



# The Possibility of Utilizing AI Technologies in Overcoming Human-Resource Deficiencies and Enhancing Cybersecurity

Eng. Mohamed Ahmed Saeed Abdulla Alzaabi

Faculty Member

Emirates Academy for Identity and Citizenship

United Arab Emirates

amagdi1992@gmail.com

## Abstract

*The research explored strategies for using AI technologies to overcome human resource deficiencies and enhance cybersecurity. It also investigated challenges that hindered the application of these strategies and presented the expected approach towards the reliance on AI technologies in overcoming human resource deficiencies and enhancing cybersecurity. The research used the mixed method approach by employing qualitative and quantitative data. The research population consists of all AI Developers and Heads of Tech Departments in the United Arab Emirates. The research sample was taken using a simple random sampling that included 150 AI Developers. A questionnaire was distributed to each individual to collect quantitative data, while a group interview was conducted for a sample of 10 Heads of Tech Departments for all qualitative data. The findings revealed that the strategies for utilizing AI technologies to overcome the problem of human skills shortages and enhance cybersecurity in the United Arab Emirates were at "moderate" levels. Challenges that hindered leveraging AI technologies and improving the sustainability of cybersecurity came with response degrees of "high". There was complete agreement on relying on AI technologies to compensate for the shortage of human skills and resources and improve cybersecurity sustainability due to the rapid developments in these cyberattacks. The researcher recommended enhancing collaboration between AI technologies and human expertise, rather than completely replacing human expertise with technology, to generate acceptance among individuals concerned about its replacement.*

**Keywords:** AI Technologies, Human-Resource Deficiencies, Cybersecurity.

## Introduction

Artificial intelligence (AI) is a broad phrase including numerous types, utilized to enhance the intelligence of applications or software. In recent years, there has been an important surge in the volume of data available on the internet, leading to accelerated advancements in AI, which now has access to an extensive array of material for learning purposes (Castillo & Taherdoost, 2023). Furthermore, the development of computer systems that can do tasks that normally call for human intelligence is known as AI (AI). These activities cover language translation, speech recognition, visual perception, and problem-solving. AI seeks to mimic human cognitive capacities so that robots can learn from mistakes, adjust to new knowledge, and carry out activities on their own (Palle & Kathala, 2024).

Also, solutions, algorithms, platforms, frameworks, ML data, and training services are all included in AI technology (Ferreira et al., 2023). Moreover, applications for AI technology are numerous and include computer vision, natural language processing, and ML (Santonen & Kaivo-oja, 2023). In addition, AI technologies have emerged as a significant and essential element of the modern corporate environment.

\* This article was submitted in August 2025, and accepted for publication in October 2025. Published Online in October 2025.

DOI: 10.21608/aja.2025.411390.1913

AI technology have proven crucial in optimizing operations, improving decision-making, and cultivating novel business models. They have transformed the competitive strategic environment, with natural language processing (NLP), machine learning (ML), and robots becoming integral to company efficiency and expansion (Bukhtueva, 2024).

Consequently, the investigation of AI technologies in human resources management (HRM) has shown a complex environment, including various uses, advantages, problems, and ethical dilemmas. The application of AI in recruitment and the potential advantages of optimizing HR functions present a range of prospects for organizational improvement (Lungu et al., 2023). In addition, human resources are the paramount assets inside every organization, surpassing all other organizational resources collectively. Human resources denote the collective of individuals collaborating to attain the organization's aims and objectives (Mohammed, 2022).

Besides, various HRM functions have increasingly been transformed through AI technologies. Sophisticated decision aid systems, model learning, motivational arrangements, salary audits, and organizational advisory systems formation and realization are also executed by HRM practice through blending some of AI technology such as data mining, discovery of knowledge, facial detection, natural language interaction, smart robots, image scanning, neural nets, and speech interaction technology (Alsaif & Sabih Aksoy, 2023).

Moreover, by enabling businesses to improve and streamline outdated security procedures, AI has completely transformed the cybersecurity industry. AI can improve vulnerability management, improve threat detection and response capabilities, and fortify governance and compliance. AI (AI) tools such as ML, natural language processing, behavioral analytics, and deep learning can strengthen cybersecurity defenses against a range of online dangers, such as malware, phishing scams, and insider threats (Jawaid, 2023). Cybersecurity encompasses technology, methods, and practices aimed at safeguarding a network, device, data, or software from attacks, damage, or unwanted access. Cybersecurity is often referred to as information technology security (Chitadze, 2022).

Furthermore, AI-based technologies have emerged as a promising paradigm change in cybersecurity, augmenting protection mechanisms against cyber threats. ML techniques, neural networks, and NLP facilitate the detection of threats and enable responses with unparalleled speed and precision. AI-driven technologies provide proactive threat intelligence, allowing enterprises to foresee and address emerging hazards in real-time (Badoni et al., 2024). Moreover, AI possesses significant potential to transform cybersecurity; yet, it also introduces novel obstacles that must be mitigated to guarantee a secure and resilient digital landscape. The interplay between AI and cybersecurity is complex. AI technologies are progressively utilized to bolster cybersecurity measures and to enable cyberattacks (Sarcea 2024).

