisational fragmentation undermines collaboration and innovation • Ethical and governance risks (bias, misuse of AI, weak regulation)

The matrix represented in Table.2 summarises the outcomes of the SWOT analysis, derived from literature and expert interviews, to outline the strategic landscape of workforce transformation. It shows how strengths such as hybrid skillsets and collaborative intelligence connect with opportunities like reskilling and innovative recruitment. At the same time, it

reveals systemic weaknesses, including skills gaps and vendor dependence, as well as threats such as job displacement and governance risks. The matrix provides a strategic framework for workforce planning amid rapid technological change.

Implications for Future Skills

The findings highlight a significant change in the skills needed for future workforce success. While technical skills in AI, data science, and cybersecurity are still necessary, they must be paired with human-centred and conceptual abilities. Skills like cognitive flexibility, problem-solving, teamwork, and a willingness to learn are becoming essential for managing uncertainty and fostering innovation. The capacity to mix human judgment with machine intelligence, communicate across fields, and adjust to changing situations will be key to workforce strength in the era of technological advancement. Therefore, organisations need to focus on developing these traits through specific training programs, inclusive hiring practices, and supportive workplace cultures.

This SWOT analysis serves as a basis for the recommendations. It emphasises the urgent need for systemic changes in workforce planning, education, and governance to ensure that we adapt to technological change inclusively and sustainably.

5.3.2 TOWS Analysis

This section builds on the SWOT analysis by applying the TOWS matrix to establish clear strategic priorities. It aligns internal strengths and weaknesses with external opportunities and threats to identify workforce strategies in the context of technological singularity. The TOWS matrix is a planning tool that helps organisations transform the results of a standard SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) into actionable strategies. Unlike SWOT, which primarily assesses the situation, a TOWS analysis emphasises the development of specific action plans by systematically pairing internal and external factors. The TOWS matrix provides a way to link diagnostic insights with practical planning (Karadzhov, 2025). By matching internal strengths with external challenges, this framework helps generate focused, data-driven recommendations to enhance workforce resilience, inclusivity, and adaptability in response to technological change.

SO Strategies (Using Strengths to Capitalise on Opportunities)

- Use hybrid skill sets and teamwork to create interdisciplinary reskilling programs. These programs prepare workers for new roles in AI ethics, agentic systems, and quantum-enhanced security.
- Take advantage of technological advances and new models, like low-code platforms and SaaS ecosystems. This will help scale inclusive, accessible learning platforms that support lifelong learning.
- Encourage soft skills resilience with AI-supported recruitment tools that evaluate adaptability, ethical reasoning, and communication.

WO Strategies (Overcoming Weaknesses by Exploiting Opportunities)

- Bridge the skills gap by linking reskilling initiatives with emerging industry roles. Incorporate these efforts into corporate education and workforce policies.
- Reduce vendor dependence by investing in internal capabilities for platform integration and assessing technology strategically.
- Improve recruitment methods by employing gamified and AI-driven tools that emphasise potential and adaptability, rather than just traditional qualifications.
- Promote curiosity and learning by encouraging ongoing learning incentives and leadership support within organisational structures.

ST Strategies (Using Strengths to Mitigate Threats)

- Implement collaborative intelligence and hybrid skills to safeguard against job loss. This involves fostering human-machine collaboration and adjusting roles accordingly.
- Leverage technological progress to establish ethical AI governance frameworks. These should include human oversight and minimise the risks associated with singularity.
- Emphasise soft skills and conceptual thinking to counteract organisational fragmentation. This will enhance cooperation across various functions.

WT Strategies (Minimising Weaknesses and Avoiding Threats)

- Redesign workforce planning models to anticipate displacement risks and identify reskilling needs.
- Reduce cultural resistance by providing change agility training and leadership development programs.

- Strengthen legal and ethical understanding throughout the workforce to address governance risks and support responsible AI use.
- Mitigate inequality by ensuring fair access to flexible learning pathways, especially for underrepresented groups.

The results of the TOWS matrix highlight a practical combination of internal strengths and weaknesses with external opportunities and threats to guide workforce change in the age of technological advancement. Key to these results is the focus on recruiting and developing a workforce with adaptable, future-fit skills. This means addressing the skills gap by connecting reskilling efforts with changing industry needs. It also involves changing recruitment practices to emphasise adaptability and potential instead of traditional credentials. Organisations should build cultures that promote curiosity and ongoing learning, and provide training to handle change, to minimise cultural resistance.

Furthermore, improving legal and ethical knowledge supports responsible use of AI. Overall, the TOWS matrix recommends an active, evidence-based method that balances technological progress with human abilities to ensure workforce resilience, inclusivity, and adaptability in a fast-changing environment.

5.4 Workforce of the future: Agility as a Foundational Trait for Future Workforce Readiness

As technological acceleration approaches singularity thresholds, the future workforce must be equipped not only with static skills but also with dynamic traits that enable ongoing adaptation, ethical decision-making, and collaborative innovation. Chapter 4 of this study identifies a common theme of agility acting as a foundation trait across all findings. With agility as a core

capability, the ability to respond rapidly to change is key to individual success during disruption. Almost all participants noted that those who could not adapt quickly were increasingly left behind, while those who saw change as a chance for growth stayed ready for the future. This position paper argues that agility, understood through three connected dimensions of Cognitive Agility, Resilience Agility, and Collaborative Agility, forms the foundation of sustainable employability in the age of technological singularity.

The mapping of future-fit skills into the trait-based workforce-readiness model shows that employability in today's technological landscape must be understood as a dynamic mix of agility traits rather than a fixed set of skills. By focusing on Cognitive Agility, Resilience Agility, and Collaborative Agility, the model provides a comprehensive framework that highlights the adaptive, psychological, and relational abilities required to succeed in unpredictable environments. Cognitive Agility stresses systems thinking, analytical problem-solving, and human-AI collaboration. It reflects the need for people to blend interdisciplinary knowledge and tackle complex problems (Alviani et al., 2024). Resilience Agility points to adaptability, stress management, and learning skills, emphasising the need to maintain performance and growth during volatile times (Rosa et al., 2023). Collaborative Agility highlights emotional intelligence, ethical reasoning, and cross-cultural communication, which are increasingly important for building inclusive and effective teams in hybrid and global workplaces (Muduli, 2013).

