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National Forum on the
Future of Work in Egypt
Joining Forces for Tomorrow and Beyond

Green Jobs and the Future of Work in Egypt: A Focus on the Agriculture and Renewable Energy Sectors

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Future of Work in Egypt
Joining Forces for Tomorrow and Beyond

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General Abbreviations and Acronyms

CBE	Central Bank of Egypt
CoCs	Centres of Competence
COP27	27th Conference of the Parties to the United Nations Framework Convention on Climate Change
CO2e	Carbon Dioxide equivalent
EBA	Enabling the Business of Agriculture
GHG	GreenHouse Gases
GIZ	Deutsch Gesellschaft für Internationale Zusammenarbeit GmbH
GWh	GigaWatt hours
IFPRI	International Food Policy Research Institute
ILO	International Labour Organization
IRENA	International Renewable Energy Agency
MoETE	Ministry of Education and Technical Education
MVA	Manufacturing Value Added
NCCS	Egypt National Climate Change Strategy 2050
NDCs	Nationally Determined Contributions
NREA	New and Renewable Energy Authority
NWFE	Nexus of Water, Food, and Energy
PVTD	Productivity and Vocational Training Department, Ministry of Trade, and
RECREE	The Regional Centre for Renewable Energy and Energy Efficiency
SEDA	The Solar Energy Department Association
SLR	Sea Level Rise
SPADE	Spatial Agricultural Database for Egypt
TVET	Technical and Vocational Education
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WISE	Workforce Improvement and Skills Enhancement

Executive Summary

Green jobs are defined as decent jobs that help reduce the negative environmental impact; improve energy and raw materials efficiency; limit greenhouse gas (GHG) emissions; minimise waste and pollution; protect and restore ecosystems and support the adaptation to the effects of climate change. Green jobs are driven by green policies and the main source of green employment is links between the economy and the environment. Green jobs offer the potential for a "win-win" solution for inclusive economic growth and job creation as well as sustained human development and well-being. A just transition to green jobs should also be gendered, recognizing that climate change adversaries are not gender neutral.

Egypt is highly vulnerable to climate change, with serious implications on water availability. **Water scarcity** is already leading to some green practices such as desalination and the reuse of agricultural drainage and treated wastewater. Egypt's economic and emissions growth are still tightly linked to each other. Taking immediate action can limit the future costs of climate change impacts. Egypt has **a constitutional commitment** to protect the environment and utilise resources wisely. The country issued its first ever comprehensive National Climate Change Strategy through 2050 in 2022. Climate change pressures have already led to policy change in Egypt, implementing a broad range of climate policies and projects.

This study addresses prospects for green job creation in Egypt, with particular emphasis on the two economic sectors of **agriculture** and **renewable energy.** The findings of this study are based on the triangulation of an extensive set of primary and secondary sources. The research process started with a thorough review of the literature. Primary sources included (i) a survey of experts and focus group discussions as part of a Delphi study design to gauge expert views on the impact of climate change and the green transition on jobs in different economic activities (ii) interviews with agribusiness leaders, energy experts, investors, bankers, policymakers and academia to learn about potentials for green job creation in the two sectors of focus.

Expert views collected through **the Delphi method** were used to extrapolate expected **number of jobs gained/lost using data from the Labour Force Survey data of 2017-2021**. These results indicate that experts believe that the most negatively affected sectors by climate change include manufacturing, agriculture, accommodation and food services, transportation, and storage activities. Almost all sectors are expected to witness at least a slight increase in employment by virtue of the green transition (with the exception of the transportation and storage sector). The top **occupational skills required for employment** across all these sectors were also analysed utilising the **O*NET skills/abilities/knowledge** codes, which showed that green transition particularly requires mechanical, building and construction, design, engineering, mathematics, computers and electronics knowledge, and coordination and operations monitoring skills.

The report shows that there are factors that can accelerate the green transition and the creation of green jobs in the two sectors of agriculture and renewable energy. In agriculture, there is ample evidence of the large adverse impact of climate change on this sector in Egypt and the food production system. The analysis differentiates between potentials for green job creation in the Nile valley (old land) and the reclaimed desert areas (new land). While the old land continues to lose jobs in agriculture in conjunction with land size fragmentation and unsustainable irrigation practices, the new land is more likely to create green jobs adopting modern irrigation systems and climate smart agriculture. In the sector of renewable energy, the factors accelerating the green transition include Egypt's competitive edge of abundant sunlight and wind energy supply; and the promotion of investments in this sector post the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27).

The analysis shows that there is ample space for a green transition and green job creation in both sectors. In agriculture, the sector is globally becoming a knowledge-intensive field and a green transformation in this field starts with a systemic and well-governed process of knowledge transfer. The analysis discusses potentials for improving the parameters for enabling the business of agriculture (EBA); use of digital technology in marketing and supply chain management; and advancing technologies for climate-smart agriculture. The space for climate change adaptation involves the adoption of multiple technologies related to enhanced seed characteristics; soil fertility management; irrigation management; and crop protection. **Digitalization of agriculture** remains an **untapped opportunity for green job creation** in Egypt. Agri-platforms have been used in a number of African countries in support of agriculture trade, with high potential for green job creation. Egypt has a nascent mobile-based advisory service that provides access to agricultural information and allows for some knowledge sharing but at a limited scale. The advent of remote sensing data collection technologies provides ample opportunities to inform and monitor agricultural production and create green jobs. The rampant informality and the low skill base of workers in agriculture remain a challenge for the sector to create green jobs and for its digitalization. Agriculture as a sector of employment is having a diminishing share of the labour force and it needs to attract more talent and investment in order to achieve its potential for green job creation.

In the sector of renewable energy, **there is ample space for the Middle East region to enhance job creation** in this sector compared to the global experience. The global experience shows that green job growth in this sector is closely related to the strength of the manufacturing sector; the strength of research and development (R&D); and the presence of robust financial support systems. Egypt has already taken steps in removing subsidies for fossil fuel use, which opens the way for further investments in renewable sources. **The establishment of funding platforms**, such as the Nexus of Water, Food and Energy (NWFE) Programme, can further **bolster investment** in this direction.

Developing skills for green jobs, as the global experience shows, requires **extensive and innovative strategies** to proactively anticipate and address emerging skill needs. This requires a comprehensive and sustained coordination mechanism between

environmental and skills policies and the outlining of a clear skills response plan. The international experience shows that the enforcement of already adopted environmental regulations accelerates the demand for green skills. Green skills identification and anticipation is still at a nascent ad-hoc stage in Egypt.

The report concludes with a set of recommendations that are divided in three main sections. The general recommendations to enhance the potential for green job creation include enforcing environmental regulations to accelerate the green transition and the demand for green jobs; bolstering coordination mechanisms for skill development and environmental policies; expanding financing opportunities for a green transition in different sectors; and facilitating knowledge transfer on green technologies. Egypt is also well positioned to benefit from debt-for-climate swap financial arrangements. In agriculture, recommendations to expand the opportunities for green job creation involve facilitating knowledge transfer at different levels of the agricultural sector; improving the parameters for Egypt's EBA; investment in the use of digital technology in marketing and supply chain management; and further investment in advancing technologies for climate-smart agriculture. Recommended policies for the creation of green jobs in the renewable energy sector involve bolstering green energy investments in the manufacturing sector; investment in research and development; and enhancing the availability of funding for small scale providers.

CHAPTER 1 Introduction

This study addresses the prospects for green jobs in Egypt with a focus on the sectors of agriculture and renewable energy. The key research question guiding the analysis in this study revolves around identifying the factors that would contribute to accelerating the green transition within specific sectors in Egypt. The study also investigates the skills needed within each sector of focus; the most relevant policies; the key enabling and disabling factors; and the key recommendations. The key objective of this study is to explore potentials for green job creation in Egypt, with focus on these two identified sectors.

The choice of the two sectors has been deliberate for their green job creation potential. Climate change has a serious impact on agriculture in particular. Agriculture is the predominant user of freshwater in Egypt, which is facing serious stressors due to climate change among other pre-existing factors. A green transition in agriculture offers the potential of creating green jobs in this vital sector of the economy and supporting climate change adaptation and mitigation policies. In the energy sector, Egypt has made large investments in renewable energy, with the Benban Solar Park as a key milestone at the cost of USD 2.2 Billion. Egypt's competitive edge in generating renewable energy, blessed with wind and solar energy supply, offers great potential for green job creation.

The analysis in this report is based on the triangulation of an extensive set of primary and secondary sources. The research process started with a thorough review of the existing literature on the situation of climate change in Egypt, the green transition in the country, and the state of knowledge on green jobs globally. A Delphi study design was adopted to collect data from experts in their relevant fields, and their views were used to extrapolate expected job loss/gains due to climate change and a green transition using data from the Labour Force Survey. This was followed by interviews with agribusiness leaders, energy experts, investors, bankers, policymakers and academia as per the list included in Annex I.

This report is structured as follows. This introductory chapter outlines the definition adopted for green jobs for the purpose of this study, the study methodology, and an overview of the institutional framework for a green transition and green job creation in Egypt. Chapter II analyses the results of Delphi survey and labour projections from the Labour Force Survey (2017-2021). Chapters III and IV respectively discuss the potential for green job creation in the two sectors of focus (agriculture and renewable energy). The report concludes with policy recommendations.

1.1 What are Green Jobs?

The analysis in this report adopts the definition provided by the International Labour Organization (ILO) of green jobs. This definition was adopted at the 19th International Conference of Labour Statisticians (October 2013). The adopted definition is:

"Jobs are green when they help reduce negative environmental impact ultimately leading to environmentally, economically, and socially sustainable enterprises and economies. More precisely green jobs are decent jobs that: improve energy and raw materials efficiency; limit greenhouse gas emissions; minimise waste and pollution; protect and restore ecosystems; support adaptation to the effects of climate change" (ILO, 2013)

Green jobs are driven by green policies. ILO/UNDP (2022:12) provide a more recent iteration of the definition of green jobs, directly linking such jobs to green policies and providing a typology of green jobs as: (i) direct jobs created in green industries, such as wind and solar electricity; (ii) indirect jobs created in the rest of the economy due to demand of goods and services as a result from the green policies and growth of green industries; and (iii) induced jobs created in all industries due to growth of income resulting from the green policies, which boost household consumption.

The main source of green job creation is through linkages between the different economic activities and the quest for environmental sustainability. Green jobs produce green goods and services that are the output of green production processes, technologies, or job functions that contribute to more environmentally friendly processes that benefit the natural environment. Green jobs can develop in both traditional and emerging sectors so long that they contribute to preserving or restoring the environment and reducing the environmental impact of economic enterprises (see Jarvis et al., 2011; Strietska-Ilina, 2012; Gregg et al., 2015).

Green jobs are defined as decent jobs. This is a central aspect that has been highlighted in the definition provided by the ILO in 2013. Work opportunities associated with environmentally sustainable practices and outputs are only considered green if they also comply with the job quality standards set by the ILO decent work agenda. Jobs that contribute to improving energy efficiency or minimising waste and pollution that are dominated by informal employment cannot therefore be considered as green jobs.

Green jobs and green policies should be context specific. Even though the goals of a greener economic setting should be universal, its implementation framework should be resilient to address different economic, environmental, and social contexts (Georgeson et al., 2017). In other words, the concept of a green economy should be flexible enough to adapt to different country conditions and, when possible, consistent in approach with international best practices (Hussain et al., 2020).

Green jobs offer the potential for a "win-win" situation of economic growth and job creation as well as sustained human development and well-being. A focus on green jobs allows for a reconciliation of goals for poverty reduction (SDG 1); decent work (SDG 8); and environmental sustainability (SDG 7 and 13). A green transition is likely to impact jobs any way, with some jobs expected to be lost (e.g., packaging), gained (e.g., pollution

control/environmental standards experts in all fields), substituted (fuel vehicle drivers to renewable ones), or transformed (plumbers using methods to recycle water for different purposes within a household) (ILO/UNDP, 2011).

A fair transition to green jobs should be gender sensitive. Climate change has a disproportionate impact on women. This vulnerability arises from the restrictive gender norms that limit women's access to markets, finance, technology, and productive resources. Accordingly, actions targeting a green transition in jobs should address these gendered inequities (Najjar et al., 2017). As "change agents" in their communities, women are pivotal to natural resource management, innovation, farming, caregiving as well as adaptation to climate change (Baruah and Najjar, 2022). Research has shown that women can play an instrumental role in sharing information related to community wellbeing, choose less polluting energy sources, and adapt more easily to environmental changes when their family's survival is at stake (ibid.).

1.2 Climate Change and the Urgency of a Green Transition in Egypt

Egypt is highly vulnerable to climate change.

Egypt's revised Nationally Determined Contributions (NDCs) report (June 2022) acknowledges the country's high vulnerability to the risks of climate change. The Nile Delta is considered an extremely vulnerable hotspot due to estimates of sea level rise (SLR) reaching about 1.0 m by year 2100 (NDC). This would inundate several coastal areas in the Nile Delta.

Climate change has significant implications on water availability. Climate change and the recurring extreme weather events (such as extreme heat, extreme cold, and unpredictable storm episodes) that accompany it will have different effects on Egypt's water resources. Two of the main concerns revolve around the rising heat levels that are expected to (i) increase evaporation upstream the Nile valley (affecting flows downstream) and (ii) rise the sea levels (encroaching on arable lands and increasing salinity in the Nile delta). Water scarcity is a serious concern in Egypt and is already leading to some green practices. According to Egypt's NDCs, the Nile River is the main source of fresh water for Egypt supplying 55.5 billion cubic metres (BCM) per year, as per the share agreed upon by international treaties. Egypt gets marginal amounts of water from non-renewable groundwater aquifers (2.1 BCM) and rainfall (1.3 BCM). Desalination efforts amount to 0.35 BCM, bringing the total water resources add up to 59.25 BCM according to the NDC. Because this share is still below the total water needs (estimated at 114 BCM), this has pushed the country to bridge the gap by reusing agricultural drainage and treated wastewater equivalent (amounting to 21 BCM according to the NDC).

Egypt's economic and emissions growth are still tightly linked to each other. Decoupling GDP growth from Greenhouse Gas (GHG) emissions is a priority. Egypt's share of global emissions remains low, estimated at 0.6% of the global emissions (World Bank, 2022). However, emission growth remained positive for most of the last 30 years, increasing by approximately 163% between 1990 and 2019, and by 31% between 2005 and 2015 alone. Energy, transport, and industry sectors constitute 80% of the national

emissions (ibid). Taking immediate action can limit the future costs of climate change impacts. According to the World Bank (2022), by 2060 the combined impact of climate change will represent between 2 to 6% of Egypt's GDP.