Therefore, this research endeavors to analyze the double role of AI to automate and streamline HR activities such as hiring, training, and performance management to mitigate employee shortage, and enhance organizational resistance to cyber-attacks through intelligent threat identification, real-time response, and predictive analytics.

## **Problem Statement:**

Cybersecurity encounters difficulties in identifying and alleviating intricate threats. Security solutions utilize Attack Graphs (AGs) to simulate multi-stage attacks; nevertheless, conventional AGs have scalability challenges and may overlook emerging vulnerabilities and attack pathways. Furthermore, conventional AGs create the graph utilizing data regarding previously identified assaults (Mohammadzad et al., 2023). In addition, cyber security faces a number of issues, some of which include the loss of data, concerns regarding privacy, and risk management (Bahtiri et al., 2023). Additionally, the realm of cybersecurity encounters several obstacles due to the swiftly advancing cyber-attacks. Cyber threat intelligence assists cybersecurity

in identifying and thwarting cyber-attacks using various technologies and methodologies. Also, Ratnawita (2025) stated that because of the proliferation of attacks that are based on AI, such as deepfakes and other sophisticated assaults, cybersecurity is facing new problems in this increasingly advanced digital world.

Moreover, according to Sarcea (2024) there is a lack of skilled cybersecurity personnel, as the complexity of cyber threats continues to increase, there is a dearth of workers who are skilled in cybersecurity. By automating mundane operations and enhancing the capabilities of existing security teams, AI technologies have the potential to assist in bridging this gap. Additionally, when it comes to cybersecurity experts, there is a skills gap in comprehending AI technology, which presents a barrier when it comes to maximizing the potential of AI-powered systems (Jimmy, 2021).

Moreover, according to Demirel and Çubukçu (2021) the department of human resources faces challenges when it comes to recruiting workers for the role. These challenges include determining whether or not applicants are qualified and determining the level of success they have achieved. Additionally, Yuling and Shan (2023) state that it is necessary for human resources to improve their skills in the utilization of digital technology such as AI, robots, the Internet of Things, and big data. In order for human resources to be able to adjust to the requirements of the industry, it is essential to have a solid understanding of programs that aim to strengthen these skills. Also, Urbina (2025) indicates that there are significant obstacles that must be overcome before AI may be implemented in human resources. These obstacles include data security and privacy, algorithmic bias, and opposition to organizational change.

In addition, according to Wahjusaputri et al. (2023) human resources are deficient in information, education, and skills pertaining to AI. The substantial expense associated with acquiring knowledge in AI. The availability of learning material is insufficiently supportive for the advancement of AI. Insufficient regulation in the advancement of AI learning.

Consequently, cybersecurity infrastructures are progressively finding it harder to combat highly advanced, multi-step cyber threats due to limitations in traditional solutions such as Attack Graphs, insufficient trained personnel, and the rapidity of AI-driven cyberattacks. The human resource units are also hard-pressed while recruiting skilled cyber security professionals and adapting to changes in technology, particularly in introducing AI tools and digital competences. Lack of knowledge within AI, prohibitive learning costs, privacy of data, and organizational hesitation further complicate the process of HR functions being updated. These interrelated issues highlight the need to investigate how AI technologies can serve as a double solution first by boosting cybersecurity strengths through intelligent automation and threat recognition, and secondly by addressing manpower shortages through efficient hiring, training, and performance evaluation systems.

## **Research Questions:**

The current research revolves around the following questions that are meant to be verified through statistical procedures:

- 1- What is the state of the strategies through which AI technologies can be utilized in overcoming human resource deficiencies?
- 2- What is the state of the strategies through which AI technologies can be utilized in enhancing cybersecurity?
- 3- What are the challenges that hinder the strategies through which AI technologies can be utilized in overcoming human resource deficiencies?
- 4- What are the challenges that hinder the strategies through which AI technologies can be utilized in enhancing cybersecurity?
- 5- What is the expected approach towards the reliance on AI technologies in overcoming human resource deficiencies and enhancing cybersecurity?

## **Literature Review:**

### ***Conceptual Notion of AI:***

The world has become a global village due to technological advancements and improved communication channels (Mahajan, 2024). AI (AI) is a significant type of technology which mainly depends on information that analyzes and influences intelligence by developing systems which replicate human abilities like learning, thinking, planning, decision-making, creativity, and more (Keresztesi, 2022). Currently, AI is considered one of the most fascinating and all-encompassing fields in computer science. AI also refers to the capability of a computer to think, listen, and solve problems. It is specialized in creating a machine that is capable of autonomous thought (Aljaber & Almushaili, 2022).

Moreover, AI is one of the most revolutionary and transformative technologies all over the world. Due to the capability of AI to mimic human intelligence and decision-making processes, it leads to a time where robots are not merely tools but also participants in problem-solving, invention, and decision-making. Advances in neural networks, machine learning, deep learning, and natural language processing have accelerated the development of AI. Therefore, AI is already influencing almost every aspect of life from the small electronics to the complex systems that drive economies and enterprises (Vinothkumar & Karunamurthy, 2023).

### ***The Application and Technologies of AI:***

AI has advanced so quickly that it is now a vital technology in a wide range of sectors, including robotics, automation, computer vision, natural language processing, medicine, education, research, and retail marketing services in all industries. It's got realized significant progress in these fields during the last ten years, resulting in a plethora of opportunities and related difficulties. Moreover, AI systems affect industry activities and job efficiency. There are many related branches to AI such as; industries, healthcare, education, and marketing service which have numerous advantages to its use (Salau et al., 2022).