Cognitive agility is the ability to learn, unlearn, and relearn as knowledge systems change, technology advances, and problems become more complex. It includes mental flexibility, awareness of one's own thinking, and the ability to switch between diverse ways of thinking. Data showed that participants who demonstrated cognitive agility actively sought new roles,

redefined challenges, and engaged in curiosity-driven learning (Ones et al., 2012). This helped them stay relevant in environments where expertise needs constant updates. Cognitive agility is closely linked to learning agility. This raises the question, “Can you learn?”, which refers to the ability to think flexibly, process complex information, and develop solutions. In contrast, learning agility describes the motivation and capacity to learn from experience, adapt, and apply new knowledge, particularly in unfamiliar situations. Together, these skills create a vital foundation for the future workforce, allowing people to acquire, apply, and adapt knowledge in changing contexts (Bertua et al., 2005; Deary, 2013). This dual capacity is also evident in skills such as adaptability and learning agility. These skills help individuals move between roles, technologies, and areas of expertise. They also involve creative problem-solving and innovation, which foster both divergent and convergent thinking while seeking innovative solutions. Lastly, ethical and critical reasoning improve reflective judgment and aid in navigating uncertainty and complexity (Alviani et al., 2024; Bertua et al., 2005; Ones et al., 2012).

Resilience agility is the ability to remain psychologically stable, ethically clear, and emotionally regulated in the face of uncertainty, stress, and disruption. It goes beyond just enduring challenges as it includes making principled decisions and handling ambiguity with integrity (Rosa et al., 2023). As shown in Chapter 4, individuals who resisted change or adhered to outdated practices often experienced a decline in effectiveness. In contrast, those who viewed uncertainty as a chance to grow demonstrated greater resilience. This skill is especially important in the context of new hybrid human and AI systems, such as those expected during the technological Singularity, where human qualities like emotional intelligence and ethical judgment become critical (Garcia Rodriguez, 2016). In unstable, uncertain, complex, and

ambiguous (VUCA) settings, resilience agility helps people respond calmly and with strong moral principles. This is supported by important skills like emotional intelligence, which fosters self-awareness, empathy, and relationship management, as well as ethical and critical thinking, which underpin decision-making with moral values and encourage ethical resilience (Muduli, 2013; Rosa et al., 2023). Together, these abilities empower individuals to act with integrity and flexibility in rapidly changing social and technical environments.

Collaborative agility refers to the capacity to work effectively across teams, disciplines, and with intelligent machines. This competency necessitates open communication, co-creation, and the integration of diverse perspectives into practical, context-appropriate solutions (Abbas et al., 2021; Muduli, 2013; Peersia et al., 2024). Insights from participants highlight the importance of teamwork across disciplines and the need to connect technical skills with leadership focused on people. As we move closer to a technological Singularity, the need for collaboration between humans and AI grows, highlighted by the rising use of AI agents in managing complex tasks at work. In these mixed social-technical environments, collaborative agility becomes essential (Zirar et al., 2023). It allows individuals to succeed in fast-changing, connected settings where innovation comes not from single experts but from the combined knowledge of various contributors (Bughin et al., 2018; Zahidi, 2023). This type of agility depends on key skills, such as working together across disciplines and integrating different knowledge systems and viewpoints. It also involves creative problem-solving and innovation, which promote shared ideas and co-creation in teams. Together, these abilities help individuals navigate and influence the rapidly changing landscape of work in an ever-more-connected and intelligent world. By connecting future-fit skills with these trait dimensions, the model goes beyond just focusing on skills. It captures the psychological, social, and strategic abilities needed for workforce

transformation. This mapping not only enhances theoretical understanding but also provides practical guidance for organisational leaders seeking to build readiness amid technological change. The following table outlines this framework, clearly showing how future-fit skills correspond to each trait dimension.

Table 3: Agility Triad framework for the workforce of the future

Trait	Future-Fit Skills	Application
Cognitive Agility	Analytical Problem-Solving Creativity Systems thinking Ethical and critical reasoning Reflective judgement "learn and unlearn" Growth mindset Curiosity	Rapidly changing how we view problems, bringing together different areas of knowledge, and using AI for flexible decision-making. Innovation
Resilience Agility	Adaptability Persistence & Grit Stress & Change Management Growth Mindset	Sustaining performance under uncertainty, bouncing back from setbacks, and continuously aligning to the needs of dynamic contexts
Collaborative Agility	Emotional intelligence Cross-Cultural Communication Ethical and critical reasoning Collaborative Intelligence	Building trust, empathy, and synergy across diverse teams, ensuring ethical and inclusive collaboration in hybrid environments

Table 3 depicts how Future-Fit Skills can be systematically mapped into the three core trait dimensions of workforce readiness: Cognitive Agility, Resilience Agility, and Collaborative Agility. This mapping provides a structured lens through which organisations can evaluate not only individuals' technical competencies but also their adaptive, resilient, and collaborative capacities in the face of accelerating technological change. Each aspect of agility provides unique skills. Cognitive agility encourages adaptability and innovation, while Resilience agility ensures emotional and ethical stability, and Collaborative agility allows for cooperative problem-solving. However, it is the combination of all three traits that creates a truly future-ready person.

