"Artificial Intelligence (AI) and Employment in the Arab Countries"

Dr. Hanan Nazir

D. Mona El-Sayed

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Hanan Nazier
Professor of Economics
Faculty of Economics and Political Science
Cairo University

Mona Elsayed
Assistant Lecturer of Economics
Faculty of Economics and Political Science
Cairo University

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1. Abstract

Recent developments in AI technology have raised many concerns regarding the future of work. While there is a positive impact of AI on productivity and employment, it is associated with considerable disruption to the nature of tasks performed in different jobs and the skill profile required for workers. In this context, this paper addresses the potential impact of AI in the labor market, focusing on non-Gulf Arab countries that have typically suffered from persistently high unemployment rates. The overall discussion suggests that AI is considerably augmenting jobs, but its effect differs considerably based on the job skill level. Arab countries, however, are found to be less exposed to AI. This is because most employment is concentrated in traditional non-tradable activities that are less likely to be augmented by AI on the one hand, and the relatively lower performance in terms of AI development at different levels in these countries.

2. Introduction

The 21st century marks the beginning of the fourth industrial revolution (4IR) that is characterized by the widespread use of highly interrelated technologies such as artificial intelligence, machine learning, robotics, the internet of things, and big data, among others, which are associated with enormous productivity gains and growth. Recent projections suggest that artificial intelligence is projected to add from $17.1 to $25.7 trillion to the global economy and an increase between 1.5 to 3.4 percentage points in the average annual GDP growth rate in developed countries over the next decade (McKinsey & Company, 2023). The artificial intelligence market is also expected to expand in the MENA region from $500 million in 2020 to about $8.6 billion by 2026 (Asad, 2024).

Despite such benefits, recent technologies are also expected to have both positive and negative implications on labor markets in terms of job creation. While some new jobs are created as a result of their emergence, some others are either augmented or displaced by these technologies (Ismail & Rizk, 2021). This is because recent advancements in technology in the field of AI have become increasingly capable of substituting workers in a wide range of tasks that have been previously confined to humans, including nonroutine tasks (Frey & Osborne, 2017).

Existing literature on developing countries suggests that the effect of these technologies is not as important as that of developed countries, as most workers are of relatively lower skills and are concentrated mainly in low-level manual jobs that are relatively less prone to automation (Das & Hilgenstock, 2022; Lewandowski et al., 2019; Pena & Siegel, 2023). Nevertheless, workers in developing countries are still at risk of substitution. Projections reveal that, on average, around 45% of existing work activities in the Arab countries will potentially no longer need human intervention compared to a global rate of 50%, placing around 20.8 million workers at high risk of being displaced by sophisticated technologies (Moore et al., 2018).

The main aim of the current study is to examine the potential impact of AI on employment in non-Gulf Arab countries. Although many studies have already addressed this impact in developed countries, there is a scarcity of studies that tackle it in Arab countries, particularly non-Gulf Arab countries. The deficiency of literature available is typically attributed to the fact that AI applications in job tasks are relatively limited in these countries compared to developed countries and Gulf Arab countries where AI technology now has many applications in different aspects of

their economies. However, the accelerating pace of technological developments will make AI technology increasingly impact the labor markets of non-Gulf Arab countries, especially since these countries have been already suffering from high unemployment rates for many decades.

Therefore, this study seeks to fill in this gap by addressing the AI-employment nexus focusing on this country group by answering the following question: *what are the potential employment implications of AI technology in non-Gulf Arab countries?* To answer this question, the study specifies the following minor questions:

- What is the current status of the Arab countries' labor markets in terms of employment profile and AI readiness?
- To what extent does AI impact jobs and skills demand in the global labor market?
- To what extent does AI impact jobs and skills demand in the Arab countries' labor market?
- What is the size of employment that is exposed to the risk of AI technology?
- What policy recommendations could be suggested to maximize the potential net impact of AI technology on employment creation and to qualify the labor force with the necessary skills needed to cope with AI technology?

The study focuses particularly on seven main non-Gulf MENA region countries, whenever data is available (i.e., Algeria, Egypt, Jordan, Lebanon, Morocco, Tunisia, and Sudan). We apply mixed methodologies throughout the analysis. First, the descriptive approach is followed by reviewing previous literature on the technology-employment and technology-skills demand nexuses. Second, the analytical and comparative approaches are adopted while analyzing the different employment and readiness indicators relevant to the previously mentioned research questions.

The study draws upon data from the International Labor Organization (ILO) and the World Bank's World Development Indicators in exploring the employment profile of the Arab countries (ILOSTAT, 2024; World Bank, 2024). It also uses key AI-related indicators published by different international institutions to assess AI readiness among Arab countries. These indexes include the AI Government Readiness Index (AIG), the Network Readiness Index (NRI), the Globa Innovation Index (GII), and the Global AI Index (GAI) (Oxford Insights, 2023, 2023; Portulans Institute, 2023; Tortoise, 2023). Additionally, it utilizes data from international organizations and recent studies such as the World Economic Forum (2023), the Economic and the Economic, Social Commission for Western Asia (ESCWA), and Felten, Raj, and Seamans (2021) in discussing the impact of global trends in technology on net job creation and skills (ESCWA, 2021, 2023; Felten et al., 2021; WEF, 2023).

The rest of the paper is structured as follows: Section 3 reviews the theoretical and empirical literature on the nexus between technology and employment and skills; Section 4 tackles the employment profile in Arab countries and their AI readiness. Section 5 examines the expected impact of AI technology on the labor market and the degree of AI exposure in Arab countries. Section 6 presents the concluding remarks of the paper and proposes some policy recommendations.

3. Literature Review

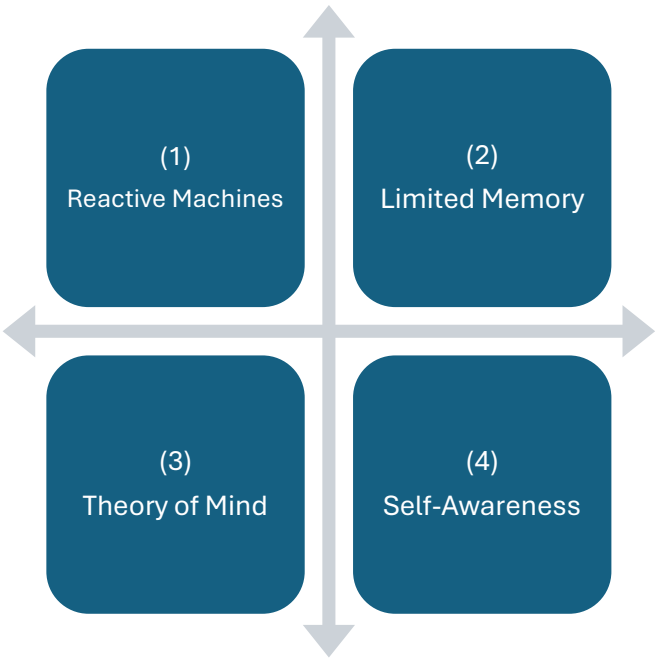
3.1. Conceptional Framework

AI could be defined as *"An element of machines that represent a form of intelligence, rather than simply achieving computations that are input by human users"*. The concept was first introduced in the 1950s by mathematician John McCarthy to describe machines that undertake untraditional tasks. Recently, it has been used to describe machines' gradual ability to imitate humans' intelligence and carry out abstract tasks that were previously confined to humans (e.g., problem-solving, decision-making, speech recognition, etc.) (Khadragy, 2022).