1.3 The Institutional Framework for Green Policies in Egypt

Egypt has a constitutional commitment to protect the environment and utilise resources wisely. Climate change is also centrally addressed in the country's Sustainable Development Strategy (SDS) 2030 and the corresponding policies.

Egypt issued its first ever comprehensive National Climate Change Strategy through 2050 in 2022.[1] The strategy was spurred by preparatory activities for the 27th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP27), which was presided by Egypt and held in the city of Sharm El Sheikh. The strategy provided an estimate of mitigation cost at USD 211 billion and focused on five specific goals with a clear reference to the importance of creating green jobs. Egypt also established a National Climate Change Council (NCCC) to play a supervisory role for steering climate change activities**.** According to the strategy, the NCCC is responsible for integrating climate change into national development planning. The strategy further establishes an institutional framework for the National Climate Change Measuring, Reporting and Verification (MRV) System. This system comprises the Central Agency for Public Mobilization and Statistics (CAPMAS) and newly established MRV units in the different ministries.

Climate change pressures have already led to policy change in Egypt, implementing a broad range of climate policies and projects.

Egypt's revised Nationally Determined Contributions (NDCs) provides a review of such policies. These pertain to:

- The phasing out of fossil energy subsidies.
- The commitment to investments in renewable energy projects such as the launch of Benban Solar Park (total of 1,465 MW), Assuit hydropower plant (32 MW), Kom Ombo Solar PV Plant (26 MW), and Gabal El-Zeit Wind Power Plant (580 MW).
- Measures undertaken to improve energy efficiency in different sectors. These include the electricity sector, which is responsible for 42% of emissions in Egypt according to the NDCs. These also include improving energy efficiency and low carbon fuels in the petroleum sector; enhancing low carbon transport; enhancing solid waste management; mobilising national and international green finance through Sovereign Green Bonds.

[1] The full strategy is available at: https://www.eeaa.gov.eg/portals/0/eeaaReports/N-CC/EgyptNSCC-2050-Summary-En.pdf accessed October 2022.

1.4 Study Methodology

The analysis in this report is based on the triangulation of an extensive set of primary and secondary sources. The research process started with a thorough review of the literature and existing reports on the situation of climate change in Egypt and the green transition in the country and the state of knowledge on green jobs globally. This was followed by a primary data collection process that included a survey of expert views constituting the main tool for the Delphi study approach explained below; and semi-structured interviews with agribusiness leaders, energy experts, investors, policymakers and academia.

The data collection process had two key objectives: 1) To gauge expert views on the economic activities that would likely be affected (either positively and/or negatively) by climate change and the green transition; and 2) to gain a deeper understanding of the green transition process in two of the major domains within the green economy. These were chosen as agriculture and renewable energy. The selection of the domains was informed by the review of the literature and by the first stage of the interviewing process, which focused on generalists.

Expert opinions were gathered using a Delphi study approach. This is a common methodology for soliciting expert views.[2] The method relies on systematically gathering views of experts in an iterative process allowing for cross checking. The list of economic activities was divided according to the sector of economic activity. The first stage of the study utilised a survey tool that comprised 15 different economic sectors based on the list of economic activities used by the Central Agency for Public Mobilization and Statistics (CAPMAS) in coding data.[3] Ten sector-specific questionnaires (with some sectors combined together in one questionnaire) were emailed to relevant experts with the aim of gathering data on the perceived expected percentage change in the number of jobs due to (1) climate change and (2) the green transition. These ten questionnaires have the same set of questions, but addressing different sets of economic activities in order to ask the identified experts about certain economic activities which they have expertise on. The experts were requested to give their opinion on whether each of these economic activities would be positively and/or negatively affected by (1) climate change, and (2) the green transition separately. Those who believed that an economic activity is positively and/or negatively affected were asked to provide their perception on a percentage estimate of jobs gained/lost within this economic activity. The sample of experts was collated by the GIZ team and included 200 respondents. Respondents were contacted by e-mail to fill in an online questionnaire. **Table 1** in **Annex III** shows the number of responses for each economic activity. A total of 51 responses were received. Two focus group discussions were organised involving survey participants to share the Delphi survey results and allow

[2] The name of the method, Delphi, is inspired by Greek mythology, connoting the seat of knowledge and wisdom. The Delphi method was popularised by the RAND Corporation (Santa Monica, California) for collecting and collating expert opinions.

[3] It is important to note that activities related to public administration, defence, and compulsory social insurance; education; health and social care; creative arts and entertainment services; activities of households as employers of domestic personnel, and activities of extraterritorial organisations and bodies were excluded from our analysis.

for an iterative consultation.

Expert opinion was used to extrapolate expected number of jobs in economic activities based on the Delphi survey results. Using the Delphi data, an average job growth rate across expert responses was calculated for each economic sector at the four-digit activity level to reflect the relative size of the effect of climate change and the green transition on employment across experts' opinions. Since the questionnaire allowed experts to anticipate the size and direction of the impact for both scenarios (by climate change and by the green transition), a rough estimate was computed for the perceived relative change in each activity; by averaging across the midpoints of the percentage change categories the experts initially chose from in the survey.

Analysis also relied on data from the Labour Force Survey rounds of 2017-2021. Based on the expert-perceived percentage changes gathered through the survey, the expected absolute change in number of jobs is then calculated for each economic activity, relying on data from the Labour Force Survey (LFS). Using the five-year average of total employment in the economy from the 2017-2021 LFS data, the expert-perceived growth rate is multiplied by the actual number of jobs in each activity (over the last five years) to project the average number of jobs that would be lost or gained for each economic activity and the for the sector as a whole.

The top occupational skills required for employment across all these sectors were also analysed. We linked the economic activities identified in the Delphi data to occupations in the O*NET skills/abilities/knowledge codes[4], therefore, identifying skill needs associated with climate change and the green transition in different economic sectors.

In-depth interviews were conducted with experts in the two sectors identified as involving major green economic potential: agriculture and renewable energy. Questions were asked about the factors that will contribute to accelerating the green transition within the sector, skills needed in the labour market, most relevant policies, and enabling and disabling conditions. The sample of experts for these interviews was selected from the larger sampling frame identified by the GIZ team for the Delphi study component. The qualitative Principal Investigator (Ghada Barsoum) obtained the approval of the Institutional Review Board of the American University in Cairo for both the Delphi survey and the qualitative interviews. Interviews were recorded and transcribed with the approval of the informants. A total of 24 respondents participated in this qualitative component. Interviews took place during the months between September 2022 and December 2022. Qualitative interview data was analysed based on a predetermined set of codes pertaining to the key themes of enabling and disabling factors, while still allowing space for the identification of emergent themes. The list of interviewees is listed on **Table 1** in **Annex I**

[4] O*NET provides a variety of occupational data, including 35 skills (e.g., persuasion; management of personnel resources), 33 types of knowledge (e.g. mathematics; psychology), and 52 abilities (e.g. written expression; manual dexterity) required by each occupation.

CHAPTER 2 Jobs that are expected to Increase/Decrease and the Projected Corresponding Skill Needs: Delphi Survey Results

This section will first discuss the expert-perceived changes in employment distribution before discussing how these changes will affect the skills, knowledge, and abilities required for the green transition.

2.1 Expert-Perceived Impact of Climate Change and the Green Transition on Jobs in Different Sectors of the Egyptian Economy

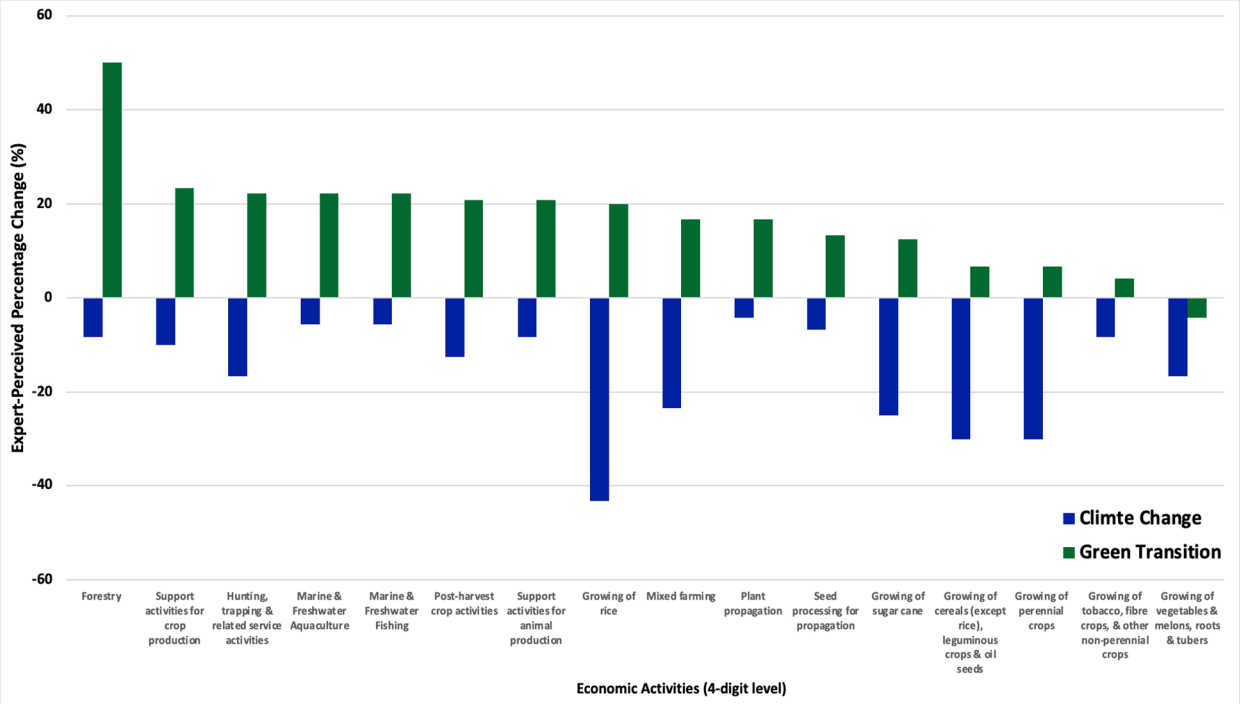
Experts were asked about the impact of climate change and a green transition separately. This is because the two processes are not necessarily intertwined. Climate change will have its impact on jobs if no action is taken. A green transition, however, requires a deliberate policy action that would lead to the creation of green jobs.

Manufacturing, construction, agriculture, wholesale, and retail trade, as well as transportation and storage activities are expected be the most negatively affected by climate change according to expert views. Figure 1 shows the perceived changes in the number of jobs based on experts' opinion and average employment data from the Labour Force Survey (2017-2021). All sectors, with the exception of the transportation and storage sector, are expected to witness at least a slight increase in employment due to the green transition.

While climate change is expected to destroy jobs in agriculture, the green transition might present an advantage for employment in this sector. Based on experts' opinions, employment in all agriculture, forestry, and fishing activities is expected to decline in the upcoming period due to climate change. Specifically, experts believe that while all agriculture-related activities are projected to witness a decline in employment by around 10%, activities related to the growing of rice will face the highest loss in employment, with around more than 30% of jobs expected to be lost **(Table 2 in Annex III).** When focusing on the absolute change in number of jobs, which is calculated from combining experts' projections with the average employment numbers from LFS data, the results reveal that activities related to the growing of tobacco, fibre crops, and other non-perennial crops, followed by support activities for crop production, growing of perennial crops, marine/freshwater fishing, and mixed farming will face the highest decline in number of jobs, with more than 5,000 jobs expected to be lost on average for each activity **(Table 2 in Annex III).** In contrast to climate change, the green transition is expected to have a positive impact on jobs in all agricultural activities except for the growing of vegetables, melons, roots, and tubers, which is expected to face a decline in employment of around 10% (**Figure 1** in **Annex III**). Interestingly, the activities that are expected to gain the most jobs from the green transition (around 5000 or more jobs) were also among the most negatively affected by climate change (the growing of tobacco, fibre crops, and other non-perennial crops; marine/freshwater fishing, and support activities for crop production)

(**Table 3** in **Annex III**).

***Figure 1**: Expert Perceived Percentage Change in Employment due to Climate Change and the Green Transition, by Economic Activities (Four-Digit Level) for Agriculture, Forestry and Fishing Sector*

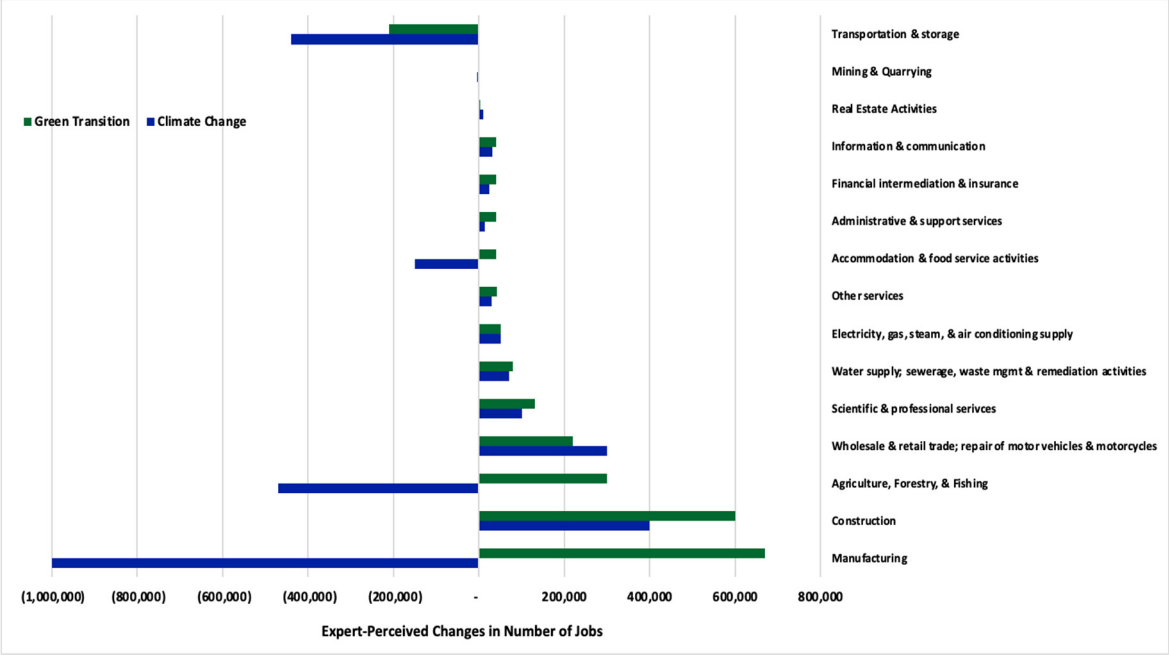


Source: Authors' calculations based on analysis of LFS data and Delphi survey data.

