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EXPLORING ARTIFICIAL INTELLIGENCE (AI) TO ANTICIPATE CHANGES IN PROFESSIONAL SKILLS IN THE NEXT ERA OF INDUSTRIAL REVOLUTION 4.0

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Abstract. *The Fourth Industrial Revolution indicates a revolutionary period driven by the incorporation of artificial intelligence (AI) into various aspects of our work environment. The goal of this essay is to anticipate and prepare for the upcoming changes by exploring the deep implications of AI on the changing skills needed in the job. The investigation commences by clarifying the increasing significance of artificial intelligence (AI) in many sectors, underscoring its influence on transforming customary job functions and demanding the creation of new vocations. The need for specialized knowledge and in-depth understanding of AI technology is highlighted by examples such as chatbot developers, data analysts, and AI specialists. This study utilises a mixed methodology, incorporating secondary data analysis and a literature review, to provide a comprehensive overview of the effects of AI on the future professional environment. A proactive attitude to skill development, an acceptance of lifelong learning, and the promotion of flexibility to technology improvements are necessary for navigating the Industry 4.0 era. The combination between artificial intelligence (AI) and characteristics that are uniquely human, such creativity and ethics, becomes obvious as a crucial factor in developing a sustainable workforce in the future.*

Keywords: *Industry 4.0, Artificial Intelligence, Integrating AI, Productivity*

1. INTRODUCTION

The Fourth Industrial Revolution is an important milestone. It fundamentally changes the way we work, communicate, and interact with technology. This is not just a technological change, but a holistic change that affects every aspect of professional and private life.

In this era, constantly evolving technologies such as artificial intelligence, cloud computing, the Internet of Things (IoT), robotics, and big data processing have permeated almost every industry. This revolution has not only changed the way goods and services are produced but has also created significant changes in the professional landscape.

In a professional context, the Fourth Industrial Revolution has brought about significant changes in skill requirements. Today, adaptation to new technologies, data-driven skills, critical thinking, the ability to collaborate with machines, and expertise in solving complex problems have become increasingly important. New professions are emerging while old ones are transforming in terms of the skills and knowledge required.

In addition, the concept of the workplace is also shifting. Many jobs can be done remotely or flexibly, allowing people to work from anywhere around the world. This gives rise to a new paradigm of flexibility, productivity, and balance between professional and personal life.

Industrial Revolution 4.0 has brought profound changes to the professional landscape, requiring us to continuously adapt, learn and develop relevant skills. The key to success in this era is open innovation, the ability to collaborate with technology, and flexibility in the face of inevitable change. By understanding and embracing these changes, we can look to the future with confidence and take advantage of the opportunities offered by Industrial Revolution 4.0 to create a better working world.

2. LITERATURE REVIEW

a. Industrial Revolution 4.0

The Industrial Revolution 4.0 is a phenomenon that is transforming the industrial landscape through the integration of advanced technologies into production and manufacturing processes. The basic concepts of the Industrial Revolution 4.0 include the application of technologies such as artificial intelligence (AI), Internet of Things (IoT), cloud computing, robotics, and big data processing to create more connected, automated, and intelligent systems.

The impact of Industrial Revolution 4.0 on professional skills is significant. One key aspect to understand in this context is technology-based skills.

1) Technology-based Skills: The transition to Industrial Revolution 4.0 (IR 4.0) necessitates a shift in technical competencies, with a focus on data analysis, process optimization, and device maintenance (Ismail, 2019). This shift is particularly relevant in the engineering field, where skills such as analytical thinking, active learning, and emotional intelligence are becoming increasingly important (Kamaruzaman, 2019). Advancements in technologies such as artificial intelligence, IoT, and big data require the ability to adapt and use these tools effectively. Technical skills and understanding of new technologies are becoming critical for professionals in various fields.
2) Adaptability: The Industrial Revolution 4.0 is creating a rapidly changing environment. Professionals must be able to adapt to technological changes, new ways of working, and changing market needs. Jameel (2018) and Hud (2020) both focus on the readiness of employees to adopt IR 4.0, with Jameel proposing an adaptive image classification approach and Hud identifying the need for relevant knowledge and skills
3) Data-Driven Skills: In this digital era, data becomes a very valuable asset. Professionals must have data analysis skills to collect, process, analyze, and interpret information generated by networked technologies. IR 4.0) has brought about a significant shift in the skills required in the workforce, particularly in the data-driven economy. (Demchenko, 2019)
4) Technology Collaboration Skills: Human-machine collaboration is becoming increasingly impordant. Professionals must be able to work with automation systems, robots, and artificial intelligence to increase productivity and efficiency. IR 4.0 necessitates a shift in skills, particularly in the engineering field, with a focus on analytical thinking, innovation, and emotional intelligence (Kamaruzaman, 2019). This shift requires collaboration between industry players, educational institutions, and training providers to develop the necessary skills (Sohimi, 2019).
5) Creativity and Innovation Skills: IR 4.0 has redefined creativity and innovation, particularly in the context of learning and skills development (Zhakata, 2022). While technology is rapidly evolving, human creativity and innovation remain the critical factors. Professionals must be able to come up with new ideas, creative solutions and innovative strategies to meet the challenges of this era
6) Soft Skills: IR 4.0 necessitates a focus on soft skills alongside technical competencies (Le, 2021; Jelonek, 2020). These skills, particularly those related to teamwork, communication, and innovation, are crucial for engineers and information and knowledge management practitioners (Jelonek, 2020; Mabe, 2022).

