Green Jobs Assessment in Jordan Technical Report

Exploring the Employment Impact of selected Green Economy Initiatives

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Green Jobs Assessment in Jordan

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Key points

Background

Jordan's first National Determined Contribution (NDCs) submitted to the Climate Secretariat in October 2021 shows the country's commitment to sustainable development. The Government of Jordan is currently supporting various policies, initiatives and programmes aimed at achieving a green economy, first and foremost the recently adopted Economic Modernization Vision 2033 which aims to accelerate sustainable economic growth.

Objective

This report is the first ever green jobs assessment for Jordan. It aims to:

- estimate the current levels of green jobs (direct, indirect and induced) in green activities, and
- showcase the potential for green jobs based on "what if" scenarios (i.e. employment effects from investing in a given green economy activity) using econometric modelling.

Methodology

The assessment carried out for this study follows the International Labour Organisation GAIN methodology for green jobs assessments. To examine the socioeconomic and environmental economy-wide effects of what-if scenarios, a macro-econometric model called Frames Jordan was developed by Cambridge Econometrics. Desk research, data analysis, and experts' consultations were carried out between July 2022 and June 2023.

To assess the number of green jobs, the green economic activities within six sectors were first identified, namely in agriculture, waste and water, manufacturing, energy, tourism, and transport. Direct green jobs are those jobs directly linked to the generation of economic output within a green activity in a given sector. Indirect and induced employment impact relates to supply chain effects of green activities and household income spending.

Green jobs in Jordan

Between 75 and 95 thousand jobs can be considered green. They represent between 21% and 30% of the employment in the selected sectors. Transport and agriculture are the sectors with the highest number of green jobs.

Jordan has considerable potential for green jobs based on 6 green economy investments

Six green economy initiatives within the pre-analysed economic sectors were selected for scenario analysis: recycled plastic; recycled textile; resource efficiency in food-processing sector; sustainable value extraction of sludge; water scarcity; and green public transport. The results are compared with a business-as usual-scenario which assumes that the economy, with its current structure, continues to grow at 2.7% annually to 2024 and 3% annually from 2025 to 2030, according to the IMF forecast.

Employment impact by 2030

The modelling suggests that by 2030, over 350 new green jobs will be created from the selected green economy investments, while the indirect and induced effects of the investment in green activities are large. Additional employment (indirect and induced) in the rest of the economy during the investment/ construction phase ranges from 6,500 – 8,300 jobs.

- Around 54 new green jobs will be created in the plastic sector from the green activity of recycling post-consumption polyethylene terephthalate (PET) into PSF. By 2030, at least 33 additional jobs will be created in the rest of the economy.
- Adopting circularity in the textile sector could bring at least 249 new green jobs by 2030. Direct green jobs will be also created in the waste sector to collect and recycle textile materials. By 2030, 66 new jobs will be created in the economy additional to the baseline through indirect and induced effects of textile recycling.

- Increasing the energy and water efficiency in food-processing sectors could bring 44 new green jobs by 2030. In the economy, resource efficiency would lead to a net positive employment impact of 89 jobs by 2030.
- Developing the economic and ecological sustainability of sludge management would add at least seven new green jobs to the water sector.
- Water supply investments and water efficiency interventions would slightly increase the green employment in the water sector, while the indirect and induced effects of the investment and lower costs are large.
- Replacing diesel buses with e-buses is expected to maintain the current level of green jobs in public transport, which was estimated to be between 30,920 and 63,500. The associated investment into charging infrastructure would lead to higher employment in other sectors such as mechanical engineering, electronics, and construction. The increase in demand for electricity would also benefit employment in electricity generation sector.

Green jobs potential

Overall, the analysis presented in this report suggests that Jordan has considerable potential of green jobs, in particular in the agriculture, transport, water and waste, manufacturing, tourism and energy sectors.

Abbreviations

DOS	Department of Statistics
EMV	Economic Modernization Vision
EV	Electric vehicle
GDP	Gross Domestic Product
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
ICE	Internal combustion engine
ILO	International Labour Organisation
I-O	Input-Output
LFS	Labour Force Survey
NDC	Nationally determined contribution
NRW	Non-Revenue Water
PET	Polyethylene terephthalate
PSF	Polyester staple fibres
RSCN	Royal Society for the Conservation of Nature

1 Introduction

This study represents the first ever assessment of the potential for green jobs development in Jordan, using the ILO GAIN methodology (Jarvis, Varma and Ram, 2011) in line with Jordan's Economic Modernization Vision (EMV) 2023-33 (Jordan Government, 2022). The vision fosters the ambition of Jordan "to be a low-carbon, resource efficient and socially inclusive nation" (Jordan Government, 2022), and targets the creation of one million jobs by 2033.