Additionally, AI is used in a variety of applications, including (Aljaber & Almushaili, 2022):

- 1- Healthcare applications of AI.
- 2- Business AI applications.
- 3- The utilization of AI in education.
- 4- Financial application in AI.
- 5- The utilization of AI in legal application.
- 6- The utilization of AI in the production sector.
- 7- The utilization of AI in banking.
- 8- Transportation-related AI.
- 9- The utilization of AI in security or defense sector.

Recently, AI technology has advanced at an unparalleled rate, changing daily interactions, economies, and businesses. Deep learning, natural language processing, and generative adversarial networks are some of the key AI technologies that have advanced AI applications to new levels. These developments have empowered finance with predictive analytics, transformed healthcare with precise diagnoses, and made it possible for autonomous systems to traverse the environment (Vinothkumar & Karunamurthy, 2023).

### ***Components of AI:***

A variety of components are needed to give specialized skills and functionalities due to the complexity and sophistication of AI. Together, these elements allow AI to tackle ever-more-complex issues, making it a vital tool for contemporary companies and institutions. AI cannot operate at its best without these essential sub-components, which limits its capacity to offer creative answers to the most pressing problems facing the globe. Some of the essential elements of AI are: (a) Machine Learning, (b) Natural Language Processing

(NLP), (c) Computer Vision(d), Neural Networks, (e) Deep Learning, (f) Cognitive Computing (Srinivasaiah, 2024).

### **Conceptual Notion of Human Resources:**

Human resources refer to the organization's view of its people as its most significant assets. Human resource management focuses on how to find, choose, train, and keep employees in the company (Ramachandran et al., 2019). Broadly, Human resources are the source of labor for social growth and manufacturing production. In a limited sense, human resources are the working-age population's ability to engage in the labor market and manufacturing production, as well as the labor capacity of society and a resource for socioeconomic development (Ngoc & Tien, 2023).

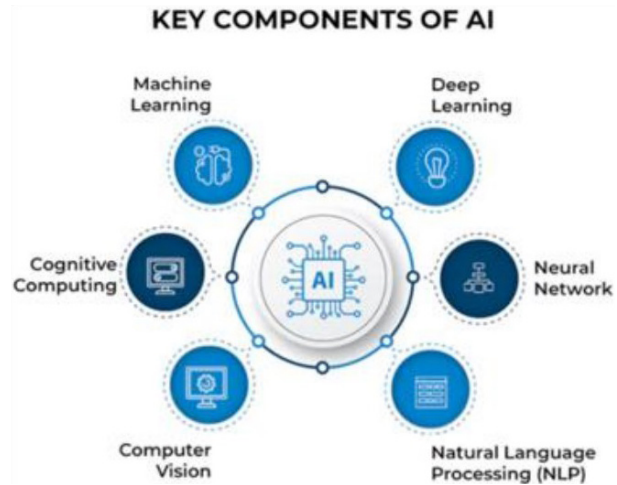
Adversely, the HR deficiencies can be represented by Traditional organizational learning theories of career advancement and skill development, which are mechanically presented in formal Valentines, are being shown to be insufficient in this situation. The flexibility needed to meet changing needs is not possible with static training. Linear career routes, however, do not take into account the varied and evolving nature of modern employment. Therefore, new strategies must be developed in order to successfully adjust companies and workers to the demands of the workforce in the future (Johnson, 2023).

### **Components of Human Resources:**

Human resources range in their knowledge, abilities, personalities, emotions, values, family status, and nationalities. managing people is tough and complex work. Additionally, human resources have different certifications and skill sets (Alam, 2023). Human resources development (workers' abilities, effectiveness, productivity, and performance), skills management, attrition, and turnover were the most often requested HR-related issues. Some well-known software, frameworks, and Enterprise resource planning (ERP) as well as AI techniques (Machine Learning, Neural Network, Deep Learning), were among the technologies that were addressed in the suggested solutions (Berhil et al., 2020).

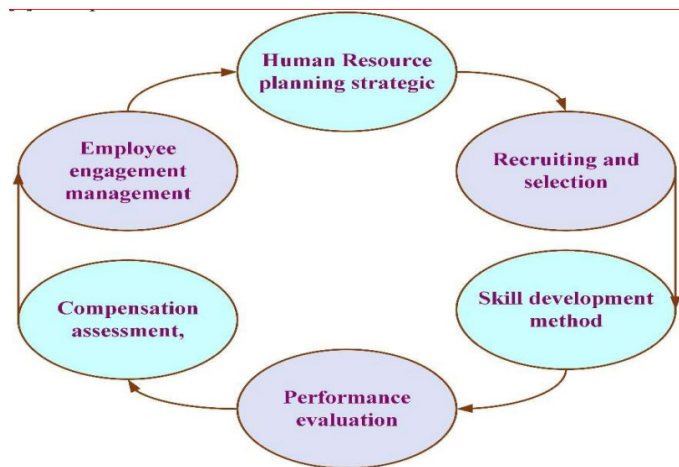
Moreover, Human resources management consists of the following (Orosoo et al., 2023):

- 1- Planning for human resources mainly helps the company anticipate future staff needs and essential traits of the workforce via the technique.
- 2- The organization's vitality is recruitment and execution, with human resources management as a contribution that provides nourishment, addresses organizational staffing, and solves personnel identification issues.