Thus, the core intention behind AI development is to make machines' intelligence increasingly similar to that of humans. The AI work rests heavily on giving machines access to a large size of training datasets on which they could identify patterns in the data and build future automated responses. The AI could be grouped into categories based on its ability to store data and respond accordingly. These categories range from reactive machines that cannot store information and can respond only to current situations to self-awareness machines that can express their inner states and others' feelings. Between these two extremes lie limited memory and theory of mind. The first has a finite memory and thus can store past historical data and respond accordingly by comparing the stored data with the surrounding environment (e.g., pre-programmed cars and maps, traffic signs, etc.). The second is more advanced and is capable of using the information to interact with different situations in a human-like manner (e.g., robot Sophia) (Merouane, 2023).

The impact of AI on employment depends on the capabilities of each type of AI. Namely, its workers' displacement effect tends to become stronger with the increased sophistication of the AI implemented. For instance, the ability of reactive machines to substitute workers is confined to well-defined routine tasks because they lack the adaptability feature to respond to unexpected events. Limited memory has greater adaptability and thus can be used in a wider range of applications like nonroutine manual tasks (e.g., driving). The scope of the theory of mind is even wider and highly applicable in interactive tasks such as customer service. While the current state of technological advancements has not reached the self-awareness level, it has great potential to undertake abstract tasks that require complex decision-making and creativity (IABAC, 2023).

Figure 1: Types of AI



Source: (Merouane, 2023)

3.2. Theoretical and Empirical Literature

Throughout history, industrial revolutions have been driven by a bundle of major technological breakthroughs of general purposes that have brought about a remarkable transformation in different aspects of the economies of industrialized countries (Moll, 2021; Nübler, 2016; Nuvolari, 2019; Popkova et al., 2019; von Tunzelmann, 2003).[1] While the technological change associated with each revolution led to enormous benefits (e.g., expansion of production, enhancement of productivity, reduction in costs, improvements in logistics, etc.), it also triggered major concerns regarding its possible impact on the workforce. Theoretical beliefs on the unemployment impact of technology could be summarized in two main views. The first view believes in the idea of "technological unemployment" which maintains that the introduction of new technologies displaces workers and leads to pervasive long-term unemployment. The second view is referred to as "compensation theories" and postulates that the unemployment impact of technology is a short-run phenomenon and, in the long run, there would be many compensation mechanisms induced by market forces that would counterbalance this negative impact and lead to job creation (Boyd & Huettinger, 2019; Campa, 2018a; Mondolo, 2021).

Compensation mechanisms work mainly in two directions (Calvino & Virgillito, 2018; Kapeliushnikov, 2019; Mondolo, 2021; Soete, 2001; Vivarelli, 2007, 2014): Firstly, the introduction of new technologies is usually associated with massive productivity gains and reduction in production costs in both technology-supplying sectors and in other sectors that adopt these technologies. If these gains are translated into higher investment and lower prices, and if consumers respond to the reduction in prices by increasing their demand, technology will lead to

[1] General Purpose Technologies (GPS) that are known for their ability to be implemented in a wide range of applications, their high degree of dynamism which makes them continuously improving over time and their tendency to stimulate relevant innovations in sectors that adopt them (Nuvolari, 2019) (Nuvolari, 2019).

an increase in overall employment. Secondly, technology is normally accompanied by the emergence of new products and services which stimulate consumption and boost employment even further. As long as these new products and services are relevant to consumers' needs and their effect is more than to compensate for the effect of any replacement of old products and services, there will be an overall increase in employment.

Notwithstanding such long debate, arguments in favor of technological unemployment are typically periodical and dominant during times that witnessed radical technological transformations, the first stage of technological change (Autor, 2014, 2015; Kapeliushnikov, 2019; Vivarelli, 2014). Even after recent advancements in technology that have increasingly widened the technological frontier of automatable activities, till now technology has not been accompanied by mass unemployment. This is because, in addition to the above-mentioned compensation mechanisms, technology is not likely to have a labor-saving effect on all sorts of workers, but only on those of particular skills (Autor, 2014, 2015; Campa, 2018b; Fiorelli, 2017; Frey & Osborne, 2017; Kapeliushnikov, 2019; Martins-Neto et al., 2022; Mondolo, 2021; Soete, 2001; Vivarelli, 2014).

Nevertheless, literature has identified several features of the fourth industrial revolution (IR4), during which AI has emerged, that distinguish it from earlier revolutions in terms of the rate, scope, and impact of its associated technologies. First, the progress rate of the IR4 has been exponential and associated with notable reductions in their costs, facilitating largely its adoption. Second, the frontier technologies accompanied by this revolution intersect closely with many aspects of the daily lives of individuals and businesses such as health, education, transportation, finance, etc. Third, both the rapid pace of technological advancements and its close connections to different aspects of life make it also expected to have a profound impact on different grounds, including the labor market (USCWA, 2019).

Recent trends in technology have motivated many studies to consider the expected future impact of recent trends in technology on employment and job creation, typically referred to as the "Future of Work (FOW) Studies". For instance, it is estimated that around 14% of jobs in the OECD are at high risk of automation (Georgieff & Milanez, 2021). In EU countries, about 14 of adults are facing a high risk of replacement and this risk is higher among males and unskilled workers (Pouliakas, 2018). Among the main emerging economies, the percentage of jobs at high risk of automation is around 77% in China, 72% in Thailand and 69% in India (Frey et al., 2016). In developing countries, the percentage ranges from 55% in Uzbekistan to 85% in Ethiopia (Frey et al., 2016). In MENA region countries, around 45% of existing work is automatable and this percentage is close to the global average of 55% (aus dem Moore et al., 2018). Notably, these studies provide only estimates of those who are at risk of displacement by technology rather than those who are already displaced.

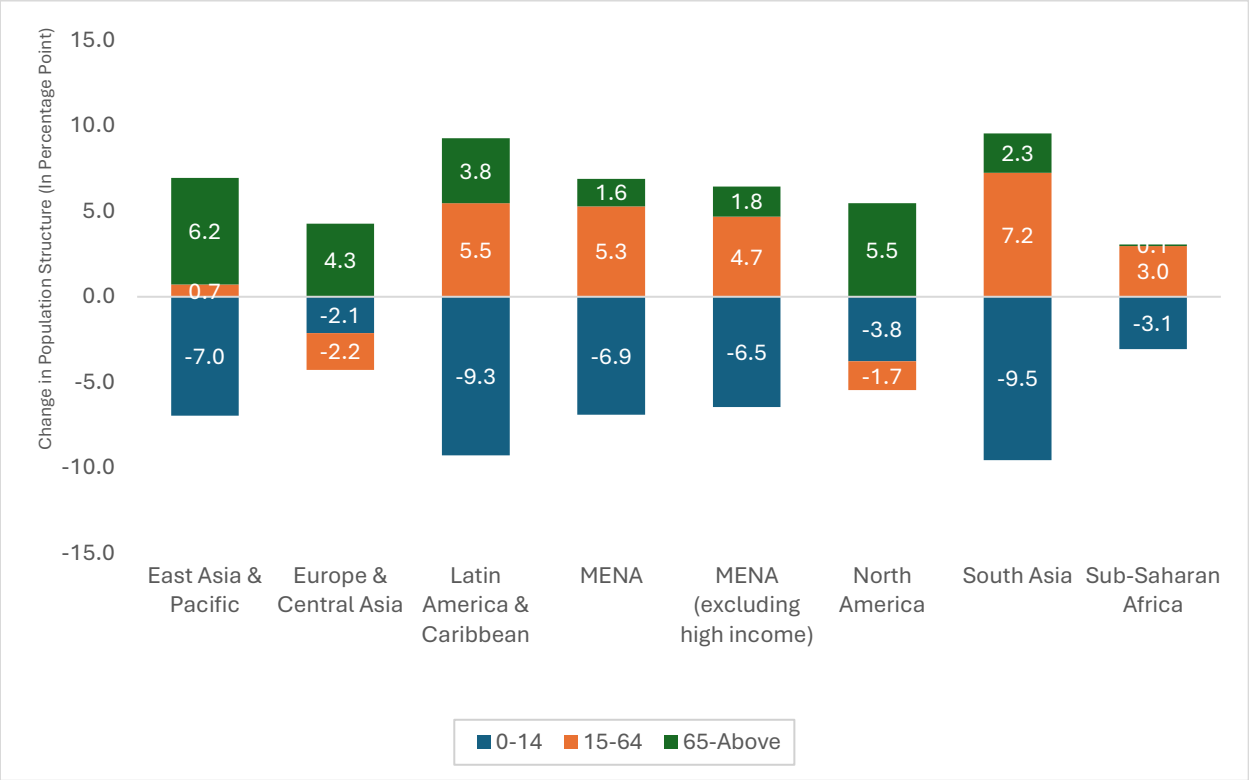
4. Employment Profile and AI Readiness in the Arab Countries