To materialise this vision, it seems of utmost importance to create a business environment conducive of green economic growth and to invest in policy interventions towards greening the economy, privileging those with relevant employment effects.

The desk research, data analysis, and experts' consultations undertaken for this report enabled to identify some key sectors particularly promising in terms of a job-rich greening of the economy. The considered sectors are manufacturing (with specific attention on plastics, textiles, food processing), water and waste, transportation, as well as energy, agriculture, and eco-tourism.

Within these sectors, green economic activities have been identified and for each of these green activities, direct, indirect, and induced employment in Jordan is estimated, relying on official data as well as on assumptions validated through expert consultations. With the help of a macroeconomic model developed by Cambridge Econometrics, the short- and long-term employment impact of selected green economy investments in line with the drivers of the EMV are estimated, to provide an indication of the potential for job creation.

The assessment relies on the ILO definition of green jobs, which considers as green "decent jobs that contribute to preserve or restore the environment, be they in traditional sectors […], or in new, emerging green sectors such as renewable energy and energy efficiency" (ILO, 2016). This definition has been operationalized in an original framework relying on output-, process-, and conservation-of-nature-based perspectives. Accordingly, green activities are defined as activities whose output and/ or process is more sustainable than its traditional counterpart, as well as all activities resulting into conservation of natural resources and preservation of ecosystems.

The following chapters present the results of the assessment. Chapter 2 takes stock of the Jordanian economy and situation on the labour market. Chapter 3 provides summary profiles for each of the selected sectors included in the assessment. Chapter 4 provides the estimated number of (direct) green jobs by sector. Chapter 5 presents the estimated number of indirect and induced jobs associated with green activities within a sector, using basic input-output analysis. Chapter 6 presents the results of the macroeconomic modelling that was undertaken to estimate the short- and long-term employment impact (2023-2030) of the selected green economy investments. Finally, policy implications (Chapter 7) and conclusions are presented (Chapter 8).

A shorter synthesis report is available on the following website: https://www.giz.de/en/worldwide/102349.html

2 Economic and employment structure of the Jordanian economy

2.1 Introduction

Jordan is an upper middle-income economy in West Asia with a population of around 11 million in 2022. The services-oriented economy has proven to be relatively resilient in the face of multiple external shocks, resulting from the country's location in the region. Repeated and prolonged forced migration to Jordan and a long-standing tradition of work-related migration resulted in a high share of non-natives in Jordan's population as well as in remittances of Jordanians working abroad playing a crucial factor in the economy. Economic growth in recent years was not sufficiently high to translate into improvements in the labour market, which suffers from structural weaknesses, such as low labour force participation, continually elevated unemployment, and persistently high informality (World Bank, 2016).

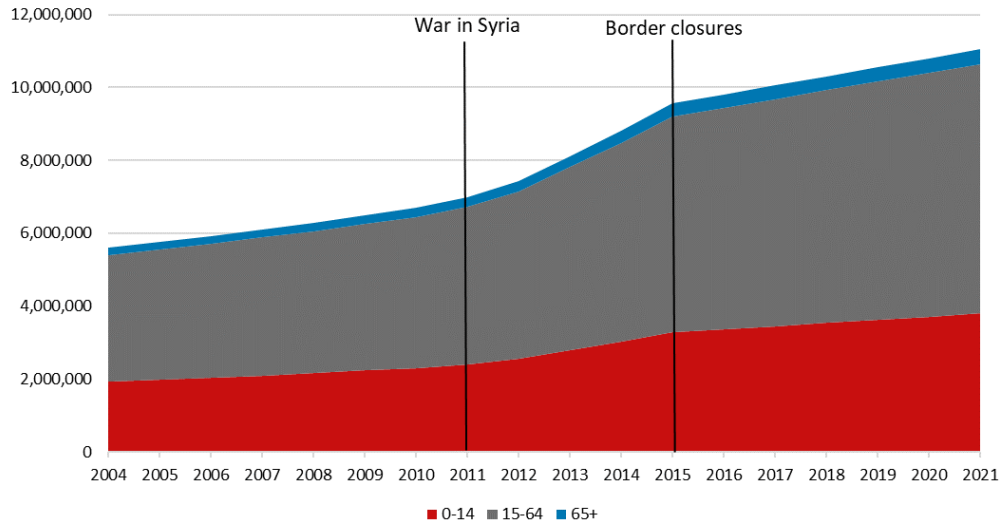
This chapter provides an overview and assessment of the economic and employment structure of the Jordanian economy.