Source: (Srinivasaiah, 2024)

**Figure 1: The Components of AI**



Source: (Orosoo et al., 2023)

**Figure 2: The Components of HRM**

- 3- Professional development is a term that involves learning.
- 4- Quality management serves as the foundation for the six dimensions. It also acts as the main source of data for additional measurements.
- 5- To encourage people to overcome obstacles at work is the goal of performance management.
- 6- Managing employees and enhancing the organization's ability to develop an efficient process of acceptable human resource allocation are the main goals of employee relationship management.

### ***The Utilization of AI in Overcoming Human-resource Deficiencies***

According to (Orosoo et al., 2023), AI has been extensively studied in many different fields. The more globalized the world is, the more technology the world requires, and accordingly, the necessity for companies to be competitive and innovative is observed. Human resource management, has been a fundamental aspect in the case of recruiting people who possess crucial knowledge and skills. Most of the activities that were once of a manual nature can be mechanized nowadays because of advanced technology.

Johnson, (2023) believed that AI can offer a transformative method for enhancing employees' skills and charting their career trajectories. In contrast, AI-powered teamwork enables the collection of real-time data about job satisfaction and employee capabilities, skill gaps, and career prospects that best suit each worker's goals and abilities. Because AI can process data, it can effectively evaluate information from a variety of sources, such as feedback, project outcomes, and performance reviews, and use that knowledge to customize learning and development initiatives. Because of this, training efforts focus on the most important areas, allowing employees to acquire the skills that are necessary for the firm. One of the primary advantages of AI in workforce development is its ability to forecast future skill demand. AI also enables proactive career path recommendations to employees based on their skills, interests, and successes. Employee engagement and motivation to take charge of their career advancement plans are guaranteed by these qualities.

Machado, (2024) also stated that AI facilitates employee development and training more successfully. HR systems keep track of all current employees' details and give the company an online personnel list. Consequently, it aids in determining skill deficiencies and developing suitable training programs. The process of finding a suitable candidate within the firm might also be aided by it. Digital and virtual training has numerous advantages for the company and its staff. These technologies can be used by employees to manage their future career chances in an efficient manner.

According to (Ghedabna et al., 2024), human resource management is evolving as a result of AI. incorporating technology into the more complex area of human resource management. By suggesting personalized training, skill development, and career advancement for staff members, AI enhances human capital for businesses. AI has begun to be adopted by human resource management, and this is altering the current environment. In the field of human resource management, AI is rapidly gaining traction in key areas like as hiring, performance evaluation, and staff development.

Machado, (2024) AI facilitates employee development and training more successfully. HR systems keep track of all current employees' details and give the company an online personnel list. Consequently, it aids in the discovery of skill deficiencies and the development of suitable training programs. In addition to assist firms in finding the right applicant within the company. Both the company and its employees can profit greatly from virtual and digital training. These technologies can be utilized by staff members to efficiently manage their future professional opportunities. If workers' skill sets are lacking, AI systems could help determine what training they need and make it easier for them to finish the required coursework.

Orosoo et al., (2023) AI is excellent at developing skills as well. Workers can participate in customized learning programs that are made to fit their particular needs and enhance their overall skill sets. Perfor-



mance evaluation is rendered more objective by AI, which eliminates biases and offers insightful information on areas that want improvement. AI's data-driven approach also aids in trouncing the HRM deficiencies in evaluating pay and employee engagement. AI in HRM is not just trendy; it is strategically necessary. It also reduces biases, increases productivity, and frees up HR professionals to work on high-value, critical projects. As technology advances, HRM will rely more and more on AI to make the most of the workforce.

Ghedabna et al., (2024) noted that AI has the potential to improve workplace productivity, reduce bias in judgment, and ultimately promote constructive decision-making when included into the human resource management process. Based on their data, AI algorithms can forecast how applicants will perform and search candidate databases to identify those groups of the most accomplished people. The capacity to identify skill deficiencies within a company and provide appropriate training.

Li, (2024) detailed that communication platforms are popular internet networks that give workers a way to stay in touch with each other, which makes it easier to solve problems at work. Online meetings and instrument repair are made easier by the program. Unlike traditional communication platforms, HR technology integration allows for the prompt detection of problems across the organization's departments. Additionally, this connectivity makes it easier to generate reminder reports, which helps managers identify issues and promote departmental cooperation to guarantee that work processes run smoothly.

### ***Conceptual Notion of Cybersecurity***

In addition, security of information and cyberspace is increasingly becoming important in the modern world. All areas of human life are increasingly becoming digital. Scientific and technological trends analysis indicates that individuals are increasingly depending on digital instruments, companies on network databases, banks on electronic payments, and countries on computer technology and software to manage strategically significant weaponry. Professional cybercriminal gangs take over people's computers and devices of every sort every day and launch all manner of malicious software against websites. Phone lines, businesses, ATMs, and even presidential sites of world leaders come to a stop in just a few seconds (Loishyn et al., 2021).