4.1. Employment Profile

The MENA region countries (excluding high-income countries), i.e., non-Gulf Arab countries, have been undergoing a demographic transformation that is restructuring their population, as illustrated in ***Figure 2***. On the one hand, over the last three decades (2000-2023) the population

structure has shifted mostly toward the working-age population by which the share increased by 4.7 percentage points (from 59.1% to 63.8%). On the other hand, socio-economic developments have contributed to delayed marriage and postponed childbearing and a reduction in fertility rates, resulting in a decrease in the share of the child population by 6.5 percentage points (from 36.9% to 30.4%). Improvements in health care have also induced a slight increase in the share of the elderly by 1.6 percentage points (from 4.0% to 5.8%) (ILO, 2024). The relatively booing labor force in the region compared to many other regions, e.g., Europe and Central Asia, North America, and East Asia and Pacific, has placed many labor market pressures.

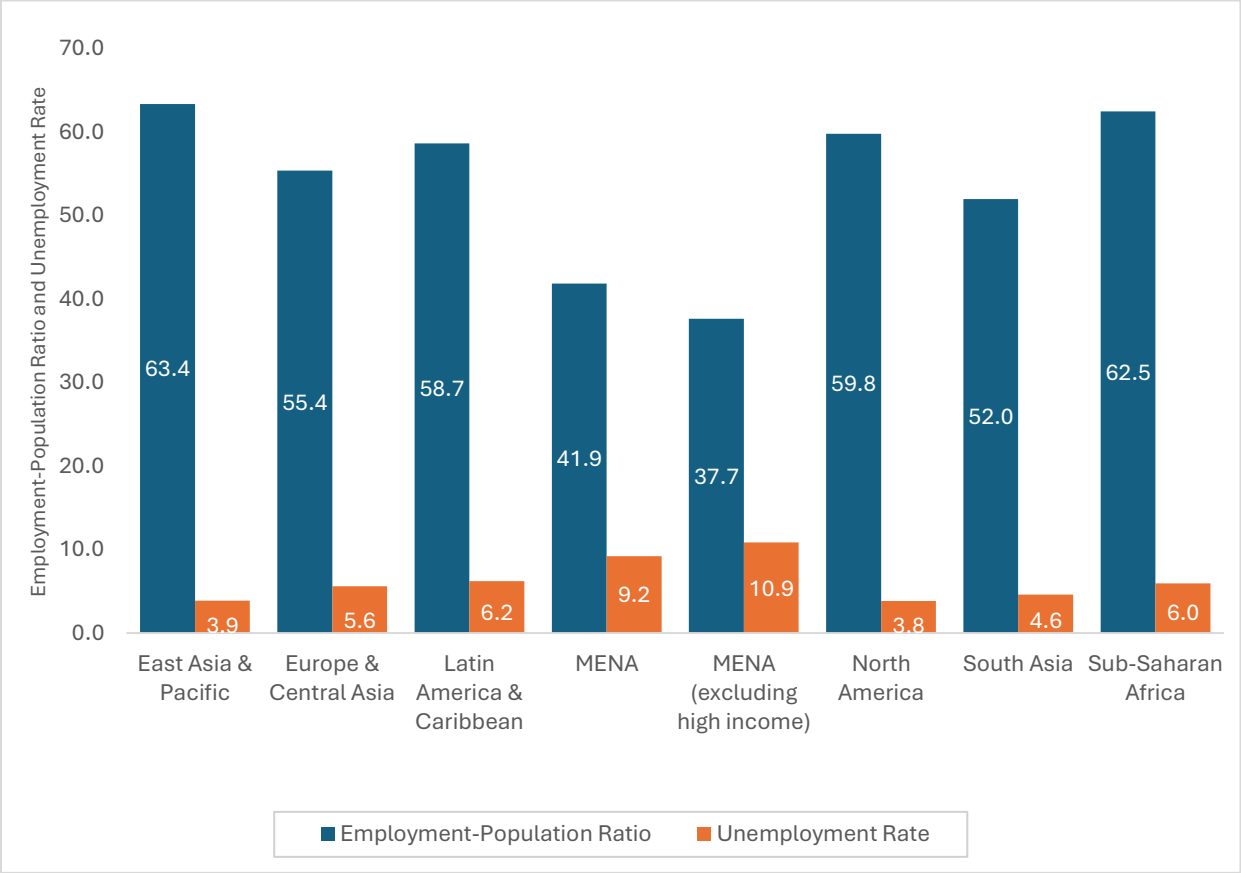
Figure 2: Changes in Age Composition of Population (2000-2023)



Source: (World Bank, 2024)

Although the growing working-age population could be a driving force for economic growth and development, the situation is different for the region. As shown in ***Figure 3***, the region has failed to fully utilize the power of its working-age population. This is evident from its lowest employment-population ratio (37.7%) and highest unemployment rate (10.9%) among all regions, indicating a limited ability of its labor market to create enough job opportunities to absorb the increasing working-age population. It is noteworthy that the unemployment problem in those countries is persistent and is not attributed only to demographic pressures. For many decades economic growth in these countries has been driven mainly by growth in employment levels rather than productivity growth. Additionally, while the contributions of capital services, as well as labor quality growth, have been typically positive, growth in total factor productivity has had a consistently negative contribution (ILO, 2022). This implies that resources are directed toward unproductive usages which makes overall growth fail to translate into sustainable employment opportunities.