In the mining and quarrying sector, jobs are expected to slightly decline as a result of both climate change and the green transition; however, the negative impact of climate change on employment is expected to be slightly stronger than that of the green transition **(Figure 2)**. In this instance, experts predict that while both scenarios will destroy jobs in the mining sector, the green transition has the potential to slightly increase employment opportunities in activities related to the extraction of natural gas; mining of chemical and fertilizer minerals, and other support activities by around 10%. Except for the extraction of crude petroleum activities, which are expected to lose around 30% of jobs in either scenario **(Table 2 in Annex III).** No other major job losses or gains were anticipated by the experts in this sector.

Both climate change and the green transition will significantly impact the employment structure in the manufacturing sector. Even though both scenarios are expected to result in substantial job losses for this sector, experts believe that, unlike climate change, the overall effect of green transition will be positive **(Figure 2).**

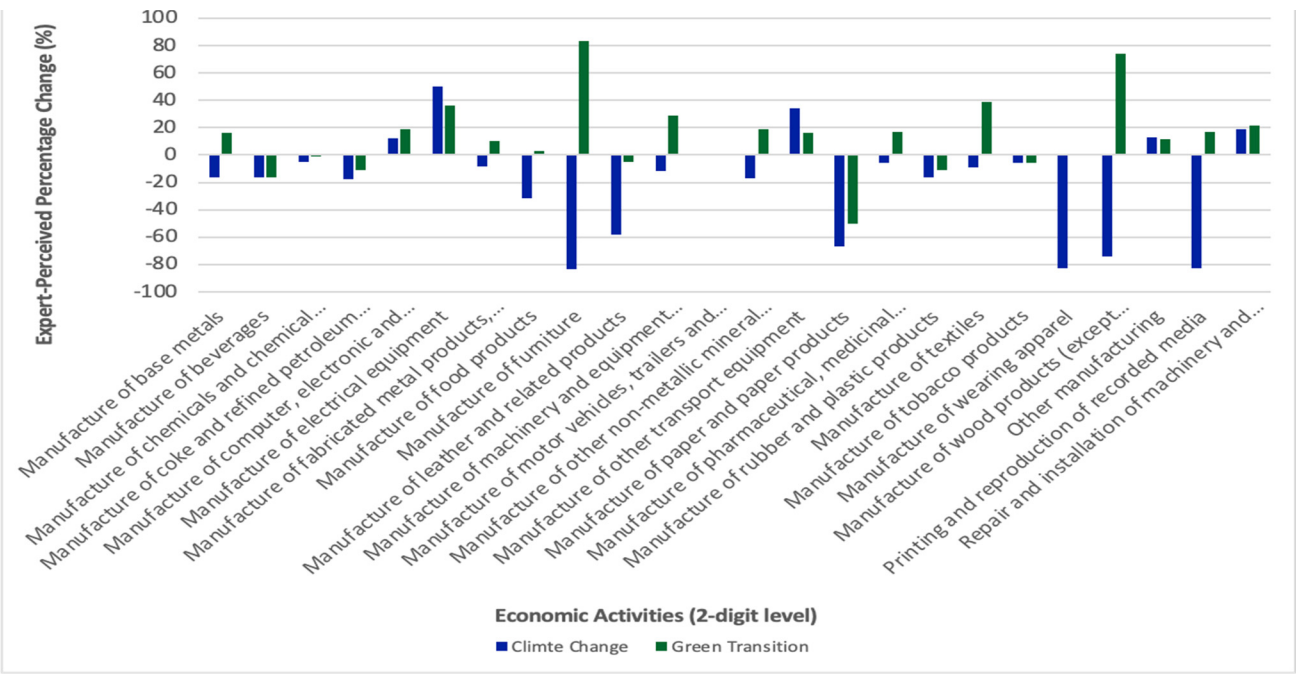
Figure 2: *Expert-Perceived Changes in Number of Jobs due to Climate Change and the Green Transition, by Economic Sector*



Source: Authors' calculations based on analysis of Delphi survey data and LFS data (2017 - 2021).

Specifically, experts believe that only activities related to the manufacture of chemicals and chemical products; tobacco products; leather and related products; beverages; coke and refined petroleum products; rubber and plastic products, as well as paper and paper products are expected to decline due to the green transition and will also be negatively affected by climate change **(Figure 3).** In contrast, activities related to the manufacture of domestic appliances; wiring and wiring devices; weaving of textiles; and the repair of fabricated metal products, machinery & equipment (except motor vehicles) will substantially gain around more than 5,000 job opportunities from both the green transition and climate change **(Table 3 in Annex III).**

Figure 3: Expert-Perceived percentage Change in Employment due to Climate Change and the Green Transition, by Economic Activities (Two-Digit Level) for Manufacturing Sector



Source: Authors' calculations based on analysis of LFS data and Delphi survey data.

All job expectations are positive for the electricity, gas, steam, and air conditioning supply sector, as well as the water supply, sewerage, and waste management sector. As **Figure 1** shows, experts estimate that both climate change and the green transition will result in a slight job growth for both sectors. Except for activities listed in **Table 3** in **Annex III**, which are expected to increase by more than 5,000 job opportunities due to the green transition and either climate change, all other activities in both sectors are expected to increase by around 1,000 jobs on average.

Employment opportunities in the construction sector are expected to substantially grow. As shown in **Figure 2**, the sector is expected to gain an average of 500 thousand additional jobs from both climate change and the green transition. Except for employment in the constructions of roads, railways, and other civil engineering projects, which is anticipated to decline by around 10% as a result of climate change, the construction sector is not expected to face any other jobs losses in either scenario.

Despite an expected decline in the number of jobs in a few activities in the wholesale and retail trade sector, the overall effect of climate change and the green transition on employment in this sector is expected to be positive. Specifically, employment in activities related to maintenance and repair of motor vehicles; retail sale of goods in specialised stores; wholesale of household goods, and retail sale of information and communications equipment in specialised stores is expected to substantially increase by more than 5,000 jobs on average under either scenario (**Table 3** in **Annex III**).

The overall effect on jobs in transportation and storage is evidently negative. Around 200 thousand jobs are expected to be lost in the whole sector as a result of the green transition and even more due to climate change **(Figure 2).** Except for a slight increase in employment in activities related to couriers, water transport, and transport via pipeline, experts believe that all other transportation activities will likely face a major decline in employment from both climate change (**Table 2** in **Annex III**) and the green transition.

While climate change is anticipated to lead to major job losses in the accommodation and food services sector, the green transition could compensate for this with more opportunities. With an anticipated decline in the number of all job activities, except short term accommodation, it is clear that the anticipated effect of climate change on this industry is alarming. On the other hand, the green transition is expected to have a more stable and positive effect on employment in this sector, with a slight decline in the number of jobs that are only related to event catering and other food service activities.

Major job gains are expected in the information and communication sector, as well as in the financial intermediation and insurance sector. Except for the respective negative impact of climate change on employment in programming and broadcasting activities and on jobs in trusts, funds, and similar financial entities, experts do not anticipate any other job losses in both sectors. In fact, experts believe that employment in all other economic activities in these two sectors is expected to increase by at least 1,000 jobs under both climate change and the green transition.

Both climate change and the green transition are expected to have a positive impact on jobs in real estate activities and scientific and professional services. According to experts' opinion, employment in all economic activities in both sectors are expected to increase, especially among legal, accounting, and advertising activities; architectural and engineering activities, as well as research and experimental development on natural sciences and engineering (**Table 3** in **Annex III**).

Even though both climate change and the green transition are expected to increase the overall number of jobs in the administrative and support services sector, a few activities are expected to face a decline in employment especially due to climate change. Experts project that only activities related to renting and leasing of motor vehicles will face a decline in employment due to the green transition, whereas climate change will substantially result in job losses in packaging activities and other office specialised support activities such as photocopying and documents preparation (**Table 2** in **Annex III**).

Employment in other services is also projected to increase under both scenarios. Even though jobs in the whole sector are predicted to increase in number (**Figure 1**), experts believe that employment in the repair of furniture, home furnishings, footwear, and leather goods will majorly decline as a result of both climate change (**Table 2** in **Annex III**) and the green transition. Yet, the repair of personal and household goods; computers, and other communication equipment are predicted to considerably increase in either scenario.

Table 2 and Table 3 in Annex III summarise the most affected activities in all economic sectors. For climate change, the analysis focuses on representing activities that experts expect will lose more than 30% of employment opportunities and/or more than 5,000 jobs. As for the green transition, the analysis identifies the activities that will gain most number of jobs. Since the experts-perceived results did not project an increase in employment higher than 10% from the green transition, the report will only focus on presenting activities that will increase by more than 5,000 jobs.

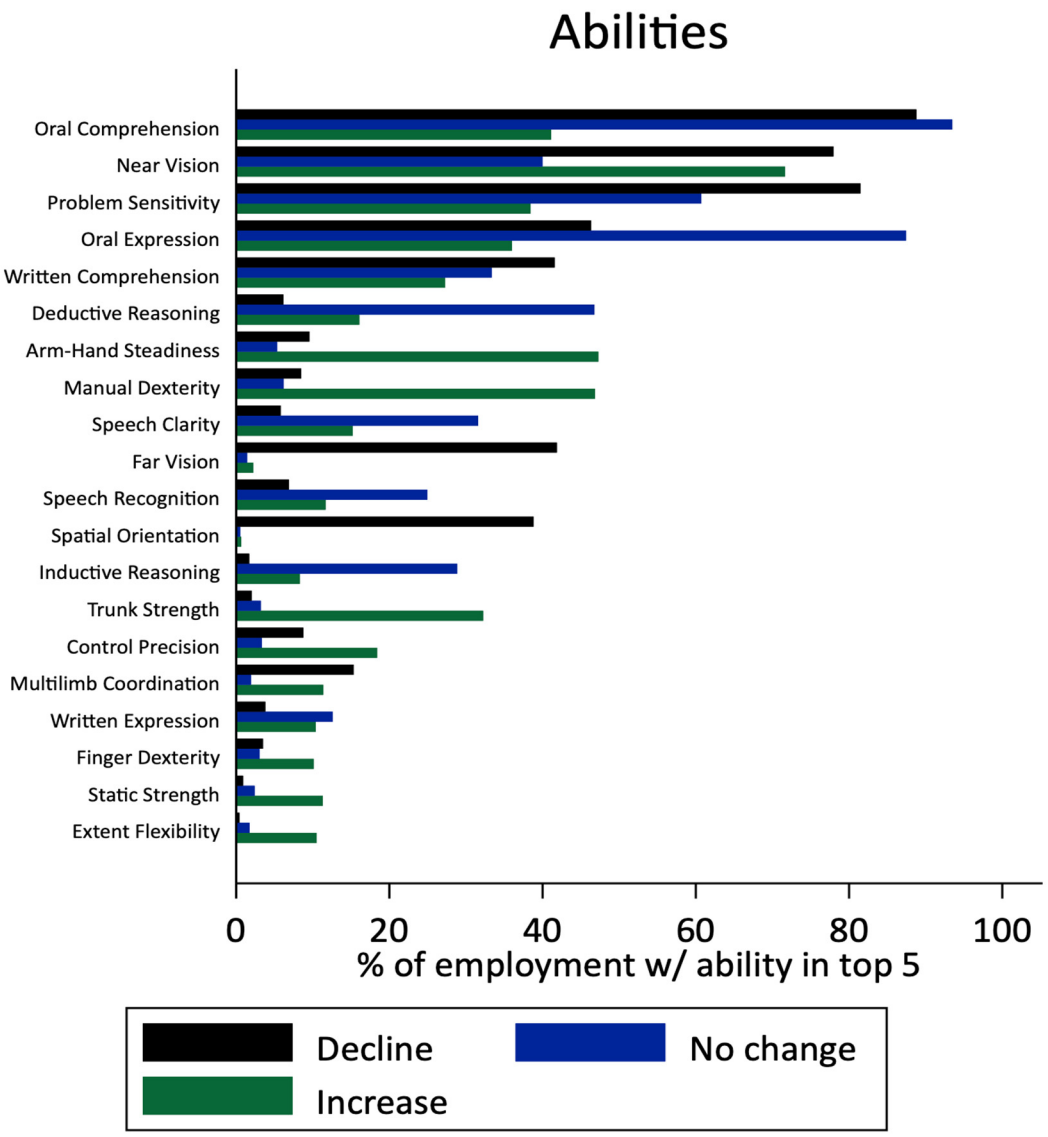
2.2 The Impact of the Green Transition and Climate Change on Skill Needs

In order to better understand the skills, abilities, and knowledge that will be needed for the green transition, we drew on **a combination of O*NET** occupational skills, abilities, and knowledge data, the Egyptian Labour Force Survey (Krafft, 2023), and expert respondent's predictions for employment changes due the green. According to the Delphi Survey Results, both climate change and the green transition are expected to alter the employment structure in most economic activities.

Expert Opinion on Top 5 Skills and Knowledge Areas as a result of the Green Transition and Climate Change

The knowledge of mathematics, mechanical engineering, design, building and construction, engineering and technology, computer and electronics are among the most crucial types of knowledge required for the green transition (see figure 5 below) and climate change (See **figure 7** in **Annex IV**) Additionally, **figure 6** below and **figure 8** in **Annex IV** show that **coordination skills** will become more demanded in either scenario. The figures also respectively reveal the importance of time management skills for climate change (Figure 8, Annex IV) and monitoring skills for the green transition (See figure 6).