2.2 Socio-economic context

Population

Due to repeated waves of (forced) migration, as well as, relatively high population growth has been sustained in Jordan, between 2004 and 2021 population has almost doubled and it is currently estimated to be 11 million for the year 2021. According to the latest census data (2016), non-Jordanian passport holders represent about 30% of the total population.

Figure 2.1: Population by age group, 2004-2021

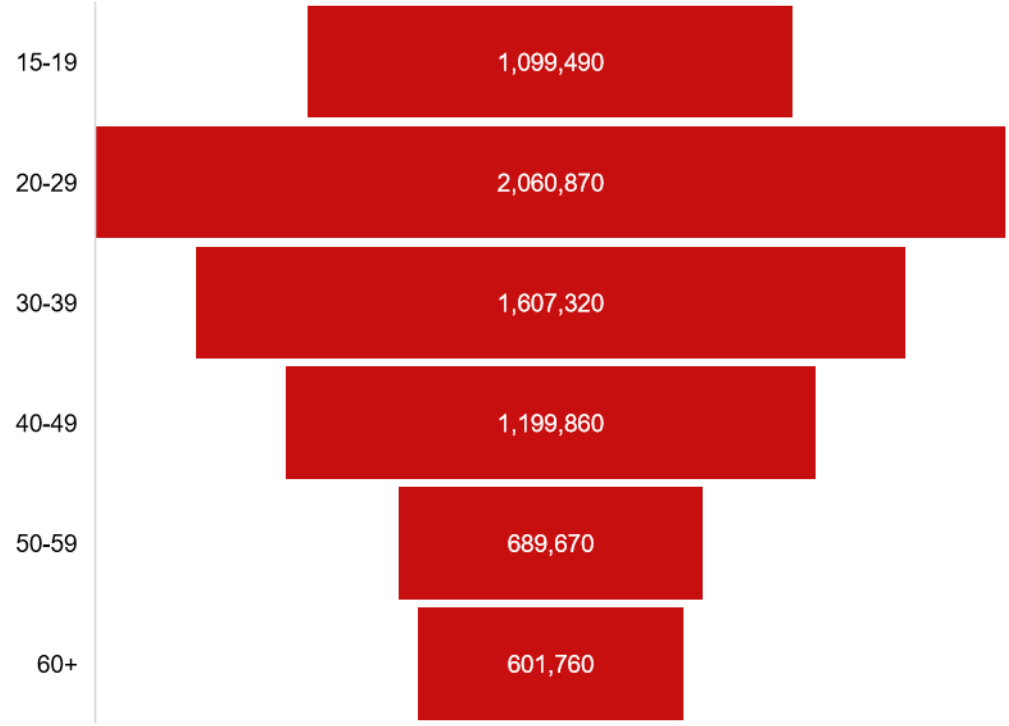


Source(s): Department of Statistics (Estimated Population of the Kingdom by Sex, Age Group and Sex Ratio 2004-2021).

As presented in Figure 2.1, working age individuals (15–64 years) accounted for 62% of total population and consists of a relatively large share of young people (Figure 2.2). The share of people aged between 15-29 was 43% in 2021. Meanwhile, merely 18% of the working-age population are aged above 50. The youth population is likely to grow in the coming years, as the share of the total population aged below 15 was 34% in 2021, while the share of people aged 65+ was 4%. The challenge lies in activating and generating sufficient and tailored jobs to absorb large numbers of young labour market

entrants, considering in particular the significant mismatch in skills levels supplied and demanded. Private sector job openings tend to require low qualification levels, whereas a large share of labour market entrants hold higher qualifications.