b. Artificial Intelligence

A subfield of computer science called artificial intelligence (AI) is concerned with building machines that are capable of activities that normally call for human intelligence. Learning, solving problems, comprehending spoken language, identifying patterns, and making decisions are some of these tasks. Artificial Intelligence (AI) comprises several

subfields, such as robotics, computer vision, machine learning, and natural language processing.

Though there are many potential benefits for humanity from artificial intelligence (AI), there are drawbacks as well. Russell (2022) addresses challenges including bias and lethal autonomous weaponry, emphasizing the necessity for a new sort of AI that is demonstrably good to mankind. The advantages of AI in cybersecurity are emphasized by Calderón (2019), notably in terms of raising the rate at which cyberthreats are detected. Vasista (2022) emphasizes how AI is being used widely across a range of sectors, including security, healthcare, and finance. However, Chowdhury (2012) notes that although artificial intelligence (AI) has limitations in terms of capability and functioning, it also offers benefits including cost-effectiveness, dependability, and permanence.

Currently, AI is evolving by incorporating advancements in various domains, ethical considerations, and the pursuit of creating more robust, adaptable, and responsible AI systems. The historical development and changing trends in AI research and application are often understood through the three broad phases that characterize the evolution of Artificial Intelligence (AI). Here are the 3 phases of AI development:

1) Artificial Intelligence Phase I: Symbolic AI (Good Old-Fashioned AI)
    - Timeframe: 1950s to 1980s
    - Approach: Symbolic AI, also known as "Good Old-Fashioned AI" or "GOFAI," focused on rule-based systems, logic, and symbolic reasoning.
    - Characteristics: Early AI systems were based on explicit rules and knowledge representation. Researchers attempted to mimic human intelligence by using logical reasoning and formal symbols.
    - Key Technologies: Logic programming, expert systems, knowledge-based systems (rule-based systems), and early natural language processing.
    - Limitations: Systems were rigid, struggled with uncertainty, context, and lacked learning capabilities. Scaling knowledge bases was challenging, and the "AI Winter" ensued due to overinflated expectations and under-delivery of promised results.

2) Artificial Intelligence Phase II: Connectionism and Machine Learning
    - Timeframe: Late 1980s to early 2000s
    - Approach: This phase focused on connectionist models, neural networks, and machine learning techniques.
    - Characteristics: Renewed interest in AI emerged with a shift toward learning from data and pattern recognition. Neural networks and other machine learning algorithms gained attention for their ability to learn and adapt from examples.
    - Key Technologies: Backpropagation in neural networks, support vector machines, decision trees, and reinforcement learning techniques.
    - Advancements: Increased computational power, new learning algorithms, and successful applications in areas such as pattern recognition, data mining, and early autonomous systems.
    - Limitations: Despite progress, scalability and limitations in training deep networks hindered widespread adoption. Practical applications were limited due to computational constraints.

3) Artificial Intelligence Phase III: Modern AI and Deep Learning
    - Timeframe: Early 2000s to the present
    - Approach: The contemporary phase of AI focuses heavily on deep learning, big data, and advancements in neural networks.
    - Characteristics: Breakthroughs in deep learning, fueled by big data availability and increased computational power (GPUs), led to significant advancements in

various AI subfields.