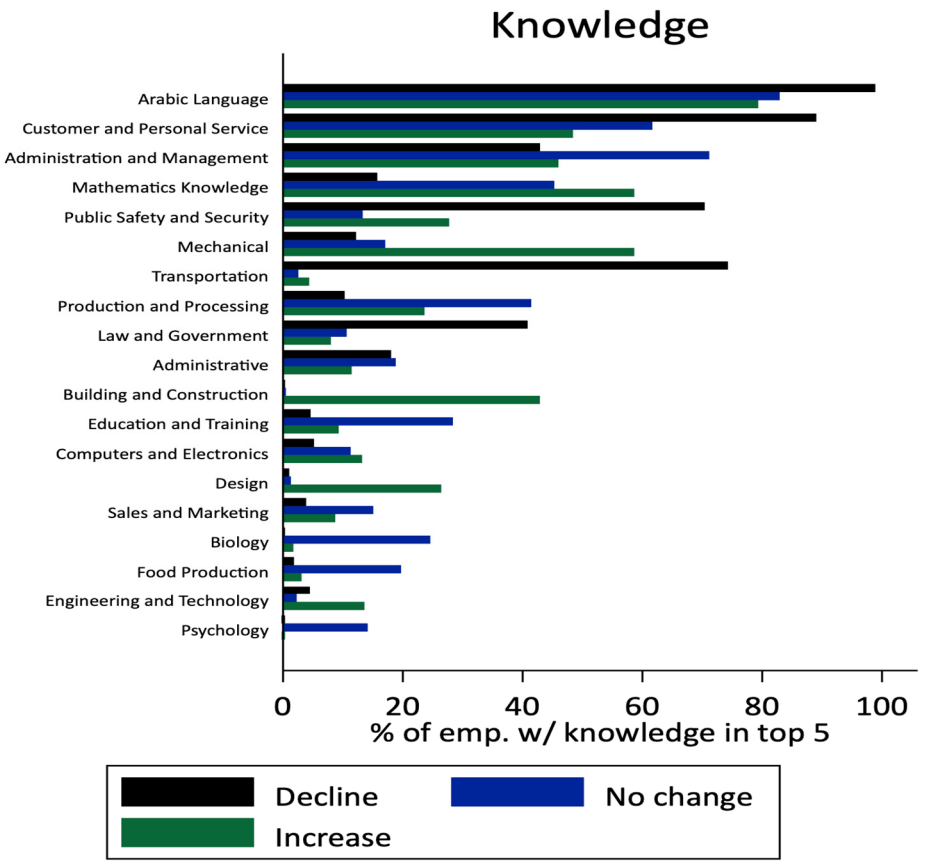
***Figure 4**: Percentage of employment that has each ability among the five most important abilities, by expert estimates of change in employment due to the green transition.*



Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

A number of physical abilities, such as arm-hand steadiness, trunk strength, and manual dexterity are particularly needed in employment increasing with the green transition, reflecting increases in employment construction and manufacturing industries.

Figure 5: *Percentage of employment that has each type of knowledge among the five most important types of knowledge, by expert estimates of change in employment due to the green transition.*



Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

Figure 5 shows the knowledge needed within occupations in industries that are predicted to decline remain the same or increase in employment as a result of the green transition.

The figure shows that mathematics, mechanical, building and construction, design, and engineering and technology knowledge are particularly needed in employment that will increase with the green transition.

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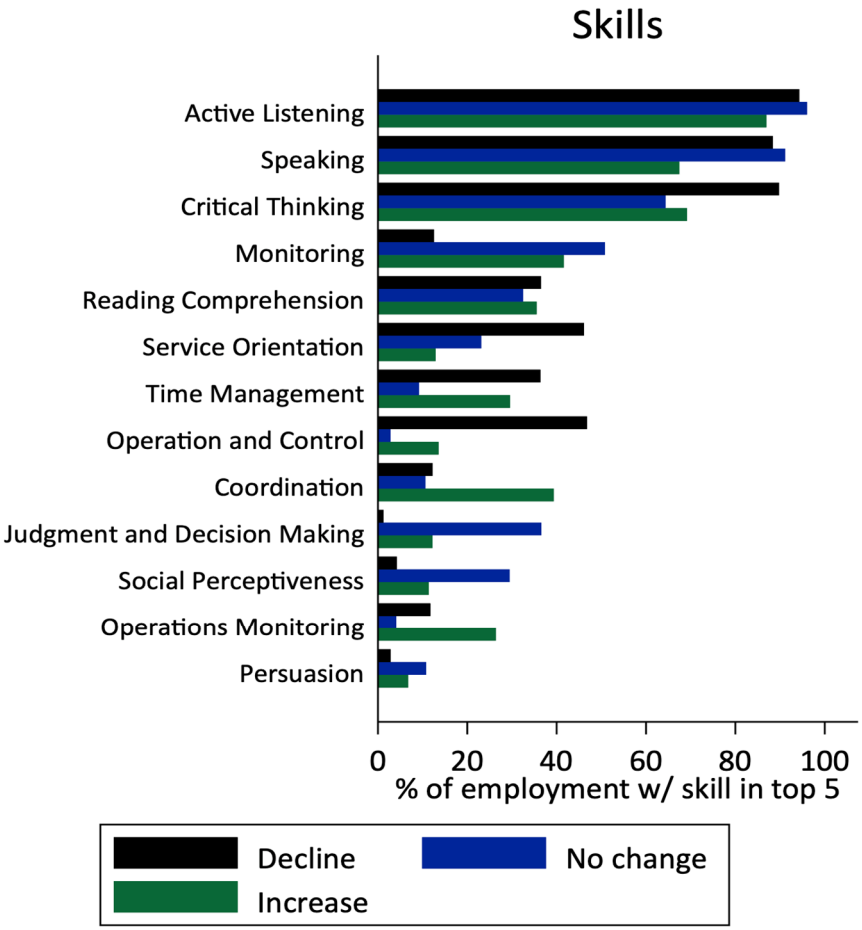
Figure 6: *Percentage of employment that has each skill among the five most important skills, by expert estimates of change in employment due to the green transition.*



Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

Figure 6 shows the skills needed within occupations in industries that are predicted to decline remain the same or increase in employment as a result of the green transition. We focus on the skills particularly needed for industries with increases in employment in our discussion. The figure demonstrates that coordination and operations management skills are particularly needed in employment that will increase with the green transition.

Globally, skill shortages are constraining the transition to a greener economy and innovative strategies are needed to address this. A study by ILO (2011) shows that this is particularly related to the task of preparing for some new occupations and for the changing skill profile of some of the existing occupations. Skill shortages for green jobs can be traced back to a number of factors related to the estimation of the capacity of growth in certain green sectors; a general shortage of scientists and engineers even in some of the developed countries studied; the low reputation and attractiveness of some sectors (waste management for example); as well as shortages of teachers and trainers in environmental topics and in green sectors (such as renewable energy and energy

efficiency). Innovative strategies and policies are needed globally to proactively anticipate and address emerging skill needs. Documented global good practices (ibid.) include comprehensive and sustained coordination between environmental and skills policies; the outlining of a skills response plan; the establishment of mechanisms for identifying, monitoring, anticipating, and providing skills that include representation from environmental ministries. The study also concludes that the enforcement of environmental regulations accelerates the demand for green skills. ultimately, tailor-made programmes, directly linked to specific job openings, have been found to be the most useful approach to retraining workers and upgrading skills in the context of restructuring measures (ibid.)

Egypt has witnessed the implementation of some tailored training programmes to address green skill shortage. Aside from many private-sector initiatives in this domain, the Productivity and Vocational Training Authority (PVTD) introduced in 2018/2019 a series of training programmes for solar energy production, with particular focus on providing the trained workforce for the Benban Solar Park (PVTD, private communication). Another planned initiative is the establishment of sectoral Centres of Competence (CoC) at the Ministry of Education and Technical Education (MoETE). The CoCs are special educational service providers in the Technical and Vocational Education and Training (TVET) system that have a sectoral focus, including renewable energy, and aim at developing their respective sectors. CoCs support technical secondary schools to offer a high-quality dual education system, with on-the-job training embedded in the system. The CoCs are envisioned to establish linkages with universities and research centres to bring the most updated state-of-the-art knowledge to the schools.

The linkage between environmental policymaking and education and training policy making remains weak in Egypt. Mechanisms for identifying, anticipating, and responding to green skill needs are important. Similarly, there is a need for ways to ensure coordination between greening sectors and education (ILO, 2018). Green skills identification and anticipation is still at a nascent stage in Egypt. Challenges identified include constrained funding for the coordination between education and enterprises along with the limited mechanisms for a social dialogue on skill needs; lack of an official and structured skills response strategy to greening within the formal education and training system in Egypt; the fragmentation of the education and training system; and the absence of a coordinating body for green skill development and green skills standards (ibid.). Initiatives to coordinate green sectors with the education system are predominantly donor reliant, which limits their sustainability and institutionalisation potentials.

The demand for green skills is contingent on job creation in green sectors. As will be illustrated in more details below, there is ample space for a green transition within the two sectors of focus (agriculture and energy). The process of green job creation remains weak, even in some of the sectors with the highest investment such as solar energy. A thorough sectoral analysis of green job potentials in each sector remains lacking. This can be tied to the global experience, noted above, where countries with strong enforcement measures of adopted environmental policies have witnessed effective mechanisms for green skill building.

CHAPTER 3: Towards More Green Jobs in Agriculture

3.1 Factors Accelerating the Green Transition in Agriculture

The starting point for the analysis is that the creation of green jobs in agriculture is contingent on agricultural transformation. **This section identifies a number of factors that could accelerate a green transition in agriculture. These factors constitute what can be described as the push by the impending impacts of climate change on this vital sector. A transformation to sustainable agriculture is estimated to create 8 million additional jobs by 2050 (ILO, 2018).** Moreover, the adverse impact of climate change on agriculture is projected to have a direct impact on food production in Egypt.

Climate change has a serious impact on agriculture in particular. There is ample evidence underscoring the long-term adverse impact of climate change on Egypt's agriculture and food systems. For instance, it is predicted that by 2050 Egypt's crop productivity will be affected as the mean daily maximum (minimum) temperatures for agricul-tural areas will increase by around 3.1°C (3.4°C) above the temperatures recorded in 2021. This rise in temperature will raise the sea levels, which will in turn encroach on arable lands and increase soil salinity, posing a serious threat the Nile delta — the food basket of the country —and affecting the harvest yield.

Agriculture is the predominant user of freshwater resources in Egypt, which mandates a shift to efficient water irrigation methods. Agriculture consumes an estimated level of 62 billion cubic metres (bcm) of water annually, equivalent to 82% of total water supply (Egypt's NDC, 2022). The water sector is facing stresses of capacity; growing urbanisation and population; and potential impact of the Grand Ethiopian Renaissance Dam. Efficient use of irrigation water has been a major challenge in agriculture in Egypt. Flood irrigation is the predominant irrigation method in Egypt, which is less efficient than drip or sprinkler technology and allows for evapo-ration losses. As a measure to reduce inefficiencies, agricultural drainage water is often reused for irrigation. However, this source only constitutes 15% of irrigation water and is particularly used on salt-tolerant crops such as olives and dates (CAPMAS, 2019). Municipal wastewater is also being recycled for irrigation purposes, but only constitutes 2 % of irrigation water (ibid.). Accordingly, there is a pressing need for more efficient water management systems and more sustainable irrigation methods to curb the impacts of climate change on this sector.

The agriculture sector in Egypt is better understood as comprising two realms of agricultural practices: the Nile valley (old land) and reclaimed desert areas (new land). While the old land continues to be fragmented, with lower rates of mechanisation, unsustainable irrigation practices, and agricultural intensification as noted above, the new land is more likely to use modern irrigation systems of centre-pivot sprinkler irrigation systems to reduce water wastage (Pereze et al., 2021). Egypt's land

reclamation efforts date back to the 1900s but have intensified over the past 40 years with mega projects such as the El Salam Canal and the Toshka project (Kassim et al., 2018). The country's NSCC includes plans for further land reclamation.

The share of agriculture of total employment in Egypt has largely declined over the past decades but agriculture is still a key economic sector. In 2000, agriculture provided 29% of total employment, down from 39% in 1990 (Perez et al., 2021). Over the past few years, the share of agriculture in employment continued to decline (**Figure 1** in **Annex II**). This is primarily a function of economic diversification and the growth of the service sector. Still, agriculture is a major economic sector in Egypt. Agriculture's role in Egypt's economy extends beyond the sector itself, with the agri-food system accounting for 27% of national GDP in Egypt and 38% of employment if we include agro-food supply chain (El- Kersh et al., 2022). Moreover, agriculture and food production growth has been rapid over the last three decades, corresponding with increasing population pressures.

3.2 Space for Climate Change Adaptation and Green Job Creation in Agriculture

Climate change adaptation technologies open venues for the creation of green jobs in agriculture. Perez et al. (2021) identify a four-pronged approach for climate change adaptation in agriculture that was confirmed by expert interviews. The approach includes 1) seed varietal technologies, with enhanced seed characteristics that counter the adverse effects of climate change; 2) soil fertility management technologies that promote sustainable use of soils that are degrading as a result of climate change; 3) irrigation water management technologies that increase efficiency in the application and utilisation of irrigation water and complement soil fertility management; and 4) crop protection technologies, including new and innovative ways of protecting crops from existing and emerging regimes of weeds, diseases, and insects induced by changing climate. Interview data provides more details on the prospects of these four technological approaches as we discuss below.

> *"It (a green transition) starts with the selection of seeds and sediments that are appropriate to the soil and weather conditions. This will greatly affect the quality of produce and the quantity of waste. (It is important to focus on) the use of modern technology and the development of new modified crop varieties that have the ability to resist weather and soil changes, as well as diseases. The disease resistance process is critical and is highly correlated with the use of chemicals and pesticides"*
>
> ***Expert interview, November 2022***

Climate change adaptation technologies are slowly finding their way to the agricultural sector in Egypt. Interviews show that management of seeds and knowledge about climate-sensitive seeds remains quite under-developed in Egypt. A

> "A third of the world's food production is wasted — around three million tons of agricultural production worldwide. This is enough to eliminate the problem of hunger worldwide. The main problem is usually the period between post-harvest and transportation"
>
> **Expert interview,**
>
> **December 2022**

key challenge in this area is the fact that knowledge transfer channels to farmers remain limited. Furthermore, expert interviews highlighted that farmers rely on information from seed vendors, which can bias their choices. The same concept also applies to soil fertility management technologies. Expert interviews also reveal that farmers are usually uninformed about the threats and benefits of the different soil fertility management techniques as they are usually biased towards subsidised inputs even if they are harmful. Evidence in the literature also confirms that farmers tend to prefer the over application of nitrogen fertiliser relative to crop-specific agronomic recommendations due to its relatively low cost (Abay et al., 2022).