Figure 2.2: Working age population (15+) by age group, 2021

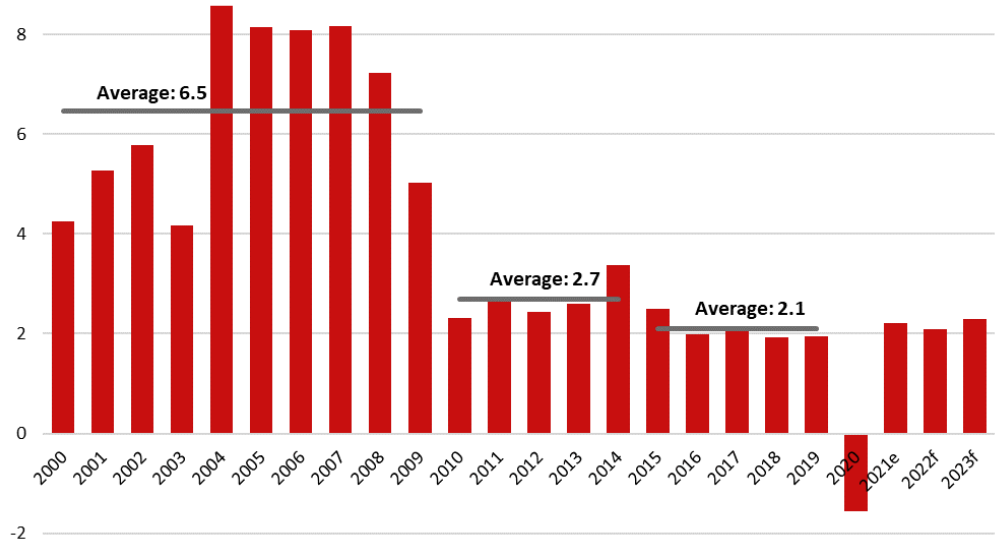


Source(s): Department of Statistics (Estimated Population of the Kingdom by Sex, Age Group and Sex Ratio 2004-2021).

Economic overview

At the beginning of the 2000s, Jordan registered remarkable economic growth rates for an average of 6.5% (Figure 2.3). The initial decline in this rate was due to the global financial crisis, which resulted in a contraction of foreign direct investments and remittances (World Bank, 2016). In 2011, the Arab Spring led to a major shock for the Jordan economy, notably in the disruption of gas imports from Egypt. The war in Syria resulted in the inflow of a large number of refugees and closures of crucial trade routes in 2015, heavily impacting the Jordanian economy. As a consequence of the Covid-19 pandemic, GDP contracted by close to 2% in 2020. A year after, the Jordanian economy grew by more than 2% reaching 2019 levels of output again. The recovery was supported by accommodative monetary and fiscal policy as well as a recovery in domestic demand and tourism.

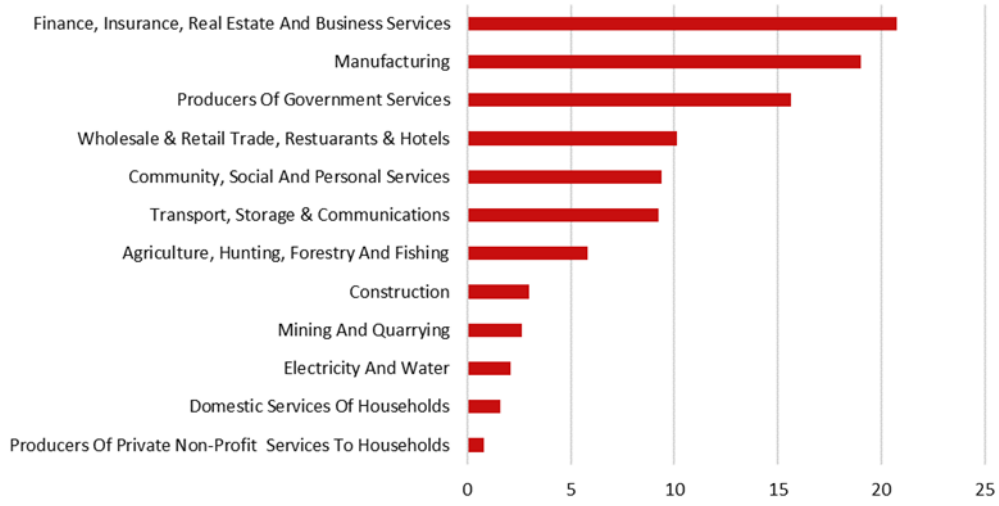
Figure 2.3: Real GDP growth, 2000-2023



Note(s): Averages across periods are compound annual growth rates.
Source(s): World Bank Data[1].

Figure 2.4 shows that *Finance, Insurance, Real estate and Business services represent* the largest share of the economy's output, at around one-fifth. This is despite the sector being relatively small as a share in total employment. *Manufacturing* is the second largest sector by GDP share and a considerable employing sector (fourth largest). Jordan's economy relies on a significant contribution (16%) of the *public sector/ government services* to GDP. *Wholesale and retail trade, restaurants and hotels*, and *Community, social and personal services*, and *Transport, storage and communication* represent around 11-12% of GDP each. A strong tourism sector contributes to the economic activity in trade, restaurants, and hotels. *Agriculture* represents a below-average share in GDP at 7%, while *Construction*, *Mining and quarrying*, and *Electricity and water*, each only contribute a minimal share to GDP, around 3-4%.