To align the transformations happening in cyberspace newly, cybersecurity has experienced great development. Cybersecurity is also seen as the strategy that can be pursued by a nation or an organization to safeguard its data and commodities that are utilized in cyberspace (Hussain et al., 2020). By contrast, the cunning and ubiquity of contemporary cyberthreats confer the world of cybersecurity with heretofore unseen challenges amid the fast-shifting digital terrain. The rigid controls and one-off processes utilized by legacy security appliances like firewalls and intrusion detection mechanisms are becoming decreasingly effective vis-a-vis the dynamic and elaborate nature of new threats. These technologies' fast false-positive responses, delayed response times, and noticeable need for human intervention come from their inability to detect complex tactics like (Salem et al., 2024).

### ***The Utilization of AI in Enhancing Cybersecurity***

According to (Khan et al., 2024), AI has the potential to revolutionize cybersecurity processes dramatically, and therefore it is crucial to overcome moral and practical challenges to be in a position to leverage this technology to the maximum. By taking advantage of AI-driven solutions and developing a culture of learning and adaptation on an ongoing basis, organizations can enhance their cybersecurity position and effectively manage an ever-changing threat environment.

Roshanaei et al., (2024) stated that due to the development and integration of machine learning (ML) and AI, the cybersecurity landscape is changing quickly. Because both of AI and ML can strengthen defenses against increasingly complex threats, they are transforming cybersecurity. These technologies have demonstrated efficacy in recognizing and preventing cyber-attacks, and they are especially useful in fields with substantial data quantities and dynamic situations. undoubtedly, AI and ML are revolutionizing cyber-

security processes, and companies must integrate them if they want to increase their capacity to identify, address, and prevent possible breaches.

Salem et al., (2024) assumed that by tackling issues like insider threats, which present serious risks from within the company and are hard to identify with traditional techniques, and botnets, which are networks of compromised devices under the control of malevolent actors that can launch coordinated attacks that overwhelm conventional defenses, AI is a vital tool in the development of more robust and scalable cyber security solutions.

According to (Jonas et al, 2023), AI is essential for enhancing cybersecurity because it makes it easier to detect risks more quickly, responds to phishing assaults more effectively, and proactively detects threats through behavioral analysis. Furthermore, it is crucial for reducing threats that are both known and unknown. AI can be utilized to address the unique issues presented by contemporary threats. This includes identifying corporate and cyber dangers, both known and unknown. AI developments are positioned to close the gap caused by unknown threats in the cybersecurity space because of their ongoing learning, flexibility, and ability to spot irregularities that traditional cybersecurity procedures might otherwise miss.

Adewusi et al., (2022) stated that advanced skills provided by AI technologies improve cyber threat identification, analysis, and mitigation, resulting in a more proactive and effective approach to cybersecurity. Significant AI instruments for cybersecurity include automated incident response, machine learning and predictive analytics, anomaly detection systems, and AI-driven threat intelligence. Additionally, the combination of AI-driven threat intelligence, automated incident response, anomaly detection systems, machine learning and predictive analytics, and other components offers an effective basis for protection against online attacks. By proactively identifying, analyzing, and responding to attacks, these AI-driven solutions help companies protect the security and integrity of their digital assets in a dynamic and ever-changing threat landscape.

According to (Camacho, 2024), Given the growing complexity and frequency of cyberthreats, cybersecurity is a top priority in today's digital environment. An effective instrument for enhancing defenses against these changing threats is AI. The different methods that AI is utilized in cybersecurity. AI systems can quickly scan enormous data sets for unusual patterns that could be signs of security breaches by utilizing machine learning methods. Additionally, AI-powered solutions make proactive defenses possible, enabling businesses to proactively reduce risks and protect private data.

## **Research Methodology**

### ***Firstly: Methodological Selection***

The research relied on the mixed method as the method that works to use qualitative and quantitative data and methods together in one research project to provide a better understanding of research problems compared to using either of them alone."

### ***Secondly: Research Population and Sample***

The research population consists of all AI Developers and Heads of Tech Departments in the United Arab Emirates. The research sample was taken using a simple random sampling that included (150) AI Developers. A questionnaire was distributed to each individual to collect quantitative data, while a group interview was conducted for a sample of (10) Heads of Tech Departments for all qualitative data.

### ***Thirdly: Characteristics of the Research Sample (Quantitative)***

The following formula was used to determine the frequencies and percentages of the research sample participants' general information, which is represented by demographic data such as gender and years of experience:



According to the preceding table, the highest percentage of sample participants by gender is 70.7% for males, followed by the lowest percentage for females (29.3%); the highest percentage of sample participants by years of experience is 44.0% for those with more than 10 years of experience, followed by 32.7% for those with 5 to less than 10 years of experience, and the lowest percentage (23.3%) for those with less than 5 years of experience.