- Key Technologies: Deep neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), generative adversarial networks (GANs), and transformers.
- Advancements: Revolutionary progress in computer vision, natural language processing, speech recognition, and reinforcement learning. Applications across industries, including healthcare, finance, autonomous vehicles, and more.
- Challenges: Issues related to interpretability, ethics, biases in AI systems, data privacy, and the ethical implications of AI applications have gained prominence.

3. RESEARCH METHODS

The purpose of this task is to investigate the latest developments in artificial intelligence and how these technologies are entering various professional sectors.

This includes exploring AI applications in various work contexts and how they affect job functions, as well as the role of individuals in professional environments. Additionally, the impact of AI penetration on future professional skill demands will be examined. It identifies critical skills, highlights the decline of skills that may no longer be relevant, and outlines changes in training and education needs to prepare the workforce for these changes.

This research employs a mixed methodology, including secondary data analysis, and literature review, to present a comprehensive picture of the impact of AI on the future professional landscape. The research results are anticipated to offer valuable insights for education, industry, and policy stakeholders in addressing the changing skill demands of the Industrial Revolution 4.0 era, which are increasingly associated with the presence of AI technologies.

4. RESULTS AND DISCUSSION

Artificial intelligence (AI) offers numerous advantages in various fields, including education, decision-making, and problem-solving. In education, AI can automate administrative tasks, provide personalized learning experiences, and improve task management (Subramanian, 2020; Al-Tkhayneh, 2023). In decision-making, AI can address complexity and uncertainty, and enhance human decision-making by sifting through vast amounts of data (Jarrahi, 2018).

Artificial intelligence technology increasingly expands and enriches decision support by coordinating data provision, analyzing data trends, providing predictions, developing data consistency, quantifying uncertainty, anticipating users' data needs, and providing information to recommend actions to users. the most appropriate form, etc

In anticipation of the next era of skills change, the role of artificial intelligence (AI) is significant. AI is not only a technology that is changing the way we work, but also a catalyst for evolution in the professional landscape. Here are the key points regarding the role of AI in anticipating the next era of skills change:

a. Increased Efficiency

In many industries, the use of AI improves the efficiency of work processes. This includes fast and accurate data analysis, more efficient supply chain management, and better scheduling. AI has been identified as a key driver of operational efficiency and competitiveness in various industries (Makar, 2023). Efforts to improve AI computational throughput and reduce costs have been explored through hardware and software architectures (Deering, 1984). In the manufacturing sector, AI applications have been found to significantly increase resource efficiency, particularly in predictive maintenance, production planning, fault detection, and energy efficiency (Waltersmann, 2021).

b. Human-AI Collaboration

There is an increase in collaboration between humans and machines. Today's jobs often involve working alongside AI systems to achieve the best results. The field of Human-AI Collaboration is rapidly evolving, with a focus on data science (WangDakuo, 2019), human-robot interaction (Scassellati, 2014), and the integration of AI into joint work scenarios (Siemon, 2021). This collaboration is also being explored in the context of cooperative games, where participants perceive human partners more positively than AI partners (Ashktorab, 2020). These studies collectively highlight the potential of Human-AI Collaboration in various domains, while also underscoring the need for further research to address challenges and optimize the integration of AI into human activities.

c. Increased Creativity and Innovation:

The integration of AI in creative processes has the potential to significantly enhance innovation and creativity. Grech (2023) and Oktradiksa (2021) both highlight the role of AI in augmenting creative experiences, particularly in the engineering field and in the development of creativity skills. McCaffrey (2018) emphasizes the need for a human-AI partnership to maximize innovative potential, with the BrainSwarming interface proposed as a means of achieving this. Lim (2019) discusses the implications of AI in the legal and copyright aspects of innovation, particularly in the creative and technological arts. These studies collectively underscore the transformative impact of AI on creativity and innovation.

d. Increased Productivity:

AI has been shown to significantly increase productivity in various industries. Gao (2023) found that a 1% increase in AI penetration can lead to a 14.2% increase in total factor productivity in manufacturing. Yang (2023) highlighted the potential of AI applications to streamline workflows and improve performance in communication, data analysis, project management, and creative pursuits. Choudhury (2022) suggested using AI algorithms to automate elements of the user experience design process, potentially enhancing productivity. Noy (2023) demonstrated that a generative AI technology, ChatGPT, substantially increased productivity and output quality in professional writing tasks. These studies collectively underscore the significant role of AI in driving productivity gains across various domains.