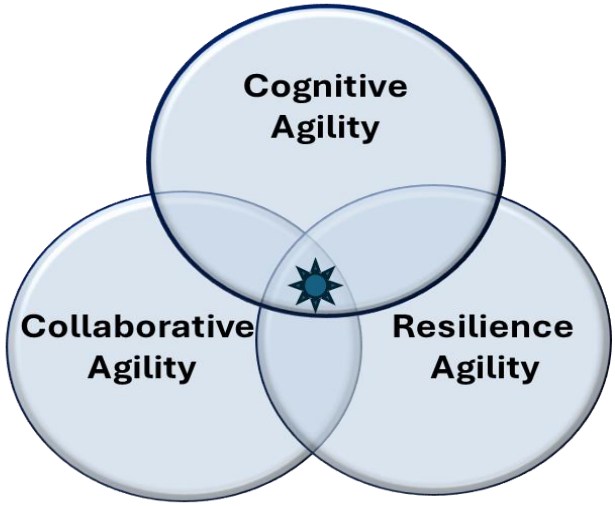

Figure 4: The Agility Triad

The conceptual model of the Agility Triad in Figure 4 illustrates the integration of the three core agility domains of Cognitive Agility, Resilience Agility, and Collaborative Agility as foundational traits for workforce readiness in the context of technological singularity. The overlapping structure highlights the interdependence of these competencies, with the central convergence representing the ideal future-fit individual capable of navigating complexity, disruption, and hybrid human-AI collaboration.

How the Three Agilities Interact:

- **Cognitive Agility** provides the *thinking capacity* to navigate complexity.
- **Resilience Agility** provides the *psychological stability* to sustain performance under disruption.
- **Collaborative Agility** provides the *relational capacity* to co-create solutions in hybrid human and AI ecosystems.

This triadic agility framework helps professionals understand the core skills required not only to survive but also to thrive in environments marked by rapid change in a VUCA context. A person with core capabilities highlighted in this triad can quickly learn new information, remain true to their values, and collaborate with both people and intelligent systems to develop solutions. These individuals are not shaken by disruption; they find energy in it. They do not just adapt; they transform. As the findings in Chapter 4 show, agility is not merely an additional trait but a key factor in workforce resilience, employability, and leadership amid rapid technological change.

The Agility Triad was developed based on the analytic strategy described in Chapter 3, which integrated a systematic literature review, semi-structured interviews, and thematic inductive content analysis. This triad represents a higher-order conceptual synthesis derived from patterns identified through these methods. The literature review established the historical and theoretical context by examining how successive industrial revolutions have reshaped job roles, skill requirements, and organisational responses. This analysis identified recurring patterns of technological disruption, workforce displacement, and the increasing significance of adaptive, cognitive, and interpersonal capabilities. Semi-structured interviews contributed contemporary, practice-based perspectives on how organisations are addressing AI-driven transformation, skill obsolescence, and workforce planning. Thematic inductive content analysis was used to integrate these data sources, enabling themes to emerge organically rather than relying on predetermined categories.

The analysis followed Braun and Clarke's (2006, 2013) six-phase framework: data familiarisation, initial code generation, candidate theme identification, theme review and refinement, theme definition and naming, and integrated narrative production. This iterative,

reflexive approach was essential for identifying constructs spanning historical evidence and current expert perspectives. Through repeated coding and theme refinement, three interrelated trait domains emerged: Cognitive Agility, Resilience Agility, and Collaborative Agility. These domains were not predetermined but surfaced inductively as the most coherent and empirically supported traits of a future-ready workforce.

To enhance analytical rigour and ensure strategic relevance, the emergent themes underwent a SWOT analysis, which systematically evaluated the strengths, weaknesses, opportunities, and threats related to current workforce capabilities amid accelerating technological change. This analysis facilitated a structured assessment of internal workforce attributes, such as adaptability strengths and skill gaps, as well as external environmental pressures, including AI disruption, quantum computing, and labour market volatility. Subsequently, a TOWS matrix was used to translate SWOT insights into strategic implications, identifying how organisations can leverage strengths to exploit opportunities, address weaknesses, and respond to emerging threats. The TOWS analysis established a connection between empirical findings and actionable strategy, demonstrating that the most sustainable workforce responses are those that enhance agility-based traits rather than focusing solely on technical competencies.

The integration of thematic analysis with SWOT and TOWS enhanced the conceptual coherence of the findings and directly informed the development of the Agility Triad. This triad constitutes the study's primary conceptual contribution: a theoretically grounded, empirically validated, and strategically actionable model that synthesises the adaptive capacities necessary for workforce readiness in the era of technological singularity. By combining historical patterns, contemporary expert insights, and strategic analysis, the triad provides a novel

trait-based framework that explains how individuals and organisations can maintain relevance, resilience, and performance during rapid technological evolution.

The findings in Chapter 4 support the Agility Triad as a strong and clear framework for understanding workforce readiness in a time of fast technological change. The literature review and expert interviews reveal three fundamental areas: Cognitive Agility, Resilience Agility, and Collaborative Agility. These areas represent the skills needed to effectively adapt to rapidly changing technology systems. There is growing evidence that calls for quick learning, systems-level thinking, and combining human and machine intelligence connect with Cognitive Agility. This shows its importance as a key skill for adapting to environments influenced by artificial intelligence, smart systems, and evolving technologies.

The focus on handling change, unlearning, psychological flexibility, and managing ongoing disruption highlights how Resilience Agility helps maintain performance during periods of uncertainty and rapid technological change. The importance of teamwork, human-machine collaboration, and social and emotional skills highlights Collaborative Agility as a key factor for success in diverse, interdisciplinary, and digitally connected workplaces.

Together, these three agility areas combine the study's insights into a clear model that explains how individuals can stay relevant and effective as organisations shift toward technology-driven work styles. Each agility area is a separate but connected concept that meets the needs of a workforce in a post-singularity world. Cognitive Agility focuses on systems thinking and AI-assisted reasoning. Resilience Agility involves psychological flexibility and stress management. Collaborative Agility emphasises social intelligence and teamwork in settings where humans and machines work together.