Egypt is a member of the global climate smart agriculture alliance. Abdel Mowla and Abdel Aziz (2022) identify two key objectives for climate smart agriculture in Egypt 1) to improve food security and rural livelihoods by increasing productivity and economic gains; 2) to improve climate change adaptation and mitigation by focusing on the reduction of CO2 emission and zero waste of agriculture including lining of water canals (specific to Egypt). Expert interviews show that climate smart agriculture should focus on farmer practices (climate smart practices in the field), ensuring buy-in from the bottom to the top of the climate smart agenda and civic engagement and addressing the serious issue of agricultural waste. According to one interviewee, the focus on reducing agricultural waste is key to ending hunger and poverty. Climate smart agriculture also allows for the focus on increasing resilience to shocks and stressors as a result of climate change; promoting innovative approaches that support community adaptation (micro-insurance financial products; early warning systems; adaptive agricultural practices). The Egyptian agriculture sector needs to reckon that the sector is globally becoming a knowledge-intensive business **(**Haile et al., 2019).

Agricultural transformation and the protection of land resources are central to the policy agenda in Egypt. The 2014 constitution, Article 29, underlines the commitment to "protect and expand agricultural land, and criminalise encroachments". Moreover, the Climate Change Strategy recognizes agriculture as the **most sensitive** sector but also a key contributor to CO2 emissions (9%). The Climate strategy focuses on developing strategic crops that are highly productive; can tolerate the adverse weather conditions of high temperatures, salinity, and drought; and have low water consumption. The strategy also highlights the importance of water and irrigation infrastructure (expansion in rehabilitation and lining of canals, development and modernization of irrigation and agricultural systems; management of the agricultural process, and water treatment). The strategy calls for reducing GHG emissions from agricultural activities (such as animal

production activities and agricultural waste management) through advocating for urban agriculture and rooftop farming as a measure of climate change mitigation.[5]

The private sector has supported the growth of irrigation water management technologies but mainly in the newly reclaimed lands. The "old" land remains reliant on the conventional flood irrigation approach. Efforts to introduce modern irrigation infrastructure (piping and water outlets) are hampered by three challenges according to the interviews. The first is the high cost of the transition to this technology, particularly to small land holders. The second is the fear that pipes and other installations might be susceptible to thefts from fields (a concern expressed by one provider); the third is the weak knowledge base and awareness among farmers about the impact of climate change on water stress. Conversely**,** interviews show that farms in reclaimed areas tended to use more green technologies including efficient water irrigation systems, solar panels to provide energy for water pumps, data-driven agriculture, and advanced technologies to support farming practices. In one farm, and according to the interviews, more than 500 agricultural engineers were hired to support the production process. This is a large-scale investment that provides evidence on the untapped potentials for investment in agriculture.

Digitalization of agriculture remains an untapped opportunity in Egypt. Leveraging digital solutions carries significant potential in increasing the profitability and productivity of smallholder farmers. Digitalization can be used in advancing precision agriculture solutions, weather information, soil sensors, drones for agriculture (Tsan et al., 2019). Data-driven farming practices remain virtually non-existent in the old valley, although interviews reflect some practices in the newly reclaimed lands. Digitalisation for agriculture offers great potentials for green job creation (Tsan et al., 2019). Egypt has a nascent mobile-based advisory service that provides access to agricultural information and allows for some knowledge sharing but at a limited scale (Kassem et al., 2021). With regards to remote sensing data, Abay et al. (2022) note that traditional data collection methods are not feasible in giving timely and useful data informing timely agricultural practices. Other countries in Africa have had more strides in this area (Tsan et al., 2019). In Egypt, International Food Policy Research Institute (IFPRI) has recently established the Spatial Agricultural Database for Egypt (SPADE), which is a new initiative that houses over 1,000 datasets and layers organised into thematic areas (ibid.). There are also great potentials for the development of agri-platforms in support of agriculture trade in Egypt and remote sensing data collection technologies. Agri-platforms have been introduced in a number of Sub-Saharan African countries (Levi et al., 2022)

Egypt's score on the Enabling the Business of Agriculture (EBA) remains low.[6] With a score of 47/100, there is ample space for improvements in the enabling environment for farmers to grow their businesses including improving the process for new seed and fertilizers registration; regulations and procedures. This can also include enhancing

[5] The full strategy is available at: https://gate.ahram.org.eg/media/News/2022/5/19/2022-637885786041087285-108.pdf accessed October 2022.

[6] The World Bank defines the purpose of EBA indicators as assessing "whether governments make it easier or harder for farmers to operate their businesses. The indicators [...] identify regulatory obstacles to market integration and entrepreneurship in agriculture" (Source: https://eba.worldbank.org/en/about-us accessed January 2023)

accessibility to credit, securing water, registering machinery, sustaining livestock, protecting plant health, trade, and finance for agriculture. EBA scores on the different parameters are included in **Annex II**, **Table 1.** An effective EBA is connected to the use of technology in agriculture and to digital readiness in agriculture (Tsan et al., 2019).

Egypt's agricultural development hinges on strengthening institutions working in this field. This relates to providing support to local, regional, and national level institutional arrangements in the agriculture sector. This also should entail building the capacity of national and local extension village-level offices to play a role in the promotion and dissemination of these technologies. In terms of legislation, Egypt has taken steps towards water management, with the new water resources and Irrigation law (147/2021) promoting water use efficiency. The country also started a fund for modern irrigation methods, which can potentially accelerate green job creation in this field.

3.3 Key Disabling Factors for a Green Transition in Agriculture

Agriculture remains the sector of the most disenfranchised, with high informality and incidence of poverty. The definition of green jobs starts with the statement that these jobs provide decent work. There is ample evidence that workers in the agriculture sector have no access to social insurance and other forms of work-related social protection measures such as medical insurance (e.g., Keo et al., 2019). Additionally, the sector relies on child labour, with a large number of children in rural areas engaged in agriculture wage work (Khatab et al., 2019).

> *"A very critical need is the human development factor. To enhance the farmers capabilities and make sure they are able to make use of modern technologies. Skills are gained from both scientific background and practical application. Therefore, one's education must be highly related to what they apply on the ground."*
>
> **Expert interview,**
>
> **November 2022**

The poor working conditions and limited support to agricultural workers renders agriculture as a "culturally" unattractive field of study. Interviews with many experts in the field show that there is a social stigma associated with the study of agriculture, even at the university level. Agricultural engineering, interviews show, is considered to be an inferior form of engineering compared to other specialisations.

The skill transfer channels to workers and small-scale landowners remain quite weak. Agriculture is a knowledge intensive field and weakness of farmer groups/cooperatives limits access to resources. The Ministry of Agriculture and Land Reclamation has offices in all villages. However, these are limited to the distribution of subsidised inputs, with little role in knowledge transfer. According to interviews, these units were not modernised and their role in the support of farmers is limited to the distribution of subsidies, with limited skilled workforce. This weak utilisation of these units, which exist in all villages, compromise the potential for green transformation in the field and the creation of green jobs.

Although agriculture is the largest employer of women in the MENA region, women's contribution to the sector remains largely undervalued and invisible. Agriculture employs about 40% of working women (UN Women, 2018). Women are also de facto farmers, with men migrating seeking other livelihood sources (Najjar et al., 2017). As de facto farmers, they have constrained access to capital, agricultural inputs, or agency (ibid.).

The weak EBA is a key challenge. This is a factor related to the investment climate in Egypt in general. Particularly, limitations for the agri-food SMEs and agricultural producers to access finance are key restrictions with regard to transition to green economy and the creation of green jobs. The legislative framework for land acquisition needs to further provide assurances for investors on the security of tenure and land ownership. Interviews show that abrupt policy changes disrupt the business environment and discourage new investment in the field.

3.4 Skills Needed in the Labour Market for a Green Transition in Agriculture

On the demand side, the skills needed in the labour market would ultimately mirror the level of green transformation in the field. The four approaches recommended for the green transformation in agriculture (Perez et al. (2021) all require skilled labour for their implementation in this knowledge intensive field. Seed and soil fertility management technologies require a higher level of expertise beyond the skills provided by TVET education in agriculture. The same applies to irrigation water management technologies and crop protection technologies. Similarly, the promotion of research and development in agriculture carries potentials for skill demands in knowledge adaptation, knowledge transfer and communication.

On the skill supply side, factors related to the governance of the education system and the desirability of the field to prospective students remain central. On the governance side, and similar to other climate change skill building measures, coordination between the education system and linkages to research findings remain lacking. The fragmentation of the education system hampers the potential for such coordination as noted above. To improve the demand for studying agriculture among students, media campaigns are needed to show the importance and the prospects of skill building in this field.

Skill supply and demand aspects are interrelated. Making agriculture an attractive field of study hinges on the increased investment in this sector so that prospective students receive the signals that this field of study is capable of creating more and better jobs.

Interviews highlight that both science and indigenous knowledge are relevant. A good example is organic farming. As one interviewee notes, Egypt's pre-modern farming has been organic. Mitchell (2002) explains how some foreign expert views challenged existing practices in agriculture in Egypt in the twentieth century. Organic farming in its current form commenced in the 1970s. In 2019, it had more than 33,000 hectares of land

(compared to 25,000 in 2006) of organic farms, mostly deserts irrigated from the Nile (ILO, 2018). Clearly, organic farming plays a crucial role in land reclamation.

Chapter 4 Towards More Green Jobs in Renewable Energy

4.1 Factors Accelerating the Green Transition in Renewable Energy Production and Green Job Creation in the Sector

Egypt has a competitive edge in generating renewable energy. According to some estimates, Egypt receives 3,050 hours of sunlight per year. The country is also blessed with wind energy supply. This is mainly in the region of the Sinai Peninsula and areas surrounding the Gulf of Suez. The country consistently observes high wind velocities and contains large uninhabited deserted areas — making it ideal for harvesting wind energy.[7]

Investment in clean and renewable energy is urgently needed due to increasing levels of air pollution. Air pollution has reached serious levels in Egypt. According to IRENA, air particulate matter (PM) in Egypt is beyond the safe standards set by the World Health Organization. This has serious health risks, particularly for children, asthmatics, and the elderly. **Figure 2** in **Annex II** shows the levels of PM in Egypt. The energy sector is also the largest producer of GHG in Egypt due to the heavy dependence on oil and gas (UNDP, 2021).

Investment in renewable energy is anticipated to grow post COP27. International financial flows in support of clean energy research and development and renewable energy production, including in hybrid systems, increased from 10.4 million of constant 2017 dollars in 2000 to 1828.2 million of constant 2017 dollars (UN STATS Hub). This is expected to significantly increase post the COP27.

The Egyptian government launched the Nexus of Water, Food and Energy (NWFE) Programme in July 2022. NWFE aims to accelerate the national climate agenda and provides opportunities for mobilising climate finance and private investments to support Egypt's green transition. It was developed on the back of the announcement of Egypt's 2050 Country Climate Strategy, and the Nationally Determined Contribution (NDC).

Egypt's reliance on non-renewable energy for electricity production is slowly changing. Figure 3 in **Annex II** shows, Egypt dependence on fossil fuel generated Electricity underwent a significant decline from 50% in 2019 to more than 30% in 2020. Moreover, it is anticipated that the share of renewable energy is bound to increase thanks to the continuing investment in the sector. In 2020, renewable sources of energy were at the historically highest point of 12%. The New and Renewable Energy Authority (NREA) has a number of outlined projects to construct two large solar and wind power generation plants.

The Central Bank of Egypt (CBE) encourages investment in renewable energy. A recent circular from the Central Bank (November 2022) requested individual banks to initiate sustainable development financing policies that are specific to each bank (circular obtained during interviews). The circular, however, does not provide practical steps for a credit guarantee fund but leaves the details to individual banks.

[7] https://energyegypt.net/the-nrea-outlines-project-plans-for-two-large-solar-and-wind-energy-projects/ accessed January 2023

Egypt's economic reform programme has particularly targeted the energy subsidy system. This can potentially contribute to the expansion of sources of renewable energy with the gradual rationalisation of such subsidies.

Egypt supported mega projects in renewable energy. The Benban Solar Park received the award for the best project funded by the World Bank in 2019 with investments of $2.2 billion. The project produces 1,465 megawatts of power and is considered the largest solar complex in Africa. Interviews show that there are 32 projects that are part of the park of Benban. Other notable initiatives include the Siemens electricity plant and El Dabaa Nuclear Plant (UNDP, 2021).

Egypt has adopted a set of enabling policies to promote the use of renewable energy. Of particular importance is the feed-in tariff[8] for renewable energy supplies. This policy compensates producers of renewable energy at an above-market price for what they deliver to the grid. Similarly, the net consumption measurement policy deducts the cost of renewable energy consumption from the energy bill of an entity (in the household, commercial and industrial sectors). In more recent years, the feed-in tariffs have gradually been replaced by competitive bidding and auctions (UNDP, 2021).

Egypt is not new to renewable energy with hydroelectricity plants already providing a major source of energy. This has been a historical achievement of the Egyptian government since the establishment of the Aswan High Dam (completed in 1970). Hydro/marine-sourced energy constitutes 45% of Egypt's renewable energy as **Figure 4** in **Annex II** shows. Currently, Egypt has six hydroelectricity power stations (UNDP, 2021). These are Aswan High Dam; Aswan Dam (1); Aswan Dam (2); Esna; Nag Hammadi; and Assiut. Together, these stations provide 45% of the renewable capacity in the country. Water in Egypt is used to produce 12,726 gigawatt hours (GWh) of hydroelectricity, according to 2017/2018 data, representing 6.5% of the total electricity generated (UNDP, 2021).

Egypt has a developed Integrated Energy Strategy. The strategy aims to generate 42% of its power from renewable sources by 2035 with outlined details on the pathway to produce, utilise and conserve energy through 2035 (UNDP, 2021). The country is also engaged in building skills for renewable energy jobs such as the establishment of Centres of Competence as part of an initiative to reform technical education.