Figure 3: Employment-Population Ratio and Unemployment Rate by Region in 2023



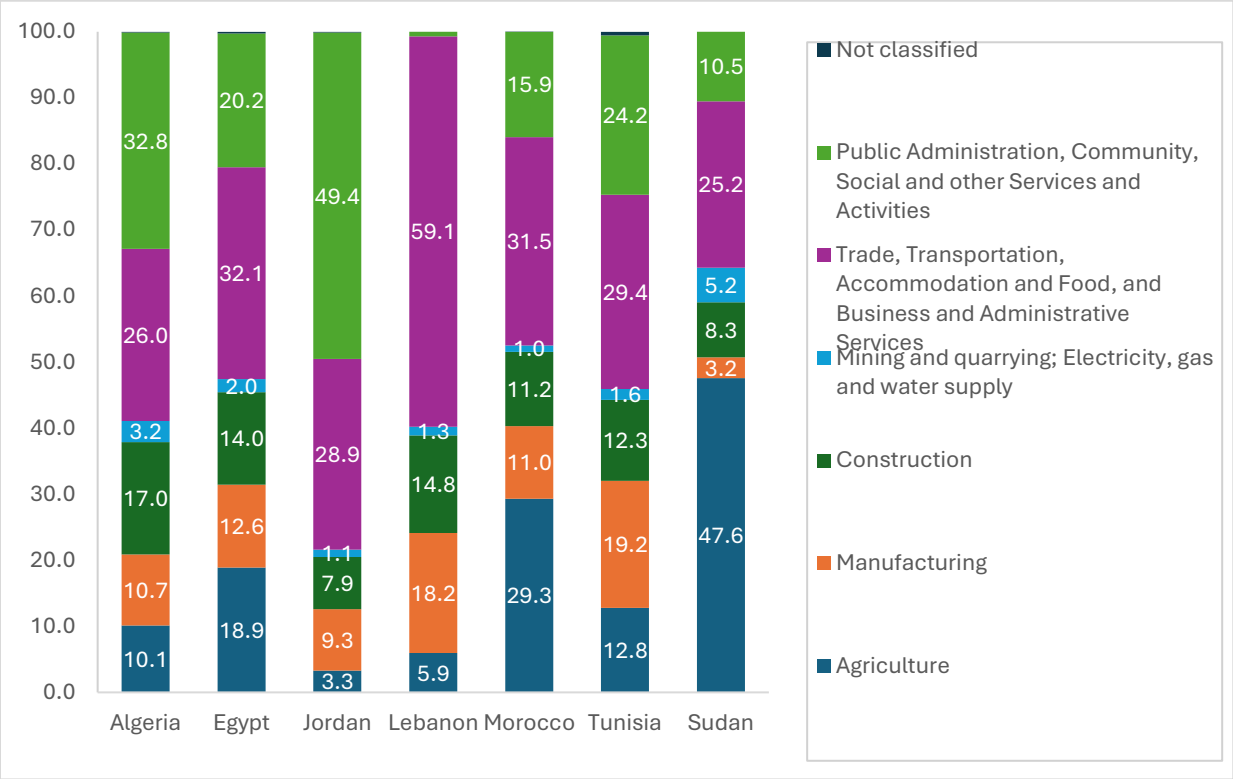
Source: (World Bank, 2024).

This tendency has negatively impacted many employment aspects in Arab countries. The decomposition of employment by economic activity in ***Figure 4*** shows a substantial part of employment (from around one-third in Jordan to nearly three-quarters in Sudan) is concentrated in agricultural and non-tradable service activities such as trade, transportation, accommodation and food, and business and administrative services. These activities have limited ability to create high-quality jobs that make the best use of AI technology, as they are typically characterized by informality (Assaad et al., 2019). In effect, informal employment has become the employment norm in many Arab countries, with the share of informal employment exceeding half of total employment in many Arab countries (e.g., 94.4% in Sudan, 67% in Egypt, and 53.3% in Jordan), which exposes workers to many vulnerabilities in their employment (ILOSTAT, 2024).

Additionally, the educational composition of employment in **Figure *5*** also showcases a domination of those with modest education in most countries, especially in Morocco and Sudan, where a substantial share of workers have basic education or below (80.5% and 70.2%, respectively). This raises many concerns regarding the extent to which workers in Arab countries are ready to reap the benefits of AI technology. It is noteworthy that the lack of workers is not confined to formal education but extends to include skills as well. Available data on digital skills among individuals in the Arab region for 2020 shows that the share of the population who have advanced digital skills (i.e., writing computer programs using a specialized programming

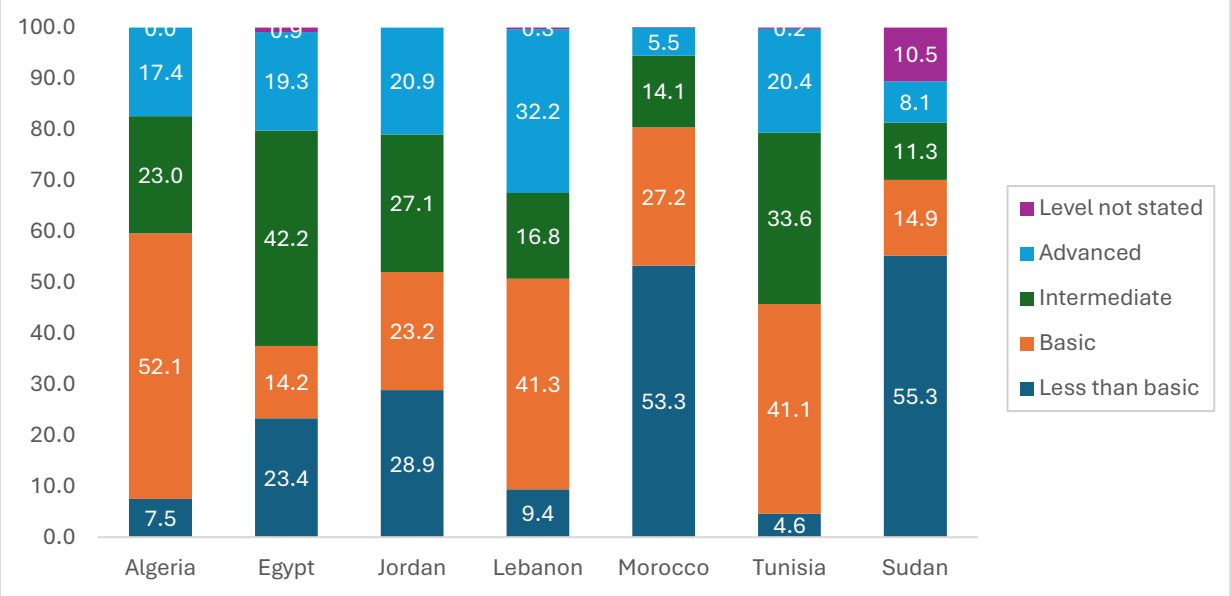
language) is still limited in these countries, ranging between2% in Sudan and 16% in Tunisia (Fardoust & Nabil, 2022).

Figure 4: Employment Structure by Economic Activity (%)



Notes: Data are for the year that is recently available which is 2017 for Algeria; 2022 for Egypt, Jordan, Morocco, and Sudan; 2019 for Lebanon, and 2023 for Tunisia. **Source:** (ILOSTAT, 2024).

Figure 5: Employment Structure by Education (%)



Notes: Data are for the year that is recently available which is 2017 for Algeria; 2022 for Egypt, Jordan, Morocco, and Sudan; 2019 for Lebanon, and 2023 for Tunisia. **Source:** (ILOSTAT, 2024)

4.2. AI Readiness

Arab countries are positioned in a relatively low rank globally in key international technology adoption indexes such as the AI Government Readiness Index (AIG), the Network Readiness Index (NRI), the Globa Innovation Index (GII), and the Global AI Index (GAI) as presented in **Table *2***. While most Arab countries are located in the second global quartile rank in the Government AI index, they are located in the third and fourth global quartile ranks in the rest of the indexes. These latter indexes give parallel attention to broader areas related to technology adoption rather than only AI in the delivery of public services to their citizens.