The model was developed through reasoning and mapping skills based on traits. This process ensured it reflected real-world experiences and theoretical ideas. Its visual form can help design assessments, develop training programs, and plan talent strategies in unpredictable and complex situations. This model aids in creating assessments and planning workforce strategies to build flexible, integrated, and strong talent pipelines. This blend contributes to the academic literature by linking theoretical concepts about agility with real applications for workforce planning and skills development. It goes beyond typical skills-based approaches by combining future-ready skills with agility traits. This enables the assessment of readiness and the development of a plan to improve employability in light of technological change. For organisational leaders, the model offers concrete insights into how workforce readiness can be developed as a flexible concept rather than a fixed goal. Ultimately, this framework emphasises that sustainable employability requires not just technical skills but also the ability to think flexibly, remain resilient, and work together ethically, helping the workforce thrive in rapidly changing, uncertain environments.

5.5 Contribution to industry practice

Martec's Law highlights the growing divide between the rapid pace of technological development and the slower, gradual changes within organisations. Considering the technological singularity, this gap presents not only a management issue but also a grave concern as AI and machine systems rapidly evolves. As can be seen from the literature reviews of historical and current contexts, as well as the interviews conducted, organisations may struggle to keep up with technological evolution unless they develop the ability to adapt as quickly in line with disruptions in a VUCA context.

This study demonstrates that preparing a future-ready workforce requires more than technical training. It must also develop dynamic skills such as continuous learning, collaborative problem-solving, and resilience in the face of uncertainty. Integrating these skills into hiring, training, and management enables organisations to address the gap identified by Martec's Law and better leverage the opportunities presented by the singularity.

Critically, this study introduces the Singularity-Ready Skills Triad, a theoretically grounded and empirically validated framework that advances understanding of workforce readiness amid rapid technological change. While prior research highlights shifting skill demands, few studies present an integrated, trait-based model to guide future workforce planning for a potential technological singularity. The triad addresses this gap by synthesising historical patterns, expert insights, and strategic analysis into a coherent framework that explains how individuals and organisations can maintain performance, adaptability, and relevance in evolving socio-technical environments.

The triad was developed through thematic analysis of literature and interview data, following Braun and Clarke’s (2006, 2013) methodology. This process identified the three key constructs of Cognitive Agility, Resilience Agility, and Collaborative Agility that consistently appear in both historical and contemporary accounts of workforce transformation. These constructs reflect the adaptive traits, positioning the triad as a future-oriented model resilient to ongoing technological change.

The conceptual contribution was enhanced by integrating SWOT analysis and the TOWS framework, which offered a strategic perspective on the emergent themes. SWOT analysis mapped internal workforce strengths and weaknesses against external technological

opportunities and threats, while the TOWS matrix translated these findings into strategic imperatives for workforce development. This synthesis confirmed that agility-based traits, rather than narrow technical skills, provide the most sustainable foundation for future workforce readiness. The triad thus represents a convergence of empirical evidence and strategic reasoning, offering a model that is both robust and actionable for companies to implement.

By presenting the Singularity-Ready Agility Triad, this study offers a novel framework that extends theories of workforce transformation, agility, and technological adaptation. It provides scholars with a new perspective on human capability in the era of AI and automation, and offers organisations a structured model for recruitment, learning, and workforce strategies suited to a singularity-driven future. The Agility triad is the main idea of this research. It brings together historical insight, current evidence, and strategic foresight into a clear framework for preparing a workforce for the future.

5.6 Recommendations

The findings in Chapter 4 show that the accelerating pace of technological advancement driven by AI, automation, agentic systems, and new computational paradigms requires a fundamental reorientation of organisational workforce strategies. Traditional approaches to skills development, recruitment, and workforce planning are no longer sufficient in environments marked by VUCA traits as well as the need for evolving technology and human interaction. The analysis revealed that while technical competencies continue to evolve, it is the underlying adaptive traits, rather than discrete skills, which determine long-term workforce resilience and organisational competitiveness. These insights informed the development of the Agility Triad:

Cognitive Agility, Resilience Agility, and Collaborative Agility. Together, these represent the core human capabilities needed to navigate and thrive in the era of technological singularity.

Building on these insights, the following recommendations translate the Agility Triad into concrete organisational actions that address the capability gaps and strategic challenges identified in Chapter 4. Each recommendation is structured around one of the three agility domains to ensure alignment between the study's conceptual framework and its practical implications. Organising the recommendations this way transitions the chapter from conceptual to more actionable strategies that organisations can use to strengthen workforce recruitment, enhance long-term readiness, and respond proactively to the demands of technological change. The sections that follow provide a structured roadmap for embedding agility-based competencies into workforce planning, recruitment, and skills development systems.

5.6.1 Cognitive Agility – Recommendations for Future-Fit Thinking and Learning

Implement Continuous Learning environments.

Organisations should create continuous learning environments in which employees can quickly acquire and update their knowledge as technology evolves. These environments should encourage ongoing development and provide clear pathways to advance AI literacy, data skills, systems thinking, and emerging technologies. Flexible training options allow employees to build skills at their own pace. Personalised learning platforms powered by AI can support this by analysing each person's skills and suggesting tailored learning and feedback. Making continuous learning part of daily work helps organisations develop a workforce that remains adaptable and ready for the future.

Embed a culture supporting unlearning and relearning.

Fixed mindsets and refusal to look at new perspectives can make it hard to adapt to changes, so organisations should include unlearning and relearning in their development plans. This can involve structured reflections, after-action reviews, and scenario-based exercises to help employees replace old ideas with evidence-based ones. Following Agile methods, companies should encourage staff to “fail fast and learn quickly through these mistakes to resolve them quickly.” Group discussions, peer learning, and guided reflection tools can help employees spot biases and change old habits. Making unlearning and relearning part of the culture allows organisations to stay adaptable as technology evolves.

Develop Human–AI cognitive integration Skills.