**Table No. (1) Distribution of Sample Individuals According to their Characteristics**

| Gender                       | Frequencies | Percentages |
|------------------------------|-------------|-------------|
| Male                         | 106         | 70.7%       |
| Female                       | 44          | 29.3%       |
| <b>Total</b>                 | <b>150</b>  | <b>100%</b> |
| Years of Experience          | Frequencies | Percentages |
| Less than 5 years            | 35          | 23.3%       |
| From 5 to less than 10 years | 9           | 32.7%       |
| More than 10 years           | 66          | 44.0%       |
| <b>Total</b>                 | <b>150</b>  | <b>100%</b> |

#### **Fourthly: Research Tools (Questionnaire, Interview)**

The researcher constructed (a questionnaire and interview) to find out the possibility to use AI techniques in resolving the problem of shortage of human resources and rendering cybersecurity more sustainable. The instruments were tested for validity and reliability through multiple means, such as the arbitrators' validity, where the questionnaire and interview were presented to the arbitrators for ruling the linguistic phrasing, clarity, and to what extent the statements belong to the questionnaire and the core question of the interview. More than 80% of the arbitrators were unanimous that the words in certain sections of the questionnaire must be removed and rewritten. For this reason, the final questionnaire after arbitration contained 24 statements across 4 axes, whereas that of the interview had 1 question. It was also validated by using it on a sample survey of thirty statements. Internal consistency was approximated by calculation of the Pearson correlation coefficient between every statement score and the overall score of the axis of the questionnaire to which the statement is assigned. The Pearson correlation coefficients ranged from .714\*\* to .880\*\*, all statistically significant at the level of (0.01). The correlation coefficients of axes were compared to the total score of the questionnaire, varying between .775\* and .878\*\*, and all of which at a level of (0.01) statistically significant; overall construct validity of axes of questionnaire was confirmed. The Cronbach's alpha reliability coefficients of the axes of the questionnaire and its overall score were checked; the Cronbach's alpha reliability coefficient of the axes of the questionnaire ranged from .861 to .905, and the overall reliability coefficient of the questionnaire was (.943). The reliability values indicate the feasibility of the questionnaire and the chance that its output can be believed. The tool of research (questionnaire) was modified according to a 5-point Likert scale.

#### **Fifthly: Statistical Methods**

These results were downloaded via the below statistical procedures by the researcher from Statistical Package for the Social Sciences (SPSS) computer package: Pearson correlation coefficient, Cronbach's alpha coefficient, percentage and frequency, arithmetic mean and standard deviations, range equation is used to determine verification degree for all dimensions: Response degree was calculated as below; the degree of very low (1), low (2), moderate (3), high (4), and very high (5).

$$\text{Category length} = \frac{\text{Max.limit} - \text{Min.limit}}{\text{No.of levels}} = \frac{5 - 1}{5} = 0.80$$

- From "1 to less than 1.80 represents a very low response degree".
- From "1.80 to less than 2.60 represents a low response degree".
- From "2.60 to less than 3.40 represents a moderate response degree".
- From "3.40 to less than 4.20 represents a high response degree".
- From "4.20 to less than 5 represents a very high response degree".

## Presenting, Discussing, and Interpreting the Research Results:

### *Firstly: The Results of the First Question: "What is the reality of strategies for leveraging AI technologies to overcome the problem of human skills shortages?"*

The arithmetic means and standard deviations were calculated for the statements in the first axis: Strategies for leveraging AI technologies to overcome the problem of human skills shortages, to answer this question. These statements were then arranged in descending order according to the arithmetic mean for each statement, as shown in the following table:

**Table No. (2) Arithmetic Means and Standard Deviations of Sample Individuals' Responses to the Statements of the First Axis: Strategies for Leveraging AI Technologies to Overcome the Problem of Human Skills Shortages**

| No.             | Statement                                                                                     | Arithmetic Means | Standard Deviations | Rank     | Response Degree |
|-----------------|-----------------------------------------------------------------------------------------------|------------------|---------------------|----------|-----------------|
| 1               | AI technologies help perform repetitive tasks.                                                | 2.96             | 1.390               | 6        | Moderate        |
| 2               | AI technologies enable the implementation of tasks that require rapid analysis.               | 3.34             | 1.310               | 3        | Moderate        |
| 3               | AI technologies offer intelligent alternatives to human expertise.                            | 3.08             | 1.245               | 5        | Moderate        |
| 4               | AI enhances the operational efficiency of organizations.                                      | 3.58             | 1.317               | 1        | High            |
| 5               | AI technologies maintain a high level of performance despite a shortage of human talent.      | 3.18             | 1.415               | 4        | Moderate        |
| 6               | AI technologies support digital transformation, which helps fill the gap in technical skills. | 3.46             | 1.566               | 2        | High            |
| Overall Average |                                                                                               | 3.27             | .715                | Moderate |                 |

It is clear from the previous table that the overall average for the first axis: Strategies for leveraging AI technologies to overcome the problem of human skills shortages, came with an arithmetic mean of (3.27), a standard deviation of (0.715), and a response degree of (moderate)

Strategies for leveraging AI technologies to overcome the problem of human skills shortages, received a "moderate" response degree. This can be explained by the fact that many organizations lack clarity on how to use AI as a practical solution to address the human resources shortage, which may be due to a lack of awareness of AI's ability to efficiently perform repetitive tasks, which limits reliance on these technologies.

### *Secondly: The Results of the Second Question: "What is the reality of strategies for leveraging AI technologies to enhance the sustainability of cybersecurity?"*

To address this question, the arithmetic means and standard deviations of the statements on the second axis were computed. The arithmetic mean for each of these statements was then used to arrange them in decreasing order, as the accompanying table illustrates.