4.2 Space for Green Job Growth in the Energy Sector

Globally, the renewable energy sector has been an engine for job creation. Egypt stands to benefit from the global experience in this regard. Worldwide, employment in renewable energy in 2021 was 12.7 million jobs, up from 12 million in 2020 (IRENA, 2022). As **Figure 5** in **Annex II** shows, China stands out as the country with the largest number of jobs created in the energy sector. China alone accounts for 42% of the global job creation in renewable energy. The sector of concentrated solar power (CSP) is the largest energy sector of employment in China. This is followed by liquid biofuels. With less than a quarter of jobs created in the energy sector, Brazil is the second largest

[8] This policy is generally designed as a tool to compensate producers of the renewable energy (e.g., solar or wind energy) a market price for the energy they can deliver to the grid.

country in employment creation in the energy sector. Liquid biofuels are the largest sub-sector, followed by CSP. The third largest country with job creation in the energy sector is the United States, creating less than one-fifth of the number of jobs created by China. Globally, jobs in solar photovoltaic (PV) were the fastest-growing jobs in 2021, accounting for more than a third of the total renewable energy workforce (IRENA, 2022).

The Middle East region lags behind in job creation in energy. As **Figure 6** in **Annex II** shows, based on data from IRENA, Jordan is the country with the largest number of jobs created in this sector in MENA. However, the number of jobs created by the energy sector in Jordan remains small (40,000 jobs), with solid biomass is the largest sub-sector in Jordan in terms of job creation.

Egypt is the third largest country in the MENA region in terms of job creation in the renewable energy sector. With less than 10,000 jobs created in the sector based on IRENA data, the country has a large room for employment expansion in this sector. The largest employment generating sub-sector is liquid biofuel, followed by CSP.

Egypt has achieved universal access to electricity, but the share of renewable energy has been low. The proportion of the population with access to electricity increased from 93.4% in 1992 to 100% in 2017 (UN STATS Hub).[9] Egypt consumes 83 tons of petroleum and natural gas equivalent products, 42% of which is used in electricity generation (UNDP, 2021).

4.3 Key Disabling Factors for a Green Transition in Renewable Energy

Job creation in renewable energy is closely related to the strength of the manufacturing sector. As the IRENA (2022) report shows, the countries that dominate the renewable energy landscape are strong in manufacturing, engineering, and related services. This allows these countries to create the majority of jobs in this field. The manufacturing sector in Egypt is lagging behind, with the country's Manufacturing Value added (MVA) at 15% in 2021 (World Bank, 2022). [10]

> "The renewable and non-renewable energy sector still needs to attract more trained, competent, and specialized workers. There is also a need to partner with civil society organizations, associations, or training centres that provide advanced skills for the construction, installation, maintenance, and operation processes."
>
> **Expert interview,**
>
> **December 2022**

Job creation in renewable energy is closely related to the strength of research and development (R&D). For example, the vast majority of global solar PV manufacturing takes place in China, supported by substantial government incentives and extensive R&D (IRENA, 2022). The production

[9] https://country-profiles.unstatshub.org/egy#goal-7 accessed January, 2023

[10] https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=EG accessed January 2023

process relies on the processing of Polysilicon ingots and wafers, which are then manufactured into cells and assembled into modules. The top ten solar PV module manufacturers have a 90% share of the global market (ibid). Research and Development in Egypt is limited to less than 1% of GDP (World Bank, 2022).[11]

Renewable energy impact programmes can only become sustainable when they are accompanied by robust financial support strategies. While there have been significant strides in funding renewable energy, more sustained sources of funding need to be put in place to ensure the continued growth of this sector. Globally, there is an urgency for credit guarantee funds to support small businesses to undertake a bigger role in the energy green transition (UNIDO, 2022). Green bonds can open the way for investment in energy. However, interviews show that the mechanisms are still unclear and there is little space for small enterprises. Egypt already has an Environment Protection Fund. However, for several years, the Fund has faced challenges due to the inflexibility of government regulations in the area of its purview, and it may be time to enhance its effectiveness by giving it more flexibility in managing its resources (UNDP, 2021). It is hoped that the NWFE initiative will provide a platform in support of further investment in renewable energy.

> *"The finance sector in Egypt is faced with many challenges. Relying on more modern financing mechanisms is a must to provide the necessary funds. But the focus should not only be in attracting foreign investments; local investors have an important role too"*
>
> **Expert interview, December, 2022**

The sector is primarily dependent on mega projects, with little space allowed for small businesses to play a role in this field. Interviews show that small businesses can play a bigger role in job creation, particularly in biofuel industries. The mechanisms for expanding opportunities for the private sector are primarily contingent on the parameters of the investment environment in Egypt.

Egypt is an electricity surplus country with high reliance on non-renewable sources, which is limiting the urgency of a green transition in this sector. As **Figure 7** in **Annex II** shows, renewable sources constitute only 7% of energy supply. Egypt is already an exporter of solar energy[12]. Moreover, as a major producer of liquid gas, investment in this non-renewable energy source continues to thrive. For example, ten gas stations were recently built for the transmission network of extra-high and high voltage as well as the construction of new distribution networks (UNDP, 2021). Egypt has recently expanded the power sector to address electricity shortage challenges in the past decade, which included the construction of three gas-

> *"Improving the business environment in solar energy; enhancing the legislative foundation and developing the corporate vision" (are key).*
>
> **Expert interview, December 2022**

[11] https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=EG accessed January 2023

[12] More details are available at https://en.eipss-eg.org/egypts-enormous-electricity-surplus-achievement-or-impasse/#:~:text=The%20Egyptian%20government%20boasts%20that,which%20means%20that%20the%20surplus (Accessed April, 2023)

operated combined-cycle power stations with a capacity of 4.8 gigawatts (ibid.). Similarly, investment in the petroleum sector continues to grow, with about 69 projects implemented in recent years, providing petroleum products to meet the needs of the local market and exporting the surplus (ibid.).

4.4 Skills Needed in the Labour Market for a Green Transition in Energy

Different skills are required at different stages of the transition. Interviews show that even though scientific, technical, and engineering expertise are the most demanded in renewable energy, the earlier stages of the transition will increase temporary employment in construction, installation, and manufacturing. Other expertise in financial analysis, maintenance, and administration will also be of high importance to ensure the smooth operation of the facilities.

International partners are part of the knowledge transfer, but this limits the sustainability of initiatives. With the help of international organisations, the Egyptian government has been able to embark on the enhancement of its technical and vocational education and training (TVET), which will provide the labour force with the required capacities for employment in new, sustainable, and green sectors. Initiatives, such as the Workforce Improvement and Skill Enhancement (WISE) project, which is supported by USAID, is developing new programs with special focus on the technicalities of renewable energy and innovation (Cote, 2019). The 3-year program for solar and wind energy technicians, developed under WISE, is already up and running in Aswan and Hurghada, with potential for up-scaling and a pool of high-quality candidates that will be ready for employment. However, efforts must be undertaken to ensure the sustainability of such initiatives.

National efforts also play a vital role in the provision of training. Various national and regional organisations also play a significant role in preparing the labour force for the transition to renewable energy. Initiatives by the New and Renewable Energy Authority (NREA), the Solar Energy Development Association (SEDA), and the Regional Centre for Renewable Energy and Energy Efficiency (RCREEE) are not only focusing on addressing the skill gap of the technical workforce but also on raising the competencies across the whole value chain by raising awareness on the importance of finding innovative solutions to expand the market and increase the scale of renewable energy production. Such capacities include but are not limited to energy pricing and trading, large-scale projects assessment and planning, and energy management software tools (ILO, 2018b).

CHAPTER 5 Policy Recommendations

The report concludes with a set of recommendations that are divided in three main sections: general recommendations to enhance the potential for green transition; recommendations specific to the agriculture sector; and recommendations specific to the renewable energy sector.

5.1 General Recommendations to Enhance Green Job Creation in Egypt

1. **Enforce environmental regulations** to accelerate the demand for **green skills** and **green jobs,** as a first step towards expanding the green job potential in Egypt. Similarly, **incentivizing private companies** to **adopt environmental and social governance (ESG) strategies** is key for the expansion of green job potentials in Egypt. The **adoption of a carbon tax** can also accelerate decarbonization and the green transition in different sectors.
2. **Develop innovative strategies** and **policies** to proactively anticipate and address emerging skill needs. Following the global experience, Egypt needs to **invest** in **comprehensive** and **sustained coordination** between **environmental** and **skills policies** in order to outline a skills response plan and establish mechanisms for identifying, monitoring, anticipating, and providing skills.
3. **Technical education system** requires further **investment** in developing and implementing **tailor-made programs** that are directly linked to **specific job openings and demanded specializations**. Tailor-made programs have been found to be the most useful approach to retraining workers and upgrading skills in the context of restructuring measures.
4. **Promote investment in green research and development** and the arrangement of **knowledge transfer,** as they are key for accelerating a green transition in different sectors. Similarly, the **investment in knowledge transfer** mechanisms on **green technologies** is key to expanding access to green skills for both wage workers and employers.
5. **Utilize green financing mechanisms** as Egypt is well positioned to benefit from **debt-for-climate swap** financial arrangements. This financial mechanism can transfer resources for climate purposes and can be leveraged in support of both mitigation and adaptation measures (Essers, 2021). Green Bonds and carbon off-set funds are specially designed financial instruments to finance green projects (Bhutta et al., 2022).

5.2 Recommendations Specific to the Agriculture Sector

1. **A policy focus on the green transformation in agriculture is central** to green job creation. **Policy design need to consider** the difference between the Nile Valley (old land) and the newly reclaimed agricultural land. Green job creation is contingent on the mix of policies that would address extreme fluctuations in weather conditions; inefficient use of resources and unsustainable practices; limited fertile land; salinization; and soil pollution from inefficient use of agrochemicals and high rates of pesticides and fertiliser use.

2. **Transfer Knowledge about climate-smart agriculture methods,** techniques for improving seed characteristics, soil fertility management, irrigation water management, and crop protection techniques **to farmers and marginalized workers**, such as females and less educated groups. This will also facilitate creating green jobs in this sector.

3. Improve the parameters for Egypt's EBA is also key to expanding investment in this sector and supporting the integration of different technologies for a green transition such as climate-smart agriculture.

5.3 Recommendations Specific to the Renewable Energy Sector

1. **Bolster green energy investments** in support of the manufacturing sector to enhance job creation in renewable energy sector. The analysis shows that countries that engage in manufacturing different supplies for renewable energy production can create the largest number of jobs in renewable energy.

2. **Encourage investment in research and development** as well as **enhancing the capacities** in renewable energy sector will support in job creation in this sector.

3. **Expand Centres of Competence** as vehicles for sector development, which represents a partnership between the Ministry of Education and Technical Education and the representatives from the private sector, particularly in promising areas, such as renewable energy.

4. **Expand the availability of funding for small scale providers** is key for this sector to thrive, particularly in areas such as biomass.

5. **Review intellectual property laws to facilitate knowledge transfer in the green economy**, promote the transition to **renewable energy** and **sustainable environmental technologies**. This will contribute to enhancing international cooperation and stimulating innovation in the field of environment and energy.

ANNEX Literature

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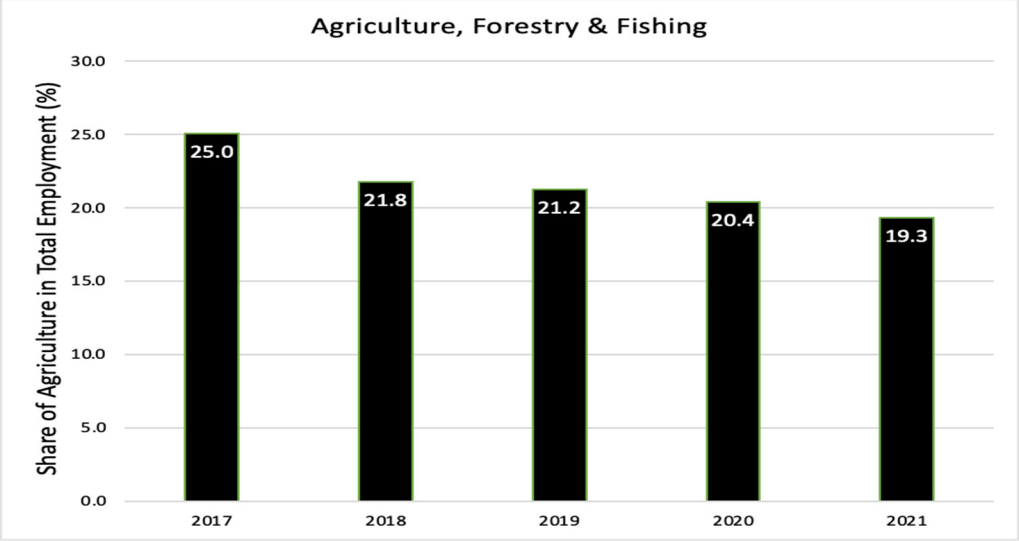
Annex I List of Interviewees

Experts that participated in the Qualitative Interviews

Name	Field of Expertise/ Entity
Dr. Hussein Abaza	Climate Change Expert
Amb. Sherif Abdel Rehim	National Focal Point
Ms. Lydia Eliewa	Ministry of the Environment
Dr. Imane Helmy	The World Bank
Mr. Mohamed Meatemed Eissawy	Assistant Minister for Monitoring, Reporting, & Evaluation
Eng. Ahmed Ghandour	Energy
Dr. Ahmed Kamal El-Helewa	Federation of Industries
Eng. Ahmed Yassine	Energy
Eng. Ali Shouman	Agriculture
Dr. Awatef Gaber	Agriculture
Dr. El Sayed Sabry	Agriculture
Eng. Emad Ali	Agriculture
Prof. Hafez ElSalmawy	Energy
Mr. Hesham Gamal	Energy
Dr. Maged Mahmoud	Energy
Dr Mahmoud Diab	Energy
Dr. Mahmoud Hozien	Agriculture
Mr. Mohamed Ali	Agriculture
Mr. Mohamed Zaki	Agriculture
Dr. Waleed Mansour	Energy
Eng. Zakaria Abdalla Fouad	Agriculture
EG Bank Team	Green Finance