As technology evolves, it becomes inevitable that AI systems will become ubiquitous across organisations. In order to ensure alignment with human-driven outcomes, organisations should offer training at all levels to help employees learn how to interpret, check, and work with AI systems. Training should equip employees to think critically about AI results and to understand the limits and ethical issues of AI decision-making. Hands-on practice with AI analytics tools, working alongside AI agents, and human-in-the-loop simulations can help employees use AI to boost their thinking. These skills keep human judgment at the centre while making the most of intelligent systems.

Promote cross-skilling

Understanding how various parts of the organisation operate fosters systems thinking among employees. Organisations can encourage this by providing rotational assignments, cross-functional teams, and interdisciplinary problem-solving opportunities. These experiences motivate employees to consider diverse perspectives and broaden their expertise. Exposure to various fields enhances flexibility, decision-making, and the ability to connect knowledge across disciplines. Supporting this learning approach prepares employees to address the complex challenges of the technological singularity era.

5.6.2 Resilience Agility – Recommendations for Adaptability and Psychological Readiness

Build Organisational Resilience Programmes

Organisations can set up structured resilience programmes to help employees do well in fast-changing environments. These might include stress management training, emotional regulation workshops, resilience coaching, and mindfulness sessions. When employees handle pressure and bounce back from setbacks, the organisation becomes more adaptable and less likely to be disrupted by modern technology.

Institutionalise Change Agility Development

Resistance to change can affect employees' readiness, so organisations should focus on building change agility into their workforce plans. This means regularly checking how prepared people are for change, rotating roles to give broader experience, and running activities like simulations, crisis scenarios, and rapid-response exercises. These steps help employees feel more confident about handling uncertainty and adapting to change.

Encourage a Culture of Psychological Safety

Embedding culture of psychological safety helps people try new things, take risks, and learn from mistakes, which all support resilience and agility. Leaders should be open about their own challenges, acting as role models to encourage honest conversations and respond positively to honest mistakes that are used as learning opportunities. Organisations need to make it clear that it is safe to question assumptions, raise concerns, and suggest innovative ideas. When people feel secure, they are less afraid of technological change and more willing to learn and adapt.

Strengthen Workforce Recovery Mechanisms

To stay adaptable over time, organisations need strong recovery systems that support employees' well-being on an ongoing basis and especially during significant changes. Strengthening the workforce could be promoted by offering flexible work options, providing time to recover after demanding projects, and offering mental health resources such as counselling, peer support, and wellbeing programmes. Focusing on recovery helps protect employees, prevent burnout, and sustain resilience during periods of technological change.

5.6.3 Collaborative Agility – Recommendations for Human–Machine and Human–Human Collaboration

Develop Collaborative Intelligence Training

Organisations should invest in training programmes that build collaborative intelligence, which means working well with both human teams and intelligent systems. This involves learning how to communicate with AI agents, understand machine-generated insights, and use AI outputs to the benefit of the process. Training should also cover how to make decisions

together, share knowledge, and coordinate between people as well as machines. By building collaborative intelligence, employees can use AI as a partner to solve problems and drive innovation as opposed to becoming a slave to AI outcomes.

Strengthen Soft Skills as Core Competencies

Soft skills like communication, empathy, conflict resolution, and cross-cultural competence should be seen as essential organisational strengths, not just extra qualities. These skills need to be part of hiring, performance reviews, and leadership training. As shown in the findings, soft skills matter even more when people work with machines and across different teams. Focusing on these abilities helps teams work better together, improves collaboration, and leads to more inclusive decisions.

Break Down Organisational Silos

To address siloed working practices found in the interviews, organisations should set up ways to encourage cross-functional collaboration. This could involve forming cross-departmental teams, establishing shared goals and performance measures, and using digital tools that facilitate more open teamwork and problem-solving. Holding regular interdepartmental meetings, sharing knowledge, and running joint innovation projects can also help build a stronger, more agile organisation.

Foster Inclusive, Multi-Disciplinary Innovation

Organisations should build environments that support inclusive, multi-disciplinary innovation by bringing together people with different skills for technical, operational, and people-focused to solve complex problems. Innovation labs, co-creation workshops, and design thinking

sessions provide spaces for testing innovative ideas, rapid prototyping, and collaborative creativity. These efforts bring in diverse viewpoints, boost creativity, and accelerate the development of innovative solutions to the challenges of technological change.

5.6.4 Triad-Level (Integrated) Recommendations

Agility Trait-Based Recruitment and Assessment Model

Organisations need to re-examine current recruitment models to move away from hiring based solely on credentials and instead focus on traits such as cognitive flexibility, resilience, and collaborative intelligence. Using tools such as psychometric tests, behavioural interviews, and simulations can help assess how well a candidate adapts, learns, and works with others in changing environments. This approach enables organisations to identify individuals capable of adapting to and evolving with modern technologies.

Align Workforce Planning with Agility Domains

Workforce planning frameworks need to be updated to ensure that roles, career paths, and succession plans align with the three areas of the Singularity-Ready Skills Agility Triad. In doing so, they link the requirements for an agility triad profile to job types, identify skill gaps, and create ways for employees to build the right skills for the future. This allows organisations to focus on building capabilities before they are needed, rather than reacting to technical changes.

Build AI-Enabled Talent Intelligence Systems

Organisations can use AI-powered talent systems to identify gaps against the Agility Triad, and in doing so, predict future skill needs and align staff development plans. These intelligent systems can be used to review workforce data, track latest trends, and give real-time insights into the strengths and weaknesses of the workforce. Using AI in talent management helps leaders make better staff recruitment and talent decisions, which ensure development efforts are aligned with workforce needs.

Integrate the Agility Triad into Organisational Culture and Leadership Models

To make the Singularity-Ready Agility Triad part of the organisation's identity, leaders should be assessed and developed for their skills in cognitive, resilience, and collaborative agility. Leadership models, company values, and stories should clearly mention the Agility triad as a key guide for behaviour, decisions, and strategy. Integrating the triad into culture and leadership helps maintain focus on agility in workforce development.