**Table No. (3) Standard Deviations and Arithmetic Means and of Sample Individuals' Responses to the Statements of the Second Axis: Strategies for Leveraging AI Technologies to Enhance the Sustainability of Cybersecurity**

| No.             | Statement                                                                                         | Arithmetic Means | Standard Deviations | Rank     | Response Degree |
|-----------------|---------------------------------------------------------------------------------------------------|------------------|---------------------|----------|-----------------|
| 7               | AI technologies contribute to early detection of cyber-attacks.                                   | 3.32             | 1.377               | 2        | Moderate        |
| 8               | AI technologies are constantly being used to adapt to new cyber-attacks.                          | 2.84             | 1.461               | 6        | Moderate        |
| 9               | AI technologies enhance the speed of response to cyber-attacks without direct human intervention. | 3.23             | 1.435               | 3        | Moderate        |
| 10              | AI technologies provide reports that help make quick decisions.                                   | 2.93             | 1.524               | 5        | Moderate        |
| 11              | AI technologies can predict future cyber-attacks by analyzing past patterns.                      | 3.42             | 1.494               | 1        | High            |
| 12              | AI techniques are being used to continuously identify security vulnerabilities.                   | 3.03             | 1.383               | 4        | Moderate        |
| Overall Average |                                                                                                   | 3.13             | .820                | Moderate |                 |

The preceding table makes it evident that the second axis's overall average had an arithmetic mean of 3.13, a standard deviation of 0.820, and a response degree of (moderate).

The second axis, Strategies for leveraging AI technologies to enhance the sustainability of cybersecurity, achieved a "moderate" response degree. This can be attributed to the overlap of several factors that hinder the use of AI in cyberspace, the most important of which is the lack of institutional awareness of AI capabilities.

Institutions also face a shortage of qualified human resources to develop these technologies more effectively, and many institutions may lack policies that support these technologies, raising legal and ethical concerns related to privacy and security for individuals.

***Thirdly: The Results of the Third Question: “What are the challenges of leveraging AI technologies to overcome the problem of human skills shortages?”***

The third axis's arithmetic means, and standard deviations of the following statements provide an answer to this query: The challenges of leveraging AI technologies to overcome the problem of human skills shortages were estimated. The arithmetic mean for each of these statements was then used to arrange them in decreasing order, as the following table illustrates:

***Table No. (4) Standard Deviations and Arithmetic Means and of Sample Individuals' Responses to the Statements of the Third axis: Challenges of Leveraging AI Technologies to Overcome the Problem of Human Skills Shortages***

| No.             | Statement                                                                                                                      | Arithmetic Means | Standard Deviations | Rank | Response Degree |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------|-----------------|
| 13              | The high cost of AI technologies hinders the ability to compensate for the shortage of human talent.                           | 3.71             | 1.353               | 2    | High            |
| 14              | It is difficult to integrate AI technologies with existing systems in organizations.                                           | 3.51             | 1.365               | 4    | High            |
| 15              | There is resistance from employees in organizations to effectively implementing AI technologies.                               | 3.82             | 1.336               | 1    | High            |
| 16              | The current digital infrastructure of organizations hinders the use of AI technologies.                                        | 3.45             | 1.504               | 5    | High            |
| 17              | Lack of awareness of the benefits of AI technologies impacts the application of these technologies in developing human skills. | 3.63             | 1.444               | 3    | High            |
| 18              | Privacy and information security concerns limit the expansion of AI applications.                                              | 3.33             | 1.354               | 6    | Moderate        |
| Overall Average |                                                                                                                                | 3.58             | .708                |      | High            |

The arithmetic mean for the third axis was 3.58, the standard deviation was 0.708, and the response degree was “high” according to the previous table.

The third axis, Challenges of leveraging AI technologies to overcome the problem of human skills shortages, received a high response degree. This can be explained by the fact that developing AI solutions to overcome the problem of human skills shortages requires advanced technical expertise that is not readily available. This creates a need for highly skilled individuals to use AI itself. Some organizations may also face challenges related to technological infrastructure, such as a lack of integrated digital work environments qualified to train AI algorithms.

***Fourthly: The Results of the Fourth Question : “What are the challenges of leveraging AI technologies to enhance the sustainability of cybersecurity?”***

The arithmetic means and standard deviations of the statements in the fourth axis were computed in order to respond to this query. The arithmetic mean for each of these statements was then used to arrange them in decreasing order, as the accompanying table illustrates:

***Table No. (5) Arithmetic Means and Standard Deviations of Sample Individuals' Responses to the Statements of the Fourth Axis: Challenges of Leveraging AI Technologies to Enhance the Sustainability of Cybersecurity***

| No. | Statement                                                                                                                  | Arithmetic Means | Standard Deviations | Rank | Response Degree |
|-----|----------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------|-----------------|
| 19  | The lack of human resources capable of integrating AI and cybersecurity technologies hinders security sustainability.      | 3.47             | 1.389               | 6    | High            |
| 20  | There is difficulty in understanding and interpreting some of the decisions made by AI technologies used in cybersecurity. | 3.87             | 1.312               | 3    | High            |
| 21  | Privacy and sensitive information are barriers to the use of cybersecurity technologies.                                   | 3.67             | 1.445               | 4    | High            |

| No.             | Statement                                                                                                                   | Arithmetic Means | Standard Deviations | Rank | Response Degree |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------|------------------|---------------------|------|-----------------|
| 22              | There is a lack of awareness among decision makers about the potential of AI technologies for cybersecurity sustainability. | 4.06             | 1.302               | 1    | High            |
| 23              | Current digital infrastructure is a barrier to the implementation of AI technologies used to detect cyber-attacks.          | 3.54             | 1.487               | 5    | High            |
| 24              | AI-powered cyber-attacks are outperforming current defense systems.                                                         | 3.95             | 1.302               | 2    | High            |
| Overall Average |                                                                                                                             | 3.76             | .555                |      | High            |

As can be seen from the previous table, the overall average for the fourth axis had a response degree of (high), an arithmetic mean of 3.76, and a standard deviation of 0.555.