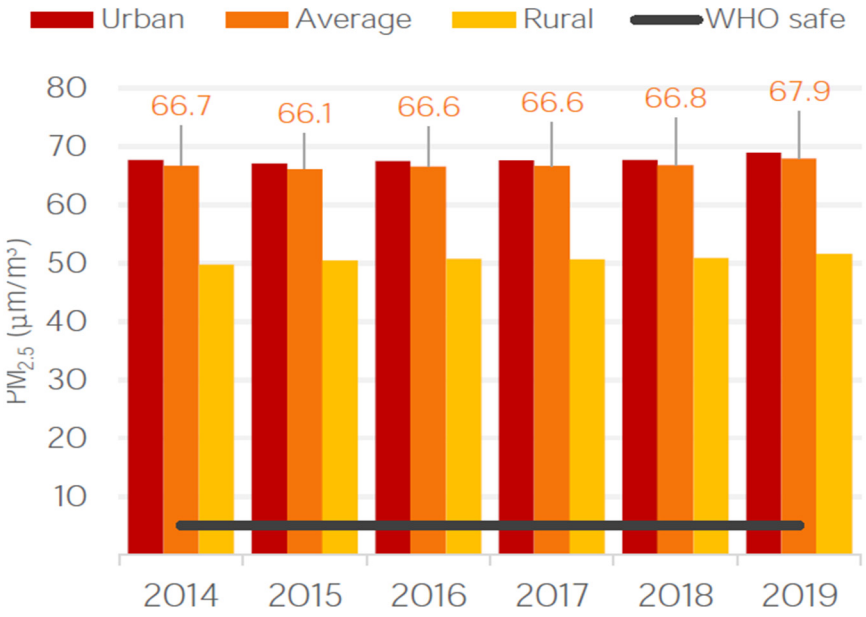
ANNEX II Additional Figures and Tables

***Figure 1**: Share of Agriculture in Total Employment, Egypt 2017-2021 (%)*



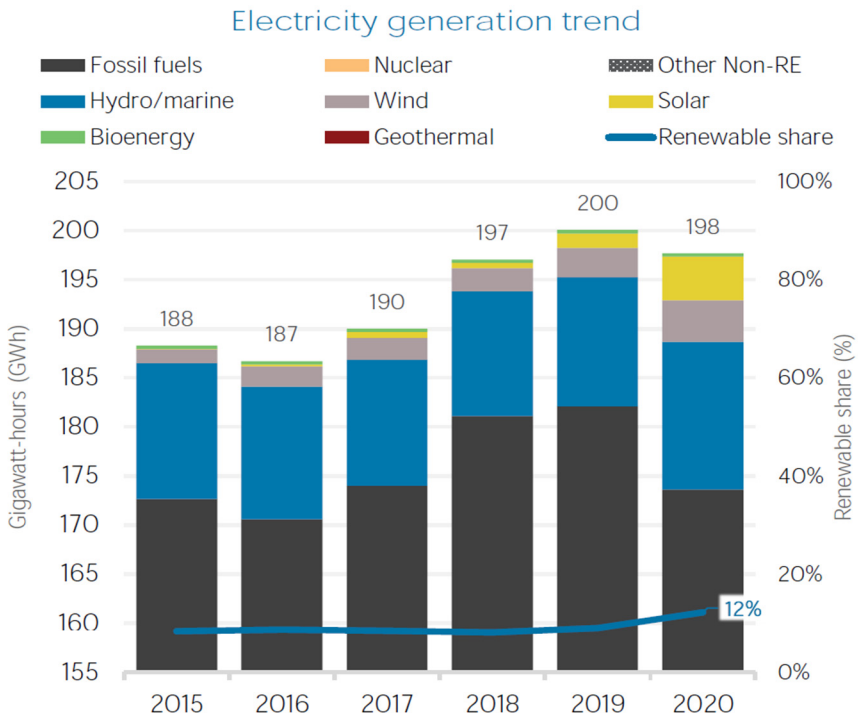
Source: Authors' calculations based on LFS 2017-2021

***Figure 2:** Air Particulate Matter in Egypt*



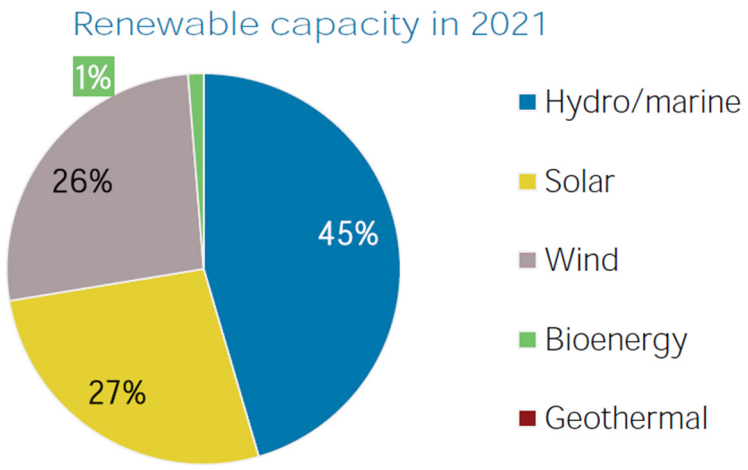
Source: Data compiled by authors from IRENA website (https://www.irena.org/)

***Figure 3**: Electricity generation trends in Egypt (2015-2020)*



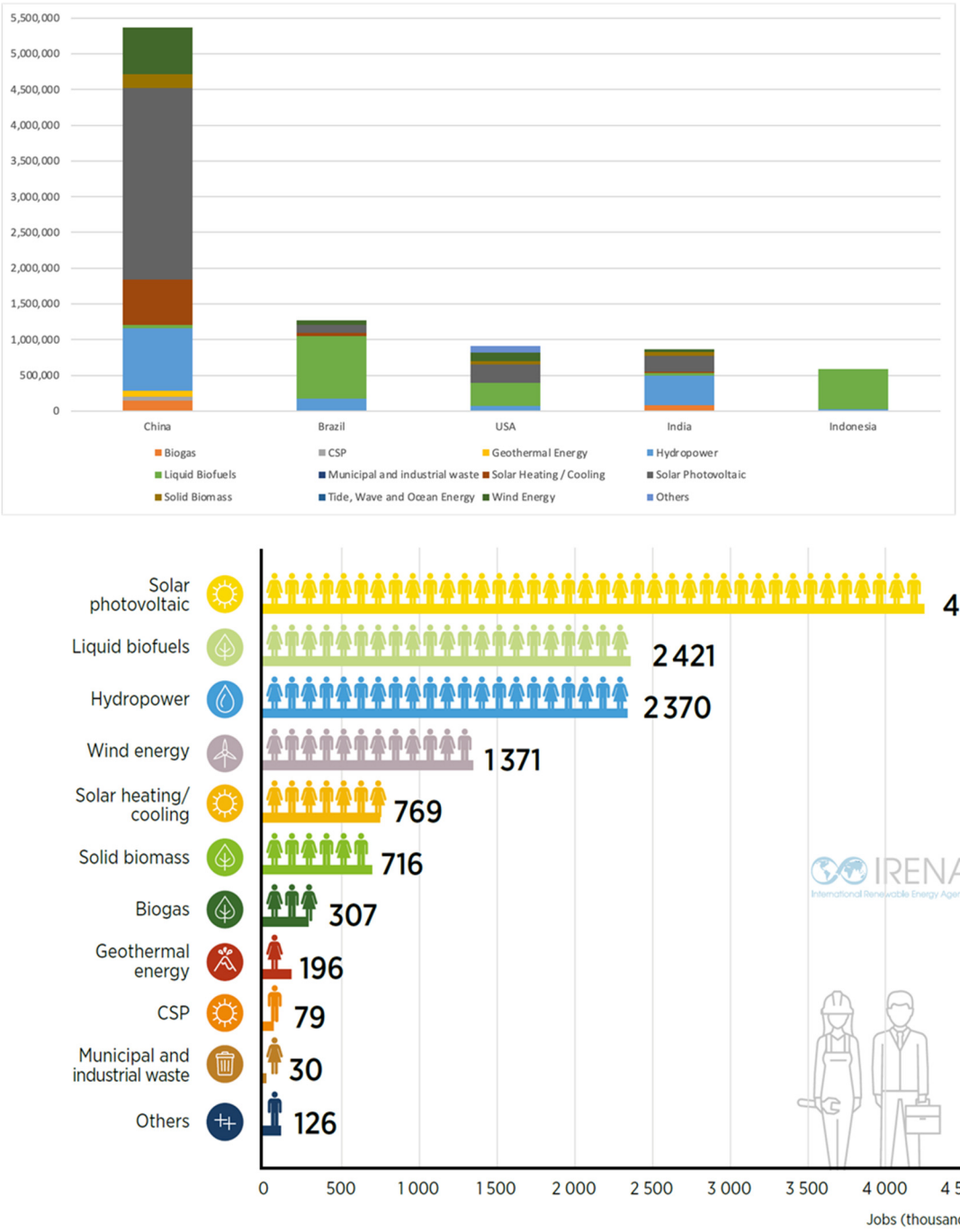
Source: IRENA 2022

***Figure 4:** Renewable Energy Capacity in Egypt (2021)*



Source: IRENA Country profile, 2022

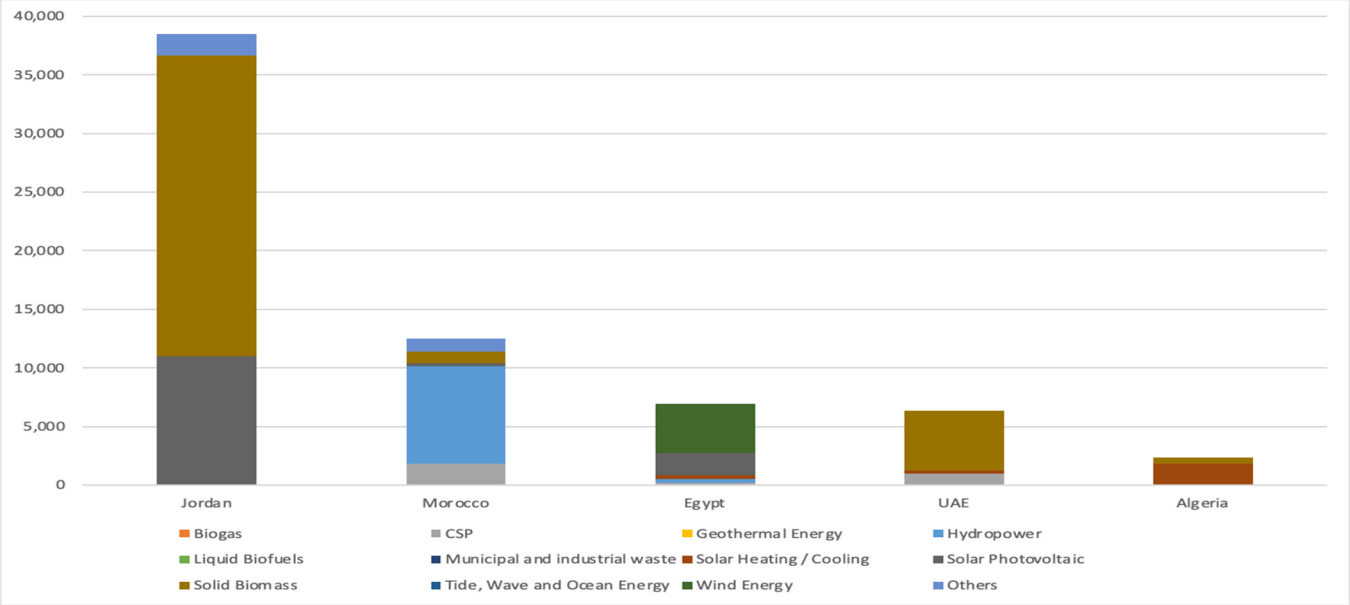
Figure 5: *Total Employment in Renewable Energy in Top Five Countries, by Type of Technology (IRENA, 2021)*



Source: IRENA, 2022[13]

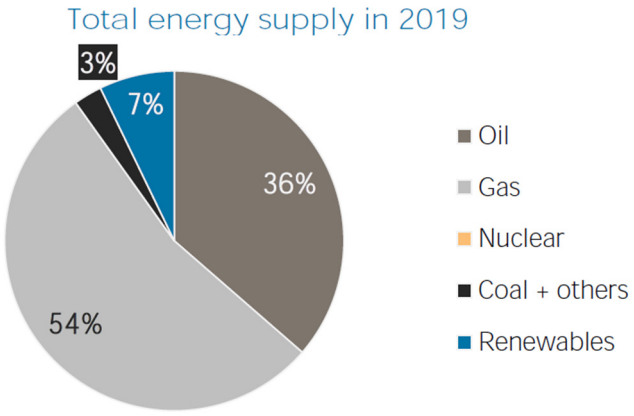
[13] Country profiles, Egypt, available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.irena.org/-/media/Files/IRENA/Agency/Statistics/Statistical_Profiles/Africa/Egypt_Africa_RE_SP.pdf?rev=5131a8b5e43949bd84b996012f7e5487 accessed January 2023

Figure 6: *Total Employment in Renewable Energy in MENA*



Source: IRENA website (accessed February 2023).

Figure 7: *Total energy supply in Egypt (2019)*



Source: IRENA, 2022[14]

[14] Country profile available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.irena.org/-

Table 1: *Egypt EBA Score details.*

EBA Total Score	47.06/100
Supplying seed	57.09/100
Registering fertilizer	59.76/100
Securing water	0/100
Registering machinery	97.62/100
Sustaining livestock	25/100
Protecting plant health	20/100
Trading food	66.98/100
Accessing finance	50/100

Source: https://eba.worldbank.org/en/data/exploreeconomies/egypt-arab-rep/2020# (accessed February 2023)

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ANNEX III Delphi Tables & Figure

Table 1: List of responses to the Delphi Survey by sector

Label	Economic Sector	Yes	No	Total # of Respondents
1	Agriculture, Forestry & Fishing	5	1	6
2	Energy, Waste, & Construction	17	1	18
3	Electronics, Machinery, & Other Manufacturing	3	0	3
4	Food Products, Beverages & Tobacco	3	0	3
5	Mining, Quarrying, & Extraction of Petroleum	3	0	3
6	Media & Information Services	5	0	5
7	Plastic, Rubber, & Metal	5	0	5
8	Textile, Wood, & Paper + Packaging Activities	3	0	3
9	Transport, Storage, & Accommodation & Food Services	3	0	3
10	Wholesale & Retail	2	0	2
Total		49	2	51

Source: Authors' compilation summarising list of economic activities

Table 2: Economic Activities that are Expected to Lose more than 30% of Employment or more than 5,000 Jobs due to Climate Change, by Economic Sector.