Table 4: Mapping Recommendations to Agility Domains - Skills Triad

Agility Domain	Recommendation	Summary of Action
Cognitive Agility	Implement a continuous learning environment	Establish AI-supported learning pathways for rapid upskilling in AI, data literacy, systems thinking, and emerging technologies.
	Embed Unlearning and Relearning Practices	Integrate reflective practice, scenario-based learning, Agile practices, and post reviews to replace outdated mental models with adaptive ones.
	Develop Human–AI Cognitive Integration Skills	Train employees to interpret, validate, and collaborate with AI systems, including critical evaluation of AI outputs.
	Promote Interdisciplinary Exposure	Use rotations, cross-functional projects, and problem-solving labs to strengthen systems thinking and broaden conceptual understanding.
Resilience Agility	Build Organisational Resilience Programmes	Implement stress-management training, emotional regulation workshops, and resilience coaching to support adaptability.
	Institutionalise Change Agility Development	Conduct change-readiness assessments, role rotations, and controlled disruption simulations to build behavioural flexibility
	Encourage a Culture of Psychological Safety	Train leaders to model vulnerability, support experimentation, and reduce fear-based resistance to technological change.
	Strengthen Workforce Recovery Mechanisms	Provide flexible work arrangements, recovery time, and mental health resources to sustain long-term adaptability.
Collaborative Agility	Develop Collaborative Intelligence Training	Build skills for hybrid human–machine teamwork, including interpreting machine outputs and integrating AI into workflows
	Strengthen Soft Skills as Core Competencies	Embed communication, empathy, conflict resolution, and cross-cultural competence into recruitment and performance systems.
	Break Down Organisational Silos	Implement cross-functional squads, shared goals, and collaborative digital platforms to enhance transparency and teamwork.
	Foster Inclusive, Multi-Disciplinary Innovation	Use innovation labs, co-creation workshops, and design thinking sprints to bring diverse expertise together.
Triad-Level (Integrated)	Adopt Trait-Based Recruitment & Assessment	Shift from credential-based hiring to assessments measuring cognitive, resilience, and collaborative agility.
	Align Workforce Planning with Agility Domains	Map roles, pathways, and succession planning to the triad to build future-fit capabilities.
	Build AI-Enabled Talent Intelligence Systems	Use AI to identify agility gaps, predict future skill needs, and personalise development plans.
	Integrate the Triad into Culture & Leadership Models	Embed the triad into leadership expectations, cultural values, and organisational identity.

In summary, the recommendations in this chapter build on insights from Chapter 4 and the Agility Triad to provide a clear set of actions for organisations preparing for technological change. By organising the recommendations around Cognitive Agility, Resilience Agility, and Collaborative Agility, the chapter provides a practical plan to improve workforce adaptability, increase organisational readiness, and develop talent systems that succeed during VUCA environmental shifts. These recommendations emphasise the need for ongoing learning environments, safe and open cultures ready for change, and collaboration models that blend human and machine skills. The framework offers a forward-looking approach to workforce

planning that moves beyond technical skill development to cultivate agility-based qualities that enable thriving and adaptation amid significant VUCA shifts and technological change.

These recommendations support the main argument of this dissertation that positions that a sustainable workforce readiness in the age of technological change relies not on predicting exact technical skills, but on building adaptive capabilities that allow individuals and organisations to grow as technology advances. The Agility Triad provides practical strategies for workforce planning, giving leaders a clear path to manage environmental uncertainty and develop resilient, future-ready workforces. The Agility Triad forms the basis for the dissertation, which reflects on the broader implications of these findings and the ongoing importance of agility-based frameworks in a complex, technology-driven world. Together, these recommendations lay a strategic foundation for creating a workforce ready for the future. They also prepare the dissertation's final reflections, considering the broader implications of these findings and the continued relevance of agility-based frameworks amid rapid technological change.

In summary, this chapter presents the findings from Chapter 4 and the Agility Triad as practical steps for organisations facing technological change. The recommendations focus on Cognitive Agility, Resilience Agility, and Collaborative Agility, which provide organisations with a clear guide to help their staff adapt, improve readiness, and build talent systems for workforces shaped by evolving technologies. The recommendations highlight the need for a learning mindset, cultures that are safe and open to change, and the promotion of collaborative mechanisms that enable people and machines to work together. The ideas offer a forward-looking approach to workforce planning, focusing on sustained agility rather than technical skills alone.

These recommendations support the main point of this dissertation, which enables the workforce to be ready for a future state of a potential technology Singularity. Organisations need to build adaptability rather than trying to predict every new technical skill. By translating the Agility Triad into practical strategies, this chapter connects theory to real-world action, giving leaders a clear way to manage uncertainty and build strong, future-ready teams. This sets the stage for the final reflections, which will examine the broader impact of these findings and why agility-based approaches remain essential as technology continues to evolve.

5.7 Limitations of the study

Although this study offers significant insights into workforce transformation during rapid technological change, several limitations should be considered regarding its findings and the development of the Singularity-Ready Agility Triad. The research primarily draws on qualitative data from a systematic literature review and semi-structured interviews. While these approaches provide in-depth, contextualised understanding, they are inherently interpretive and may incorporate subjective perspectives from both researchers and participants. The purposive selection of interviewees to obtain expert viewpoints may not adequately capture the full range of industries, geographic regions, or organisational contexts influenced by emerging technologies. Consequently, the generalisability of the findings is constrained, and the identified themes may not be applicable across all sectors or workforce groups.

Second, the rapidly evolving nature of technologies such as artificial intelligence, automation, and other related technologies presents a temporal limitation. The technological landscape is changing so quickly that the literature and expert insights analysed in this study may soon be outdated. Some observations may lose relevance as modern technologies, workforce models,

and organisational practices emerge. This limitation is especially relevant to the research's forecasting elements, which rely on historical patterns and expert expectations that may shift as the technological singularity approaches.