The GII index includes indicators that capture indicators inputs (i.e., institutions, human capital, infrastructure, market sophistication, and business sophistication) and outputs (i.e., knowledge and technology outputs and creative outputs). Also, the NRI rests on many areas including availability and quality of infrastructure, digital skills among individuals, policies, and societal and economic outcomes derived from the use of technology. Additionally, the GAI assesses the national AI capacity in terms of three main dimensions. The first includes talent, infrastructure, and operating environment; the second comprises research and development; and the third involves government strategy and commercial. The main weaknesses lie in areas related to the developments of their enabling institutions, infrastructure, business and market, and the technology sector.

This modest performance of the Arab countries is attributed to the fact that the Arab countries have attained only 8.4% of their digital potential, compared to 18% in the USA and 15.2% in Europe[2]. Arab countries are generally characterized by a digital paradox in which the adoption of digital technologies at the consumer level (e.g., smartphone penetration and social media usage) is above the average performance of many high-income countries, while its performance in the remaining levels is still underdeveloped (McKinsey & Company, 2016). Over the next three decades, it is estimated that fully digitalizing the MENA region by expanding the coverage of its digital infrastructure and services could lead to an increase in its GDP per capita by at least 46%, double the female labor force participation, and reduce frictional unemployment from 10% to 7% (Cusolito et al., 2022).

Table 1: Indexes of Technology Adoption in the Arab Countries

	Algeria	Egypt	Jordan	Lebanon	Morocco	Tunisia	World Average
AIG	36.0	52.7	56.9	47.6	43.3	46.1	50.6
Q Rank	3rd	2nd	2nd	2nd	2nd	2nd	
NRI	37.5	44.1	47.7	39.7	45.4	42.3	48.7
Q Rank	4th	4th	4th	4th	4th	4th	
GII	16.1	24.2	28.2	23.2	28.4	26.9	33.5
Q Rank	4th	3rd	3rd	3rd	3rd	3rd	
GAI	NA	16.9	NA	NA	13.6	13.7	26.0
Q Rank	NA	4th	NA	NA	4th	4th	

[2] Captured digital potential is measured by the degree of digital adoption in the levels of consumers, businesses, and government, and the strength of ICT supply and innovation in comparison with the digital potential of the region.

Notes: the AI index included 193 countries, NRI included 134, GII included 132, and GAI included 62 countries. **Source:** (Oxford Insights, 2023; Portulans Institute, 2023; Tortoise, 2023; WIPO, 2023).

5. Labour Market Impact of AI

5.1. Impact on Global Demand for Jobs and Skills

The recent Future of Work report by the WEF (2023) highlighted that the increased adoption of new and frontier technologies is considered among the key macro trends identified to have a greater impact on net job creation by 803 business companies employing around 11.3 million workers in 45 developed and developing countries. Globally, a net share of 36.4% of companies reported an expected job creation impact of technology adoption within five years (2023-2027). Among 74.9% of companies, AI is listed as a highly potential technology expected to be adopted over these five years. Also, a net share of 25.6% of companies reported a positive impact of its implementation on net job creation. The total jobs distribution over this period is estimated to be 152 million job roles globally of which 83 million are vanishing and 69 million are emerging, representing a net reduction in employment by 14 million job roles (2% of the current workforce). As shown in ***Table 2***, the top net growing jobs are predominantly technology-related, while the top net declining jobs are predominantly clerical.

Job disruption is also expected to be associated with a disruption of 44% of existing skills currently in the labor market. Generally, abstract, socioemotional, and technological skills are currently at the top of the skills that are highly demanded by businesses, and their demand is also expected to increase in the future. While AI and big data skills are not currently among the top 10 core skills, they are expected to be in the 7th place in terms of growth in the future, as illustrated in **Error! R eference source not found.**. Additionally, given that AI and big data have the potential of displacing workers, they come in the third priority in companies' training strategies and are expected to constitute around 40% of future training programs provided in the United States, China, Brazil, and Indonesia to maximize the net positive effect form their implementation.

Table 2: Expected Labor Market Impact of Technology (2023-2027)

Top net growing jobs	Top net declining jobs
AI and Machine Learning Specialists	Bank Tellers and Related Clerks
Sustainability Specialists	Postal Service Clerks
Business Intelligence Analysts	Cashiers and Ticket Clerks
Information Security Analysts	Data Entry Clerks
FinTech Engineers	Administrative and Executive Secretaries
Data Analysts and Scientists	Material-Recording and Stock-Keeping Clerks
Robotics Engineers	Accounting, Bookkeeping, and Payroll Clerks
Big Data Specialists	Home Appliance Installers, and Repairers
Agricultural Equipment Operators	Legislators and Officials
Digital Transformation Specialists	Statistical, Finance and Insurance Clerks
Top 10 core skills	**Top 10 rising skills**
Creative thinking	Creative thinking
Analytical thinking	Analytical thinking
Resilience, flexibility, and agility	Technological literacy
Motivation and self-awareness	Curiosity and lifelong learning

Curiosity and lifelong learning	Resilience, flexibility, and agility
Technological literacy	Systems thinking
Dependability and attention to detail	AI and big data
Empathy and active listening	Motivation and self-awareness Talent management
Leadership and social influence	Talent management
Quality control	Service orientation and customer service

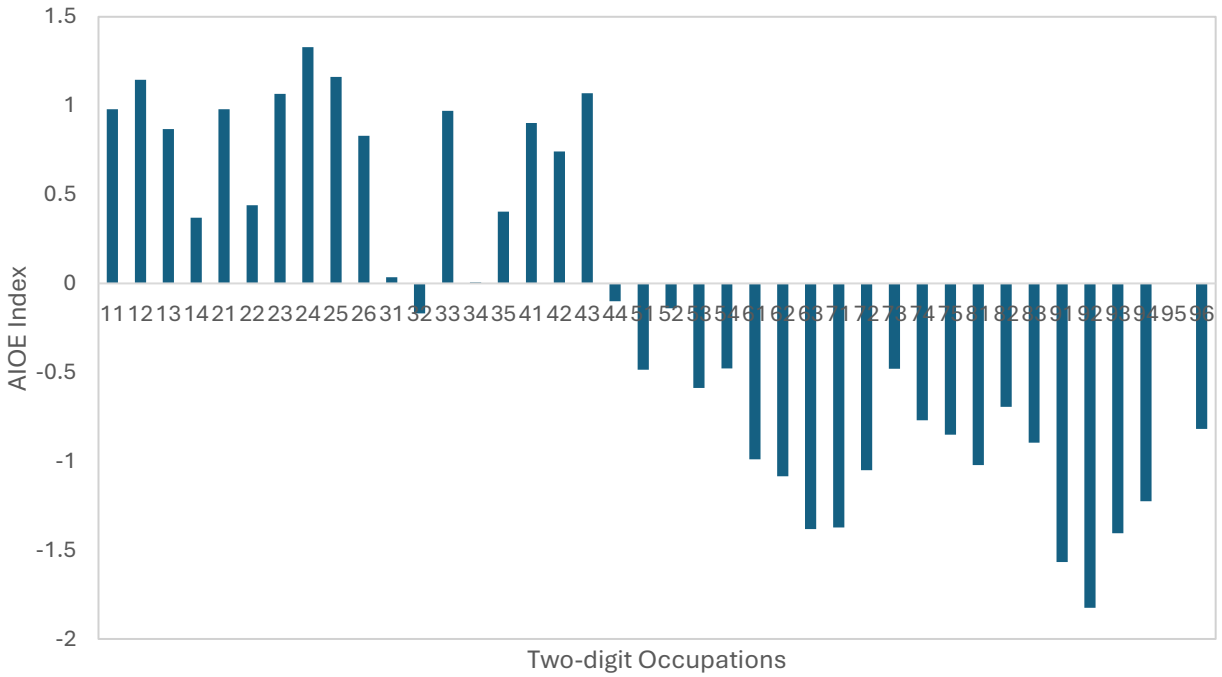
Source: Authors based on (WEF, 2023)