	Expert Perceived Percentage Change in Employment	Expert Perceived Change in Number of Jobs
Economic Sector	Economic Activities (at the 4-Digit Level) that will decrease by more than 30%	Economic Activities (at the 4-Digit Level) that will decrease by more than 5000 jobs
Agriculture	Growing of rice	A. Mixed farming
Mining	Extraction of crude petroleum	
Manufacturing	A. Processing & preserving of fish, crustaceans & molluscs. B. Reproduction of recorded media C. Sawmilling & planning of wood D. Manufacture of dairy products E. Manufacture of vegetable & animal oils & fats Manufacture of other food products n.e.c. G. Processing & preserving of meat. H. Manufacture of luggage, handbags, saddlery & harness I. Tanning & dressing of leather; dressing & dyeing of fur. J. Manufacture of coke oven products K. Manufacture of footwear L. Manufacture of pulp, paper & paper products M. Manufacture of cordage, rope, twine & netting N. Manufacture of carpets & rugs O. Manufacture of furniture	A. Manufacture of cutlery, hand tools & general hardware B. Manufacture of other fabricated metal products n.e.c. C. Manufacture of cocoa, chocolate & sugar confectionery D. Manufacture of made-up textile articles, except apparel E. Manufacture of structural metal products F. Processing & preserving of meat. G. Manufacture of vegetable & animal oils & fats H. Manufacture of plastics products I. Manufacture of basic iron & steel J. Manufacture of grain mill products K. Manufacture of refined petroleum products L. Sawmilling & planning of wood M. Manufacture of wooden containers & other products of wood, cork, straw & plaiting materials N. Manufacture of carpets & rugs O. Manufacture of dairy products P. Manufacture of footwear Q. Manufacture of clay building materials R. Manufacture of pulp, paper & paper products

	P. Manufacture of wearing apparel, except fur apparel M. Manufacture of builders' carpentry & joinery R. Manufacture of veneer sheets & wood-based panels S. Manufacture of wooden containers & other products of wood, cork, straw & plaiting materials T. Printing & service activities related to printing	S. Printing & service activities related to printing. T. Manufacture of other food products n.e.c. U. Manufacture of builders' carpentry & joinery V. Manufacture of furniture W. Manufacture of wearing apparel, except fur apparel
Wholesale & Retail Trade		A. Retail sale via stalls & markets B. Sale of motor vehicle parts & accessories C. Wholesale on a fee or contract basis
Transportation & Storage	A. Service activities incidental to land/water/air transportation B. Freight rail transport	A. Warehousing and storage B. Passenger air transport C. Urban and suburban passenger land transport D. Postal activities E. Passenger rail transport, interurban F. Service activities incidental to land/water/air transportation G. Freight transport by road H. Other passenger land transport
Accommodation & Food Services	Beverage serving activities	Beverage serving activities
Administrative & Support Services	A. Packaging activities	
Other Services	A. Repair of footwear & leather goods	

Note: The perceived percentage change in employment is calculated solely across experts' responses in the Delphi Survey. As for the perceived change in number of jobs, it is the output of multiplying the perceived percentage change with the average total employment in each activity over the last five years in the LFS sample.

Table 3: Economic Activities that are expected to Gain more than 5,000 Jobs due to Green Transition, by Economic Sector

Economic Sector	Projected Change in Number of Jobs Economic Activities (at the 4-digit Level) that will increase by more than 5,000 jobs
Agriculture	A. Growing of other non-perennial crops. B. Marine & Freshwater Fishing C. Support activities for crop production
Manufacturing	A. Manufacture of furniture B. Manufacture of builders' carpentry & joinery C. Preparation & spinning of textile fibres. D. Weaving of textiles E. Manufacture of clay building materials F. Manufacture of domestic appliances G. Manufacture of wooden containers & other products of wood, cork, straw & plaiting materials H. Manufacture of structural metal products I. Sawmilling & planning of wood J. Manufacture of glass & glass products K. Manufacture of pharmaceuticals, medicinal chemical & botanical products L. Manufacture of other food products n.e.c. M. Manufacture of basic iron & steel N. Repair of fabricated metal products, machinery & equipment (except motor vehicles) O. Manufacture of wiring & wiring devices P. Printing & service activities related to printing. Q. Manufacture of carpets & rugs R. Manufacture of other fabricated metal products n.e.c. S. Manufacture of grain mill products T. Manufacture of basic chemicals U. Manufacture of general-purpose machinery
Electricity, Gas, Steam, & Air Conditioning Supply	A. Electric power generation, transmission, & distribution B. Manufacture of gas; Distribution of gaseous fuels
Water Supply; Sewerage; Waste Management & Remediation Activities	A. Collection of non-hazardous waste B. Water collection, treatment & supply C. Sewerage
Construction	A. Other specialized construction activities

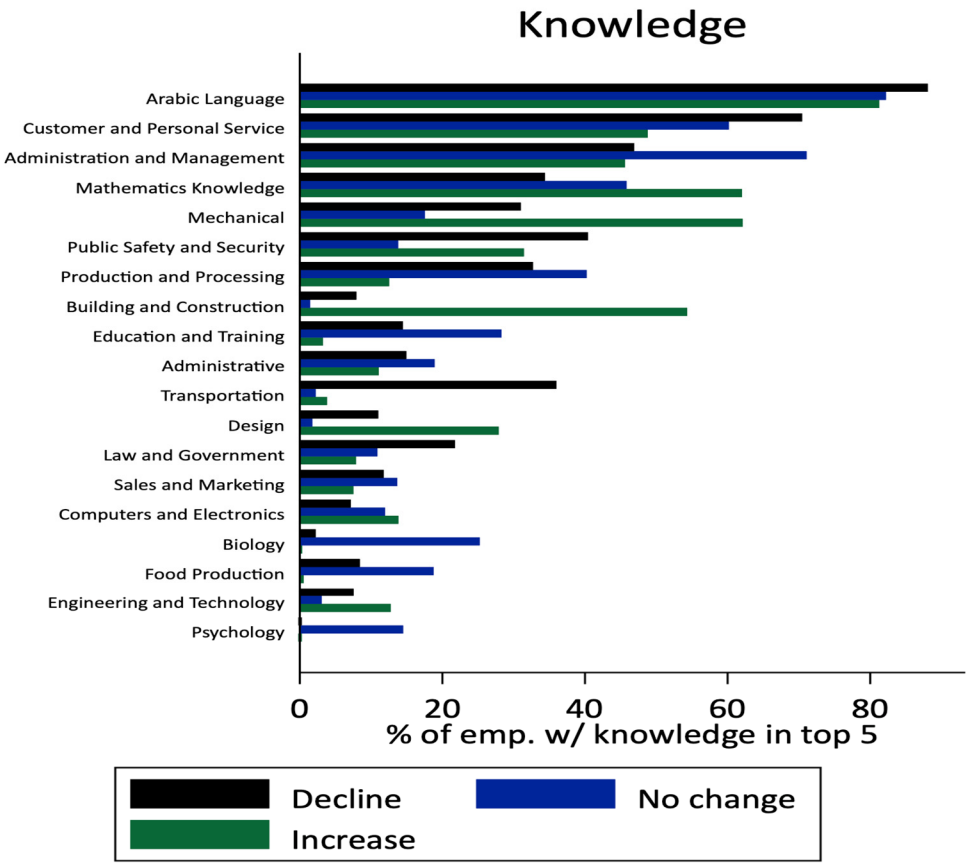
	B. Building completion & finishing C. Electrical installation D. Plumbing, heat & air-conditioning installation E. Construction of buildings F. Site preparation
Wholesale & Retail Trade	A. Maintenance & repair of motor vehicles B. Retail sale of other goods in specialized stores C. Sale of motor vehicle parts & accessories D. Wholesale on a fee or contract basis E. Sale of motor vehicles F. Wholesale of household goods G. Retail sale via stalls & markets H. Retail sale of information & communications equipment in specialized stores
Accommodation & Food Services	A. Short term accommodation activities B. Beverage serving activities
Information & Communication	A. Wired telecommunications activities B. Other information service activities n.e.c. C. Publishing of books, periodicals & other publishing activities
Financial Intermediation & Insurance	A. Life & Non-life Insurance B. Monetary intermediation (includes central banking)
Scientific & Professional Services	A. Architectural & engineering activities & related technical consultancy B. Legal activities C. Advertising D. Research & experimental development on natural sciences & engineering E. Accounting, bookkeeping & auditing activities; tax consultancy. F. Activities of head offices G. Photographic activities
Administrative & Support Services	A. Combined facilities support activities. B. Packaging activities C. General cleaning of buildings & other industrial cleaning activities
Other Services	A. Repair of personal & household goods B. Repair of computers & communication equipment

Note: The perceived percentage change in employment is calculated solely across experts' responses in the Delphi Survey. As for the perceived change in number of jobs, it is the output of multiplying the perceived percentage change with the average total employment in each activity over the last five years in the LFS sample.

ANNEX IV: Knowledge, Skills, and Abilities Figures

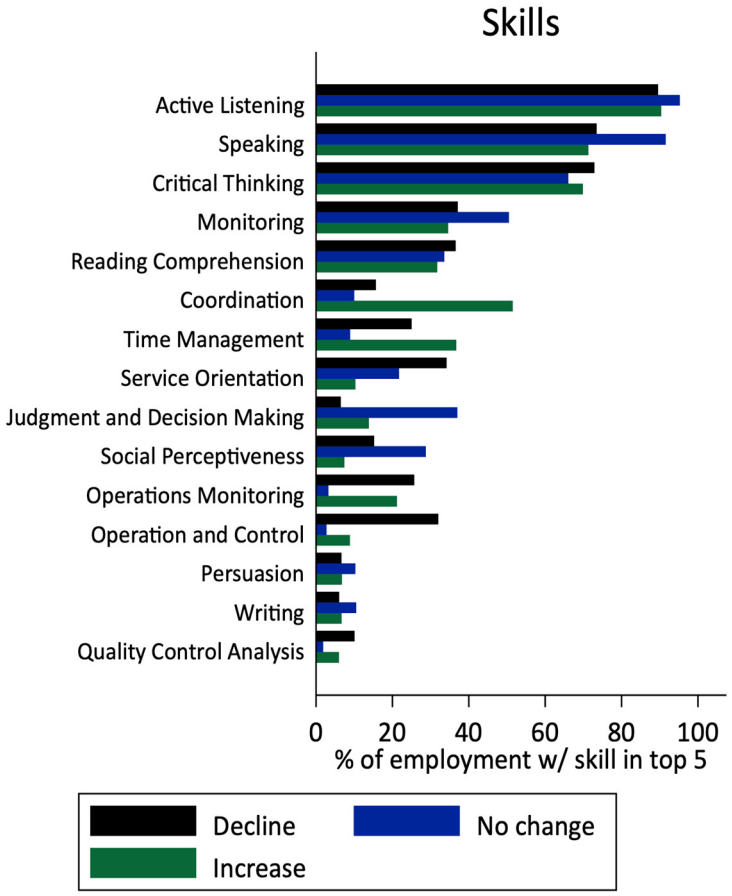
In order to better understand the skills, abilities, and knowledge that will be needed for the green transition, we drew on **a combination of O*NET** occupational skills, abilities, and knowledge data, the Egyptian Labour Force (Krafft, 2023)/ (GIZ Egypt, 2023, and expert respondent's predictions for employment changes due the green transition. **Figure 7** (for knowledge) **Figure 8** (for skills) and **Figure 9** (for abilities) show the knowledge, skills and abilities needed within occupations in industries that are predicted to decline, remain the same, or increase in employment as a result of climate change. We focus on the skills particularly needed for industries with increases in employment in our discussion.

Figure 7: *Percentage of employment that has each type of knowledge among the five most important types of knowledge, by expert estimates of change in employment due to climate change.*



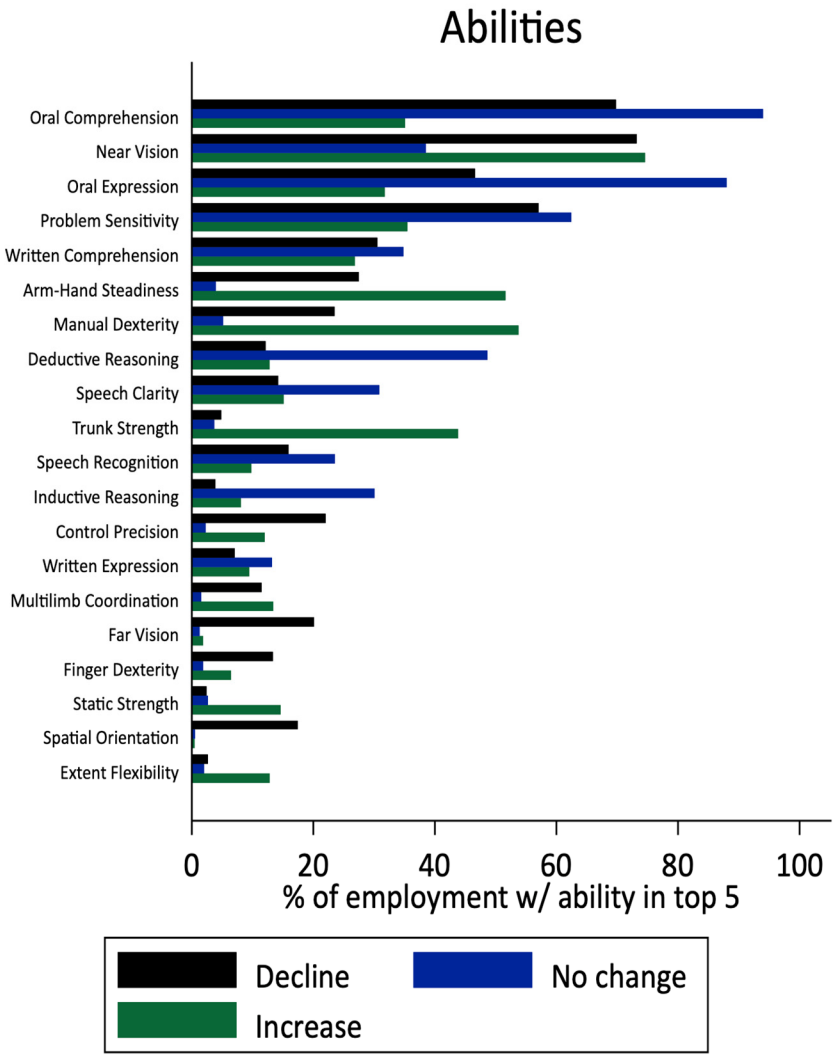
Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

Figure 8: *Percentage of employment that has each skill among the five most important skills, by expert estimates of change in employment due to climate change.*



Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

Figure 9: *Percentage of employment that has each ability among the five most important abilities, by expert estimates of change in employment due to climate change.*



Source: Authors' calculation based on O*NET 26.2 and LFS 2017-2021 data

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