Using SWOT analysis and the TOWS framework adds another level of interpretation, which can be shaped by the researcher's own perspective. These tools are subjective and depend on how strengths, weaknesses, opportunities, and threats are defined. Although the thematic analysis based on Braun and Clarke's method helped confirm and expand these insights, the strategic conclusions still depend on the specific context and might change in different organisations or technology settings.

Finally, the conceptual framework developed, the Singularity-Ready Skills Agility Triad, emerged inductively from the data and reflects the specific themes identified in this study. While it offers a novel and theoretically grounded contribution, it has not yet been empirically tested or operationalised in organisational settings. Further research is needed to validate the triad across broader populations, assess its predictive value for workforce readiness, and explore its applicability in diverse cultural and industry contexts.

Despite these limitations, the study provides a robust foundation for understanding the adaptive traits required for future workforce resilience and a strategic framework to guide ongoing research on organisational planning in the era of technological singularity.

5.8 Future Research

In line with the identified limitations, several future research directions can provide further validation and expand this study's insights. Expanding the empirical base by including larger,

more diverse participant samples across industries, regions, and organisational sizes would be valuable to broaden the context of this study. Researchers could examine how adaptive traits in the Agility Triad appear in sectors with different technological maturity or in workforces shaped by unique cultural, economic, or regulatory factors. Similarly, studies across various countries or industries could clarify how various context influences workforce adaptability and organisational readiness for technological disruption.

Further, longitudinal research is needed to track how workforce traits, organisational strategies, and technological capabilities evolve over a longer timeframe. As technology advances rapidly, long-term comparative studies would help examine the development of agility-based traits on workforce and the impact on how organisations adjust workforce planning in response to modern technologies. Researchers could also assess whether the triad remains a stable model or if new domains of agility emerge as technological singularity approaches.

It is also crucial that future research should empirically test and operationalise the Agility Triad. This may include developing validated measurement tools, behavioural indicators, or assessments to evaluate cognitive, resilience, and collaborative agility in workforces. Subsequent experimental or quasi-experimental studies could then assess the effectiveness of interventions such as learning ecosystems, resilience training, or hybrid collaboration models in strengthening these traits. These findings would offer evidence-based guidance for organisations implementing the recommendations from this dissertation.

As technology continues to evolve, subsequent research should examine the interaction between human agility traits and emerging AI systems. As AI becomes more autonomous and integrated into organisational workflows, studies could investigate how human–machine collaboration

affects skill development, decision-making, and organisational culture. Research may also address ethical considerations, including fairness, transparency, and the psychological effects of working with increasingly intelligent systems.

Finally, future research could expand the strategic scope by examining how workforce agility integrates with broader organisational capabilities such as innovation, leadership, and digital transformation. This approach would support the development of multi-layered frameworks that connect individual traits, team dynamics, and organisational strategy in preparation for technological singularity.

Together, these suggestions for future research can advance theoretical understanding, strengthen empirical evidence, and help organisations build resilient, future-ready workforces equipped to thrive amid rapid technological change.

5.9 Summary and Final Reflection

This study shows that technological disruption is not a distant possibility but a current reality. Historical lessons indicate that adaptation is possible, but the scale of the singularity requires exceptional agility. Success in this environment will depend not only on technical skills but also on human qualities such as curiosity, resilience, and collaboration. These traits help individuals and organisations prosper amid uncertainty.

Collectively, the findings, analysis, and conceptual synthesis presented in this dissertation demonstrate that the rapid convergence of artificial intelligence, automation, and emerging technologies is fundamentally transforming the workforce. This transformation necessitates new forms of adaptability, strategic foresight, and enhanced human capability. By tracing

historical patterns across industrial revolutions, examining contemporary organisational realities, and integrating these insights through rigorous qualitative and strategic analysis, this study introduces a future-oriented framework in the form of the Agility Triad that identifies the essential adaptive traits required for individuals and organisations to succeed amid profound technological change. Although the accelerated pace of change generates uncertainty, it also creates significant opportunities to reimagine work, expand human potential, and design more resilient and inclusive workforce systems. The primary contribution of this research lies in both its conceptual model and its call for organisations (and educators) to prioritise agility, continuous learning, and collaborative intelligence as foundational elements of future workforce readiness. As technological evolution continues to accelerate, the insights and framework developed in this dissertation offer guidance for navigating future complexities, ensuring that the workforce is not only prepared for the singularity but also positioned to influence its trajectory.

Ultimately, this research shows that understanding how past industrial revolutions reshaped work and identifying adaptive traits for future technological transitions are essential. These insights inform the development of strategic workforce planning frameworks that enable organisations to thrive in the era of the emerging technological singularity. This research contributes to the ongoing discussion on the future of work, offering academic insights and practical guidance. It emphasises that preparing for the singularity is not about predicting a specific moment of change but about fostering continuous readiness for transformation.

APPENDIX A

PARTICIPANT INFORMATION SHEET

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

PARTICIPANT INFORMATION SHEET

Study title

THE TECHNOLOGY SINGULARITY, ADAPTING TO NEW WAYS OF WORK.

Invitation Paragraph

You are invited to participate in a research project. Before you decide whether you want to take part, it is important for you to understand why the research is being done and what it will involve. Please take the time to read through the following information carefully and discuss it with others if you wish. Please do ask me if there is anything that is not clear or if you would like more information. I would appreciate it if you would take the time to decide whether or not you wish to take part. Thank you for reading this and for your consideration.

What is the purpose of the study?

Technological advances have exponentially transformed human history through multiple industrial revolutions, with further advances driven by AI rapidly progressing us into a cognitive age, which may lead to a technological singularity, where humans might lose control of technology and its impact across the workforce. During these volatile times, comprehensive research is needed to understand this

revolution's challenges and opportunities for the workforce. Historical transformations suggest potential job losses and new business models, potentially changing the current workforce and future jobs. Reskilling and careful workforce planning frameworks are essential to adapt to these changes, which demand adaptability and resilience. This study will explore technology's evolving impact on the workforce and evaluate human workforce practices for future readiness.