Felten et al. (2021) also constructed an index that ranks occupations by the degree to which they are expected to be impacted, either positively or negatively, by the AI, which is the Artificial Intelligence Exposure Index (AIEO). The AIEO index is constructed by identifying key AI-related applications and linking them to occupational abilities data. More specifically, the Electronic Frontier Foundation (EFF) AI Progress Measurement Project collects data on the progress of AI applications in a wide range of fields resting on data from verified academic and nonacademic sources. The AI applications included are abstract strategy games, real-time video games, image recognition, visual question answering, image generation, reading comprehension, language modeling, translation, and speech recognition. Meanwhile, the Occupational Information Network (O*NET) describes different occupations by a set of 52 abilities, considering both the prevalence and the relative importance of each ability in an occupation. The 52 O*NET abilities based on which occupations are described cover four main aspects which are cognitive, psychomotor, physical, and sensory-perceptual constructs (Felten et al., 2021)[3].

Results of the AI occupational exposure are reported in ***Figure 6***, which plots the two-digit occupations against their AIOE index. The figure reveals that AI exposures differ considerably among occupations, with high-skilled occupations such as managers, professionals, and technicians having the highest AIOE scores. On the one hand, the AIOE scores are the highest among occupations like business and administration professionals; information and communications technology professionals; administrative and commercial managers; numerical and material recording clerks; and teaching professionals. On the other hand, they are the lowest among agricultural, forestry and fishery laborers; cleaners and helpers; laborers in mining, construction, manufacturing and transport; subsistence farmers, fishers, hunters and gatherers; and building and related trades workers (excluding electricians). Generally, except for clerical occupations that are typically middle-skilled, AIOE tends to be higher high-skilled occupations than low-skilled occupations. These findings are also consistent with those highlighted by WEF (2023) which reveals that high-skilled jobs, especially technology-related jobs, and clerical jobs are the most impacted by AI. While companies expect a positive AI impact on the former jobs, they expect a negative AI impact on the latter.

Figure 6: AI Occupational Exposure Index at the 2-digit Level

[3] The AIEO index is mapped and aggregated from the six-digit SOC occupational level to the two-digit ISCO-08 occupational level to match the available employment data for the Arab countries in the ILO micro database.



Notes: Occupations from 11-14 are managerial occupations, from 21-26 are professional occupations, from 31-35 are technical occupations, from 41-44 are clerical occupations, from 51-54 are sales and services occupations, from 61-63 are agricultural occupations, from 71-75 are craft occupations, from 81-83 are machine operating and assembling occupations, and 91-96 are elementary occupations. **Source:** By authors based on (Felten et al., 2021) and (ILOSTAT, 2024).

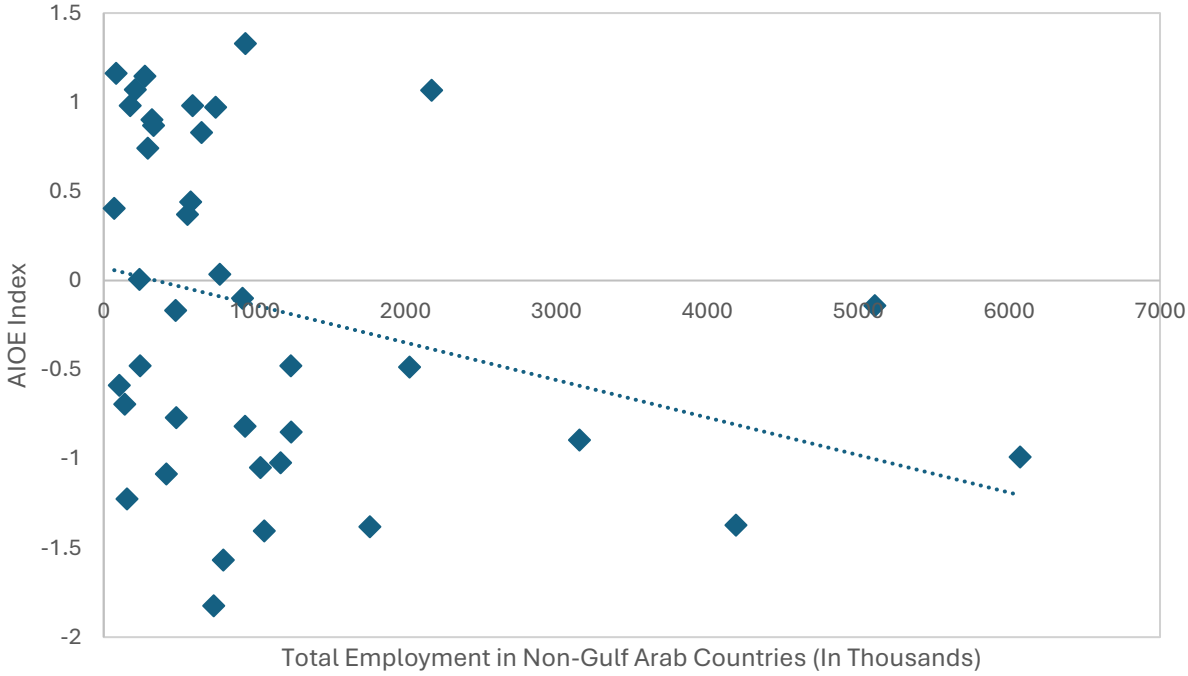
5.2. Impact on Arab Countries' Jobs and Skills

For the Arab region, ESCWA (2021) estimates show that around 36% of jobs are prone to AI augmentation, AI being introduced to its daily tasks, but this does not necessarily mean that this will be associated with workers' displacement. The lists of most and least 10 AI-augmented jobs are in line with global trends discussed in the previous subsection. On the one hand, many of the most 10 AI-augmented jobs are technology-related (e.g., ICT system analyst, software analyst, data analyst, etc.) and some others are high-skilled finance jobs (e.g., credit analyst, financial auditor, bank treasurer, etc.). On the other hand, the least 10 AI-augmented jobs include blue-collar that are characterized by low-to-middle skill levels (e.g., pipe welder, carpenter, baker, grill cook, cleaner, etc.) (ESCWA, 2021).

Nevertheless, it is noteworthy that Arab countries are less exposed to AI **Figure** *7* below explores the size of employment exposed to AI technology by plotting the employment size of each two-digit occupation against their AIOE scores. The figure reveals a negative link between both variables (see Table A-1 for the distribution of occupational employment for each country), indicating an employment concentration in occupations with low AI exposure. This finding comes in line with existing literature that found evidence for relatively lower exposure to sophisticated technologies in developing countries than in developed due to the low technological absorptive capacity and the concentration of workers in low-skilled occupations that do not rely on technology. However, the literature posits that exposure to these technologies in developing

countries is increasing over time (Das & Hilgenstock, 2022; Gasparini et al., 2021; Lewandowski et al., 2019; Maloney & Molina, 2019; Martins-Neto et al., 2021; Pena & Siegel, 2023).