e. AI upskilling

The impact of AI on workers' skills is a complex and multifaceted issue, requiring a transdisciplinary approach to understand its implications (Morandini, 2023). While AI can lead to deskilling, the concept of Hybrid Intelligence, which combines human and AI capabilities, can help prevent this and foster upskilling (Rafner, 2021). In the field of higher education, AI is transforming the traditional classroom model to a learner-centric one, but it also presents challenges such as workforce displacement (Bhatnagar, 2020). The application of AI in higher education is a growing field, but there is still uncertainty about its pedagogical use and impact (Aggarwal, 2023).

f. Emergence of New Jobs:

AI has created new jobs and requires different skills. The emergence of AI is reshaping the job market, creating new opportunities and challenges (Khatri, 2020) highlight the need for new skill sets and the potential for job displacement, with Khatri emphasizing the importance of skill enhancement and re-skilling. (Badet, 2021) further explores the creation of new, more complex tasks and the demand for high-skilled workers, while (Squicciarini, 2021) provides evidence of the increasing demand for AI-related skills in various sectors.

A lot of opportunity arises from the AI revolution for individuals who can reskill and adapt. Here's a list of jobs that will be secure in the future thanks to AI (Forbes Technology Council, 2023):

20 New Jobs in the AI Revolution

No	New Jobs	Description
1	AI Trainer And Operator	These professionals will utilise and train the systems, fine-tuning them to achieve the desired outcomes. Additionally, AI requires vast amounts of data, creating new opportunities in data engineering.
2	Sentiment Analyzer	Understanding customers' sentiment, that is, how they perceive products and services, using generative AI to interpret blogs, posts, ratings, and other sources, can be challenging due to the lack of context provided by these tools.
3	Content Creator	Currently, generative AI relies on existing content, much of which is repetitive and uninteresting. In the future, there will be an increasing need for skilled writers and influencers who can produce engaging and captivating content for AI systems to assimilate.
4	AI-Generated Work Auditor	Security professionals are generally proficient in using AI tools. Although these tools can enhance efficiency, employees are still performing the same job with the same level of responsibility. Due to the potential risks associated with AI, it is possible that new roles will be created where humans are required to audit or analyze the output.
5	AI Prediction Analyzer	As algorithms increasingly take over the responsibility for prediction, it remains crucial for humans to lead in making judgments and decisions based on the predictions provided by AI models.
6	AI Input And Output Manager	As artificial intelligence (AI) becomes increasingly integrated into work processes, there will be a need for individuals to manage the inputs and outputs of AI tools to prevent bias and violations of privacy or security.
7	AI Integration Specialist	These professionals assist organisations in the smooth adoption of AI technology. Their role involves understanding an organisation's workflow, identifying areas that could benefit from AI, and customising AI solutions to suit specific needs.
8	AI Compliance Manager	These professionals will ensure that AI systems comply with legal and ethical standards, addressing issues such as data privacy, bias, and algorithmic transparency to reduce potential legal and reputational risks.
9	AI Ethicist	Developing ethical AI requires AI ethicists who specialize in implementing guidelines for all AI systems. They ensure that these systems are designed and deployed in an unbiased manner, eliminating issues around privacy, fairness, transparency, and accountability.
10	VR Experience Designer	VR experience designers are responsible for creating virtual worlds, simulations, and interactive stories that provide unique and captivating user experiences.
11	AI Applications Developer	As AI continues to grow, companies will require individuals who can guarantee adherence to best practices, performance, and capabilities, all while considering the increasing ethical considerations.
12	AI Instructors	Organizations require AI instructors to design comprehensive training programs that equip employees with the necessary skills and knowledge to work effectively with AI tools and technologies.
13	Language Ingestion Optimizer	With the change in search engine algorithms, new roles were created to influence rankings. Similarly, generative AI models that consume content will require the services of LIOs to promote brands.
14	AI Prompt Engineer	Organizations are actively recruiting AI prompt engineers to assist in the rapid adoption of AI. These engineers work with cross-functional teams and focus on a variety of natural language processing activities, such as prompt optimization, to enhance the performance of large language models. They also conduct code and design reviews.
15	AI Output Verifier	The use of generative AI tools will require skilled professionals to verify the source, quality, and legality of the content produced. This is necessary to ensure that the content is factual, truthful, and valuable to the organization's brand, and does not infringe on any copyrights. Human oversight is crucial in maintaining the integrity of services augmented by generative AI.
16	AI Art Director	An AI art director is responsible for developing the vision for a project, instructing the AI on what is required, and requesting changes when necessary..
17	AI Personality Designer	By utilizing knowledge of human psychology and culture, AI interactions can be made to feel more human-like, transforming AI from a mere set of tools into a meaningful digital companion..