This study is being conducted by Nerina Naik, over a six-month period, as part of her coursework in completing the Doctorate in Business Administration at the Swiss School of Business and Management, Geneva.

Why have I been invited to participate?

You have been invited to take participate in this study as you have been identified as a subject expert and key influencer in the recruitment of technology experts. It is anticipated that you are likely to provide valuable insights into your experience of the impact of technology on the workforce. It is expected that you will respond to questions honestly.

Do I have to take part?

No. It is totally up to you to decide whether to take part, as participation is entirely voluntary. If you do decide to take part, you will be asked to read and sign an Informed Consent Form and provided with this information sheet to keep. You are still able to withdraw up to 24 hours after the interview without having to give a reason, and your decision will in no way adversely impact you.

What will happen to me if I take part?

The study involves taking part in an individual interview, where you will be asked about your thoughts, experiences and opinions regarding the impact of technology on the workforce. You are required to respond honestly and without any pressure to questions relating to your experience.

What are the possible disadvantages and risks of taking part?

The are no potential identified risks are anticipated in taking part in this study. In the unforeseen occurrence of discomfort or distress during the study, you are very welcome to stop the interview process immediately.

What are the possible benefits of taking part?

The results of this study will provide valuable guides and frameworks that enable businesses to evolve workforce management practices in line with the impact that technology may have on the workforce. In such a changing environment, it is of the utmost importance to conduct thorough research to stay informed about the existing workforce in relation to new ones and new recruitment methods. The main beneficiary of the study is the researcher, who will use the data for a postgraduate research report.

Will my taking part in this study be kept confidential?

Only your first name will be used in the interview, and your name and the names of any people you talk about will be replaced by pseudonyms during transcription to ensure anonymity. Only the researcher will have access to the data, which the researcher will store. The confidential data will be used for a qualitative research report. The interview recording will be destroyed after being transcribed. The report will include anonymised quotes and may be used for future research; however, any researcher who has access to this data must agree to preserve the confidentiality of the data. Any information about you which leaves the University will have all your identifying information removed.

Will I be recorded, and how will the recording be used?

This interview will be recorded and should take around 45 minutes. Interviews will be held online using either Microsoft Teams or Zoom software. This interview will be set up in consultation with you during a mutually suitable time. The interview recording will be destroyed once it has been transcribed. The transcript will be analysed using the appropriate qualitative data analysis method.

What will happen to the results of the research study?

The results of this study will be used to complete a report to be marked as part of a doctoral dissertation. This report is to be used purely for academic purposes; however, it will be shared with industry leaders and other academics, and it may be used for future research. Any researcher who has access to these data may only do so if they agree to preserve the confidentiality of these data.

Who is organising and funding the research?

This research is not funded and is being arranged by the researcher Nerina Naik in conjunction with Swiss Business School, Geneva as part of a dissertation project.

Contact for further information and complaints

For general information

Researcher name: Nerina Naik

Email: nerinanaik@gmail.com

APPENDIX B

INFORMED CONSENT

INFORMED CONSENT FORM

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

THE TECHNOLOGY SINGULARITY, ADAPTING TO NEW WAYS OF WORK.

Researcher: Nerina Naik

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CONDUCTED BETWEEN

30/06/2025 AND 30/06/2026

The participant should complete the whole of this sheet		
	YES	NO
Have you read the Participant Information Sheet?		
Have you had an opportunity to ask questions and discuss this study?		
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)		
Do you understand that you will not be referred to by name in any report concerning this study?		
Do you understand that:		
• Participation is entirely voluntary and can be withdrawn without consequence. You do not have to give any reason for withdrawing • You can withdraw up to a month following the interview without giving a reason, and your decision will not adversely impact you. All data will be anonymised following this period to ensure your personal details remain confidential in this process. • All personal information collected about you during the research will be kept strictly confidential and retained for a month following the interview, while the underpinning anonymised dataset will be retained for ten years		

I agree to my interview being audio and video recorded		
I agree to the use of non-attributable quotes when the study is written up or published		
The procedures regarding confidentiality have been explained to me.		
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.		
I agree to take part in this study.		
I am over 18 years of age, and I am confident that I can participate in this study honestly and without bias.		
I understand that taking part in the project will involve taking part in an individual interview, where I will be asked about my thoughts, experiences and opinions. You have been invited to take participate in this study as you have been identified as a subject expert and key influencer in the recruitment of technology experts. It is anticipated that you are likely to provide valuable insights into your experience of the impact of technology on the workforce.		

Signature of research participant:
Print name:
Date:

APPENDIX C

INTERVIEW GUIDE

THE TECHNOLOGY SINGULARITY, ADAPTING TO NEW WAYS OF WORK.

Nerina Naik, 2025

Current Skill Trends

1. What are the most in-demand skills in your industry today, and how have they changed in recent years?
2. Which technical and soft skills do you see as essential for employees to thrive in the current workforce?

Future Skills Evolution

3. What emerging technologies do you believe will have the biggest impact on skill requirements in the next 5–10 years?
4. How do you anticipate jobs evolving—will the workforce require entirely new skill sets, or will existing ones be adapted?
5. In your experience, what differentiates those employees who succeed in the evolving workplace from those who struggle with change?

Workforce Preparedness

6. Have you found that some employees are just unable to adapt to the evolving requirements of their role over the past few years,

   Please elaborate ?
7. What advice would you give to professionals looking to future-proof their careers in the face of rapid technological change?

Recruitment and Employment Impacts

8. How has your approach to hiring changed due to evolving skill demands? Are you looking for different qualifications/criteria now compared to five years ago?
9. In your experience, what recruitment or hiring tools have been most helpful in recruiting successful candidates and why?
10. In your experience, how should recruitment models adapt to accommodate the changing nature of work and skills demand?

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