Figure 7: Link Between AI Exposure and Employment



Notes: Countries in which employment data at the two-digit level are available include Jordan for 2021, Egypt for 2022, Lebanon for 2019, Sudan for 2022, and Tunisia for 2019. **Source:** By authors based on (ILOSTAT, 2024)

In fact, the increase in AI exposure over time is expected to bring about a major transformation of Arab countries' labor markets, even if they do not currently seem to be heavily impacted by such sophisticated technologies. Projections for the MENA region show that AI and machine learning specialists and data analysts and scientists will be at the top of the growing jobs in the MENA region (2023-2027). The projections also stressed the need for prioritizing skills like analytical and creative thinking, and AI and big data for reskilling and upskilling the workforce (WEF, 2023). Meanwhile, technology-related jobs, especially those that are mostly linked to the fourth industrial revolution, currently constitute only 5% of total jobs in these countries, with Egypt, Lebanon, and Morocco contributing the most to this share. Moreover, the most highly demanded jobs are still dominated by sales managers, accountants, commercial sales representatives, chefs, and receptionists, among others. These jobs are primarily customer-based services that are less likely to be augmented by AI (except accountants), and only a few of them are technology-related such as software developers and graphic designers (ESCWA, 2023).

Recognizing the need to take sincere steps toward preparing their economies for the impact of AI technology, many countries have recently initiated their AI national strategies and policies. In 2019, Egypt established the National Council for Artificial Intelligence in partnership between the government, academics, and private businesses in the AI field. Its core responsibility is to unite the country's efforts in AI by setting the national AI Strategy, developing AI-related applications, and recommending AI capacity-building programs (MCIT, 2024). The Ministry of Digital

Economy and Entrepreneurship in Jordan also initiated an AI strategy and implementation plan in 2023 that targets to establish an enabling AI ecosystem in the country (MDEE, 2023). In Morocco, the government established a center of excellence for AI in 2020 and a national fund to support AI-related startups (Tachicart, 2023). The Lebanese Ministry of Industry has introduced the National Artificial Intelligence Strategy (2020-2050) in the Lebanese industrial sector and its related entities to enhance AI adoption in the sector (Ministry of Industry, 2019).

The experience of Gulf-Arab countries reveals a promising impact of AI technology in several aspects of the economy. First, it is capable of bringing around USD 150 billion to those countries, representing around 9% of their combined GDP, which results mainly from the sophisticated state of AI in those countries (Chandran et al., 2023). The United Arab Emirates and Saudi Arabia are among the top-performing Arab countries concerning their ability to innovate and innovation outputs, with an average annual contribution of AI to their economies reaching 33.5% and 31.3%, respectively. This is particularly due to the huge investments devoted to AI technology in these countries. For instance, Saudi Arabia's AI national strategy targets to attract USD 20 billion in investments by 2030, mainly in energy, healthcare, and government sectors. The United Arab Emirates also implements AI in a wide range of sectors like transportation and logistics and the healthcare sectors (Middle East Briefing, 2024).

Generally, the contribution of AI to GDP in the MENA region in general and Gulf countries in particular are concentrated in retail and wholesale trade, consumer goods, accommodation, and food services (19%); public sector, including health and education (18.6%); transport and logistics (15.2%); technology, media, and telecommunications (14%); financial, professional, and administrative services (13.6%); construction and manufacturing (12.4%); and energy, utilities, and resources (6.3%). The implementation of AI in highly labor-intensive sectors like trade is expected to lead to significant labor productivity shifts. Product enhancements are also expected to be huge in sectors like health, automotive, and financial services. Moreover, the growth of sectors that implement AI is expected also to increase the demand for inputs from other sectors and drive their growth as well (PwC, 2018).

6. Conclusion and Policy Implications

This paper studied the impact of AI on the labor market of Arab countries. First, it provided a literature review of the relationship between AI and employment by introducing the concept of AI, summarizing the theoretical background on the nexus between technology and employment, and reviewing some empirical results on the future of work in both developed and developing countries. Second, it examined the employment profile in the Arab region, highlighting the unemployment problem. It also assessed the relative performance of those countries concerning AI readiness compared to the rest of the world, relying on different AI-related indexes available for a wide range of countries. Third, the paper highlighted the impact of AI on the future of work globally in terms of jobs and skills disruption, highlighting the main jobs and skills that are expected to witness net growth in the future. It then moved to point out how AI is going to augment jobs in Arab countries and the degree of their exposure to the AI impact.

The study concludes that the demographic factors in terms of the continuous increase in the share of the working-age population have exerted many supply pressures on the labor markets of the Arab countries, leading to a relatively lower employment-population ratio and higher

unemployment rate. This has been coupled with growth originating mainly from factor inputs rather than productivity, suggesting a high reliance on unproductive activities as key growth drivers that are unable to ensure sustainable employment generation. Arab countries also show modest performance compared to the rest of the world in AI readiness, as they are typically ranked in the third or fourth quartiles in most of these indexes.

The expected future impact of AI on the labor market reveals that AI is going to augment jobs, especially high-skilled jobs, including technology-related jobs, and clerical jobs, while it is less likely to have an impact on blue-collar jobs. This will also lead to changes in the soft and hard skill composition needed in the labor market toward creative and analytical thinking and AI and big data. The current status of AI exposure is low in Arab countries, as most employment is concentrated in occupations that are less likely to be augmented by AI. This is also reflected in the current jobs demand which generally lean toward jobs that are less likely to be augmented by AI. However, given that previous literature on developing countries stressed the increasing AI exposure over time in these countries, this implies that AI will increasingly impact the labor markets of Arab countries.

Many policy implications could be inferred from the above discussion. First, given that the future of labor markets will rely more on high-skilled and technology-related jobs, the Arab countries need to direct their structure transformation towards highly productive sectors that employ sophisticated technology to enhance their productivity and ability to create sustainable employment opportunities. Second, it is also important to enhance different aspects of AI readiness in Arab countries to cope with the increasing pace of technological advancements and maximize the net benefits of AI technology. Third, it is also critical to perform upskilling and reskilling programs for the existing and future workforce to ensure that they acquire the necessary soft and hard skills that reflect the reality of the labor market and at the same time guarantee their employability in high-quality jobs.

Focusing particularly on Egypt, over the past few years Egypt, for instance, has been working to build the capacities of students at different education levels and graduates in the fields of data science, Artificial Intelligence (AI), cybersecurity, robotics, automation, and digital arts to acquaint them with the requirements of the future labor market. Examples of initiatives in this area include Digital Egypt Cubs Initiative, Egypt University of Informatics, Digital Egypt Builders Initiative, Youth Enablement for Freelancing, Egypt Future Work is Digital, among others (MCIT, n.d.). It has also initiated six technological universities targeting technical education graduates in different locations (e.g., Gharbiya, New Assiut, New Taiba in Luxor, 6th of October City, Borg Al Arab, and East Port Said), in addition to the already existing three technological universities in New Cairo, Delta, and Beni Suef (Egypt Independent, 2022).

Most of these initiatives are free and are available for their target applicants nationwide, including those who are from less advantaged areas in Upper Egypt such as Minya and Sohag. Moreover, the delivery of the content of some initiatives is either virtual or hybrid, which provides high flexibility to attendees to participate in the comfort of their homes. Moreover, the target audience of many initiatives is not confined to those who specialize in ICTs or have a strong background in the field. For instance, many initiatives target introducing the basics of digital skills to different groups of populations such as students in schools and universities, women and housewives, public

sector employees, people with disabilities, etc., without requiring them to have an ICT-related degree.