18	AI Security Engineer	The use of AI has led to an increase in new malware, viruses, sophisticated targeted spam, and phishing attacks. As a result, every organization will require the expertise of an AI security engineer to secure against malicious use cases of AI.
19	AI-Assisted Visual Merchandiser	In the retail industry, an AI-assisted visual merchandiser could have a crucial new role by using AI to analyse consumer behaviours and preferences. This role could utilise computer vision and machine learning techniques to create dynamic, personalised displays (static images for in-store). usage or digital images for online promotion) to more effectively attract and engage with prospective customers.
20	Tech Entrepreneur	In the past, creating a mobile app required a team of five to ten people and over $500,000 in seed capital. However, with the help of AI tools that write code, a team of just one or two people with $20,000 can launch a similar app in a matter of weeks. Starting a business has never been easier, even for non-technical founders.

g. AI Tools 3.000+

A range of studies have explored the use of AI tools in various fields. Simões (2022) focuses on future trends in AI and digital transformation, identifying key events and their potential impact on different industries. Li (2021) offers a review of recent trends and industry prospects for AI, emphasizing the role of deep learning and the need to address associated challenges. These studies collectively underscore the growing significance of AI tools in diverse applications and the need for ongoing research and development in this field.

The following is a list of 20 AI tools out of 50 analysed by Sujan Sarkar (2023) released through the link of https://writerbuddy.ai/blog/ai-industry-analysis. Data from various directories covering AI tools, there are 3,000+ tools. From this data, the top 50 most popular AI tools were selected, covering more than 80% of the traffic in the AI sector during the study period (September 2022 to August 2023).

20 Most Visited AI Tools and Their 24B+ Traffic Behavior

Rank	Tool Name	Tool Category	Total Visits (Sep 22 - Aug 23)	Avg Monthly Visits
1	chat.openai.com	AI Chatbot	14.6B	1.5B
2	character.ai	AI Chatbot	3.8B	318.8M
3	quillbot.com	AI Writing	1.1B	94.6M
4	midjourney.com	Image Generator	500.4M	41.7M
5	huggingface.co	Data Science	316.6M	26.4M
6	bard.google.com	AI Chatbot	241.6M	34.5M
7	novelai.net	AI Writing	238.7M	19.9M
8	capcut.com	Video Generator	203.8M	17
9	janitorai.com	AI Chatbot	192.4M	48.1M
10	civitai.com	Image Generator	177.2M	17.7M
11	vocalremover.org	Voice & Music	165.5M	13.8M
12	you.com	AI Chatbot	140.3M	11.7M
13	perplexity.ai	AI Chatbot	134.3M	14.9M
14	cutout.pro	Background Removal	133.5M	11.1M
15	craiyon.com	Image Generator	128.1M	10.7M
16	hotpot.ai	Design	125.3M	10.4M
17	copy.ai	AI Writing	109.3M	9.1M
18	leonardo.ai	Image Generator	101.6M	11.3M
19	jasper.ai	AI Writing	94.9M	7.9M
20	deepai.org	Image Generator	89.1M	7.4M

However, AI also has limitations, such as the inability to mimic human intuition and the potential for errors in programming and processing (Chowdhury, 2012; Al-Tkhayneh, 2023). Despite these limitations, the advantages of AI in education and decision-making are significant

CONCLUSSION

The profound impact of AI across industries underscores the emergence of new professional roles and the transformation of existing ones. Professions such as AI Specialists, Data Analysts, Chatbot Developers, and more exemplify the demand for expertise in AI-related fields, requiring individuals to acquire specialized skills and comprehensive knowledge of AI technology.

AI's integration enhances workplace efficiency, enabling process automation, precise data analysis, and informed decision-making. However, this evolution raises ethical concerns surrounding privacy, data security, and socio-economic implications, especially in terms of job displacement and the evolving nature of human roles in the workforce.

As we navigate the era of Industry 4.0, a crucial emphasis lies in the continuous adaptation to technological advancements. This necessitates a commitment to lifelong learning, fostering an in-depth understanding of AI, and the ability to collaborate effectively with this technology for optimal utilization.

Therefore, embracing AI's potential requires a proactive stance, fostering adaptability, continuous learning, and a comprehensive understanding of AI's responsible use.

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