The fourth axis received a high degree of response. This can be attributed to the increasing complexity of cyberattacks, which require highly capable AI models to keep pace with these ever-evolving threats. This is made difficult by the limitations of the high-quality data needed to train these models. This increase may also be due to the lack of specialized skills in integrating AI and cybersecurity, which leads to a gap in the ability to design and implement these solutions.

***Fifthly: The Results of the Fifth Question: “What is the expected trend toward relying on AI technologies to overcome the human skills shortage and improve the sustainability of cybersecurity?”***

After the researcher conducted a group interview with several heads of technology departments to uncover the expected trend toward relying on AI technologies to overcome the human skills shortage and improve the sustainability of cybersecurity soon, the responses were analyzed in the following axes:

Compensating for the human skills shortage. Despite the presence of highly skilled human resources, there are deficiencies in some aspects that prevent the sustainability of cybersecurity. This is due to the increasing complexity of cyberattacks. With the increase in AI technologies specialized in identifying and repelling cyberattacks, such as predictive analysis and automatic detection of these threats, it is easier to compensate for the human skills shortage and reduce reliance on experienced individuals. Some responses also indicated using AI technologies in routine operations, saving time and effort for individuals to focus on other tasks.

Some responses indicated a clear trend that contradicts the complete replacement of human expertise by integrating human expertise with these technologies. This is achieved by improving human decisions and supporting them with suggestions to improve the quality of these decisions. This is achieved by exposing these technologies to repetitive tasks that generate algorithms that help understand these tasks and how to find a better way to deal with them. Participants agreed that AI technologies are not a complete replacement for human capabilities (as is currently prevalent) but rather are considered a supportive tool to facilitate tasks, provide individuals with better plans to deal with them and enhance security performance. Some responses also indicated that AI technologies contribute to enhancing the speed of response to cyber-attacks by early detection of these threats and their rapid analysis, as well as by providing a way to deal with them.

Some responses pointed to challenges facing implementing these technologies in the desired manner that provides their full benefits, namely the difficulty of integrating these technologies with existing systems, which may be resolved soon. This is due to the economic, social, and strategic importance of these technologies, which include reducing operating costs, increasing efficiency, improving the performance of security teams, and reducing the need for many employees. It also helps deal quickly and smoothly with big data, which takes a lot of time when handled by humans. Some other responses pointed to another type of challenge: the high cost of some of these technologies, which organizations with limited budgets face. However, some other responses pointed to this point, stating that the current intense competition between technologies will lead to the creation of less expensive programs to address these challenges.

### Summary of Results:

- 1- The reality of strategies for utilizing AI technologies to overcome the problem of human skills shortages in the United Arab Emirates is at a “moderate” level, given the lack of a clear vision to date in the manner hoped for to fully utilize these technologies.
- 2- The reality of strategies for leveraging AI technologies to enhance the sustainability of cybersecurity came with a response degree of “moderate,” which is the same level as overcoming the problem of human skill shortages, confirming this theory.
- 3- Therefore, it is natural that the challenges of leveraging AI technologies to overcome the problem of human skills shortages came with a response degree of “high,” given the aforementioned fact that these technologies require advanced expertise that is not yet available.
- 4- The challenges of leveraging AI technologies to enhance the sustainability of cybersecurity also came with a response degree of “high.”
- 5- While considering the expected trend toward relying on AI technologies to overcome the human skills shortage and improve the sustainability of cybersecurity, the results concluded that there is complete agreement on relying on AI technologies to compensate for the shortage of human skills and resources, as well as to enhance and improve cybersecurity sustainability due to the rapid and massive developments in these cyberattacks. It was concluded that there is no complete replacement for human expertise, but rather, the integration of these technologies with human expertise was indicated.

### Recommendations

- 1- Enhancing collaboration between AI technologies and human expertise rather than completely replacing human expertise with technology generates acceptance among individuals concerned about its replacement.
- 2- Investing in developing these technologies and integrating them with existing systems to fully utilize them and realize the expected economic, security, and social benefits.
- 3- Providing courses and workshops for those working in the fields of AI and cybersecurity to effectively utilize these technologies, enhancing their ability to make sound decisions in less time and with guaranteed results.
- 4- Investing in research and development to produce low-cost technologies, as is common in today’s intense competition, enabling organizations with limited budgets to utilize these technologies.
- 5- Conducting periodic assessments to determine the effectiveness of AI technologies to ensure the sustainability of cybersecurity, given the continuous evolution of technological and cyber threats.

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