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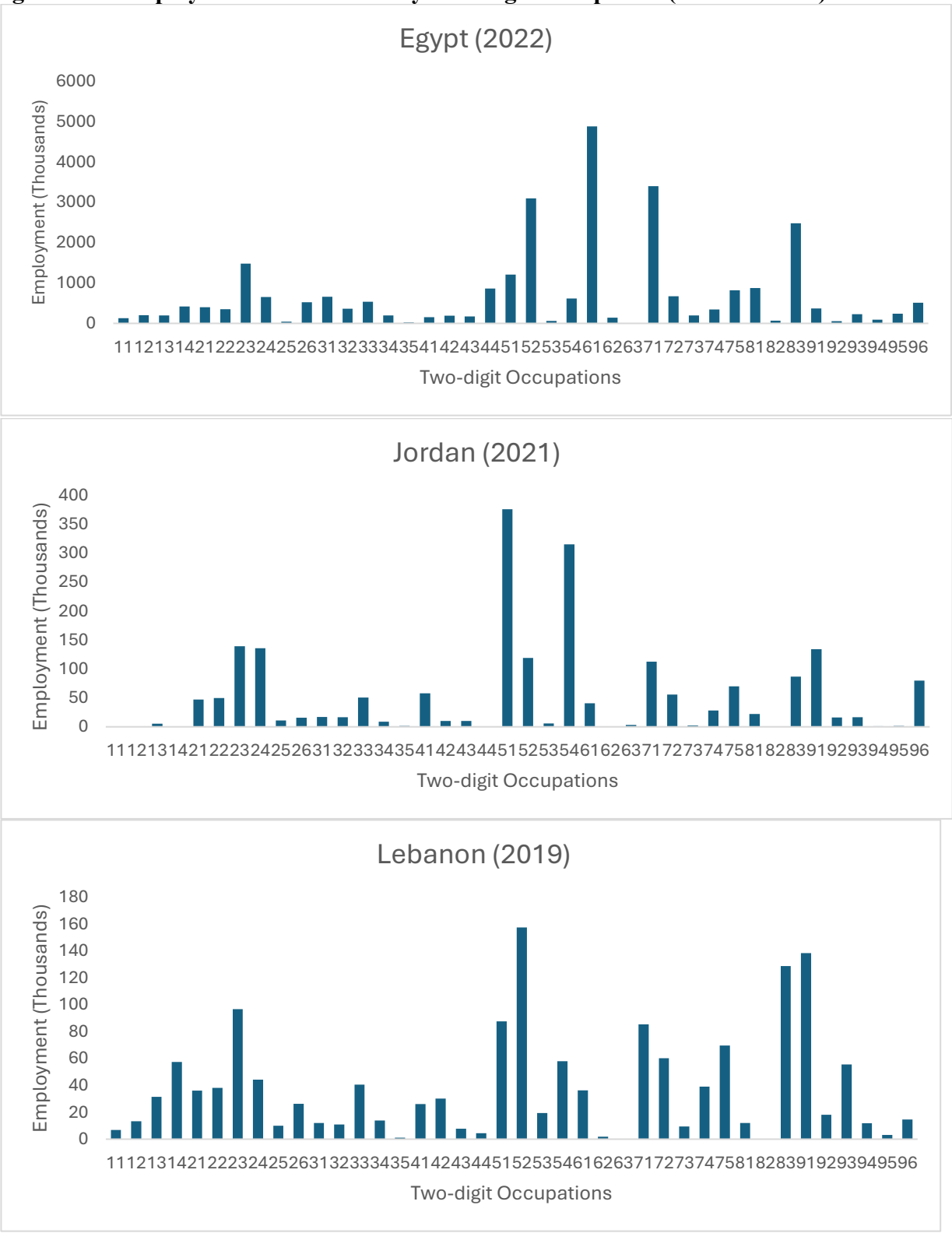
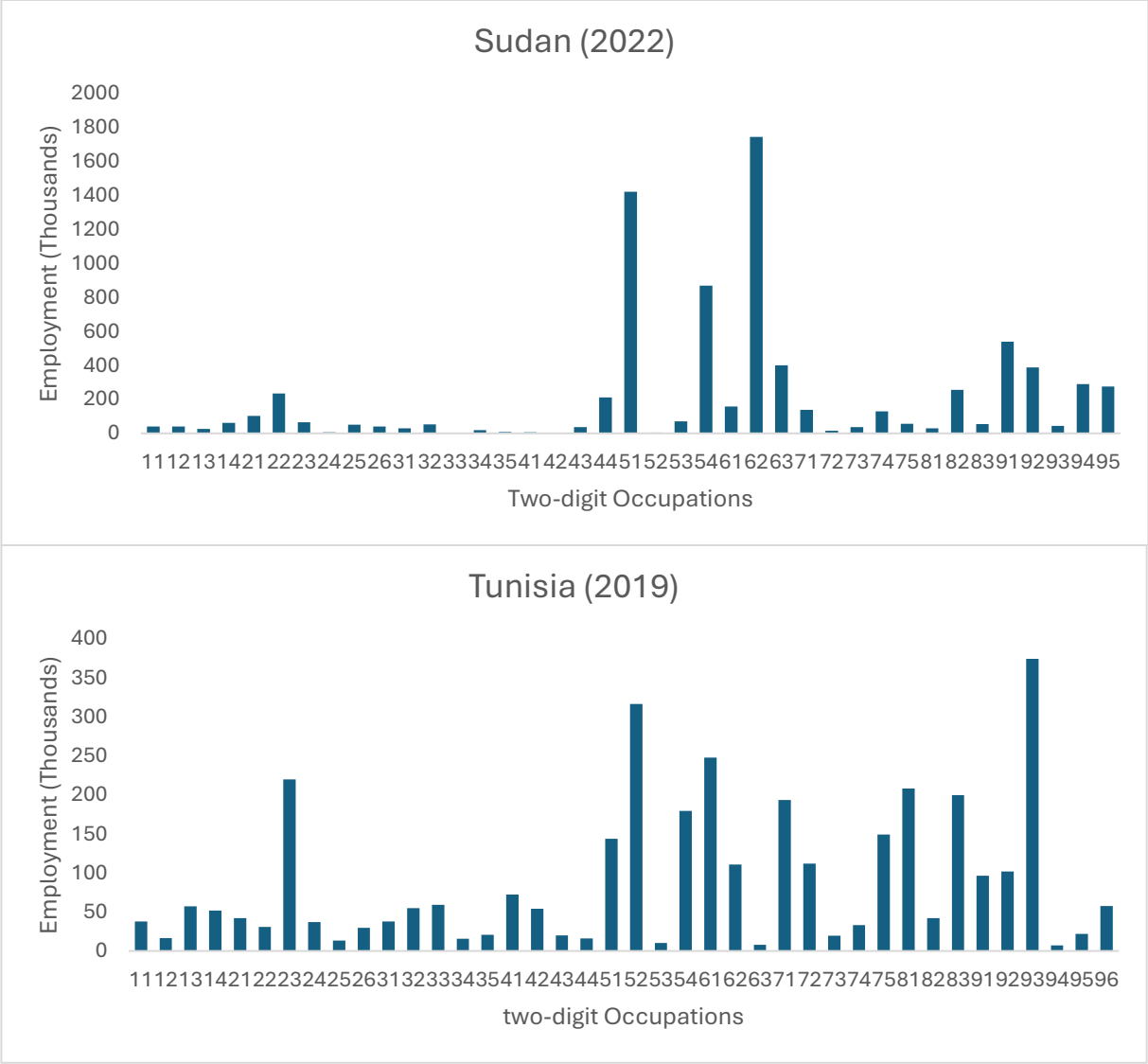
8. Appendix

Figure A-1: Employment Distribution by Two-digit Occupation (in Thousands)





Source: By authors based on (ILOSTAT, 2024)