Figure 2.4: Sectoral shares in GDP (%), 2021



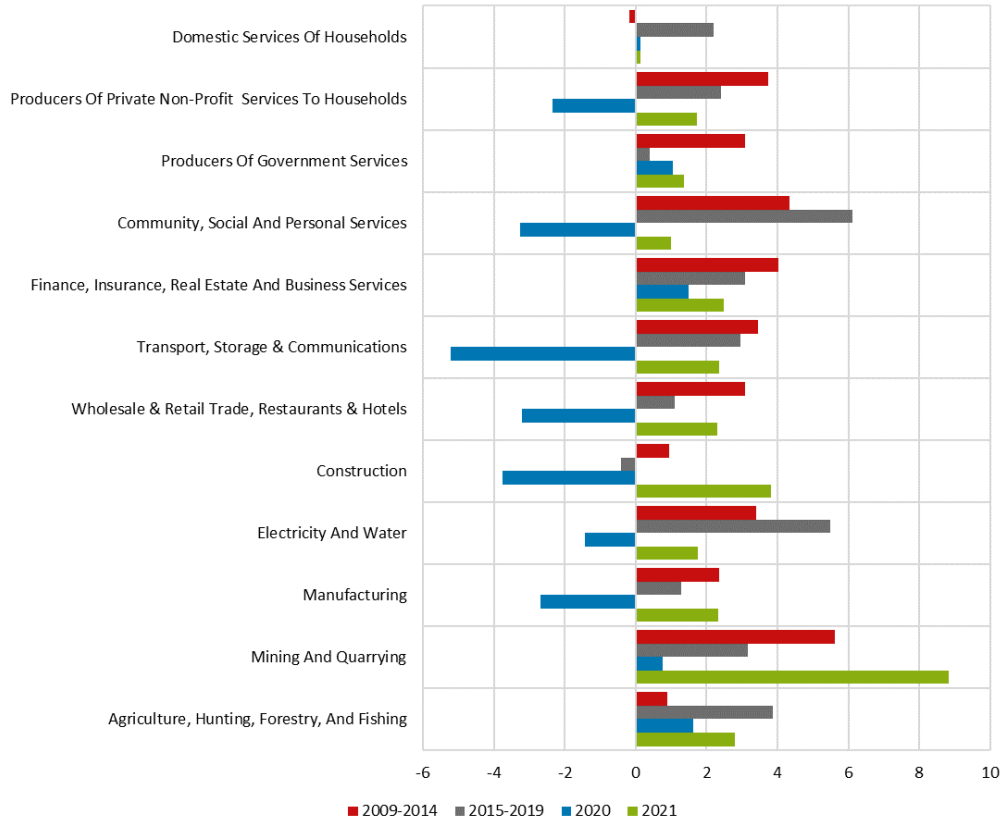
[1] https://data.worldbank.org/indicator/NY.GDP.MKTP.KN?loca-container=null&locations=JO

Source(s): Department of Statistics (Gross Domestic Product by Economic Activity At Current Prices).

Over the past 12 years (2009-2021), the average growth rate of *Community, Social and Personal Services* was close to 5% annually (Figure 2.5), the fastest growing sector in the economy. *Electricity and water*, the smallest sector in terms of GDP, is the second-fastest growing sector over the same period. *Finance, Insurance, Real Estate and Business Services*, the largest sector by GPD contribution, also grew on average at more than three percent annually.

All main sectors experienced varying dynamics within the four periods presented in Figure 2.5. Due to the Covid-19 pandemic in 2020, many sectors declined, such as *Transport, Storage and Communication* (-5%), *Construction* (-4%), *Community, Social, and Personal Services*, *Wholesale and Retail Trade*, and *Manufacturing* (-3% each). *Mining and Quarrying*, and *Construction* saw higher volatility in growth rates over the periods, sometimes with positive growth followed by negative growth within just two years. The growth rate of *Mining and quarrying* ranged between -46% in 2009 to 27% in 2014, while that of the *Construction* sector ranged between -5% in 2010 and 13% just the year before.

Figure 2.5: Annual GDP growth rate (%) by broad sector, 2009-14, 2015-19, 2020, 2021



Note(s): GDP in constant prices. Averages across periods are compound growth rates.

Source(s): Department of Statistics (Gross Domestic Product By Economic Activity At Constant Prices).

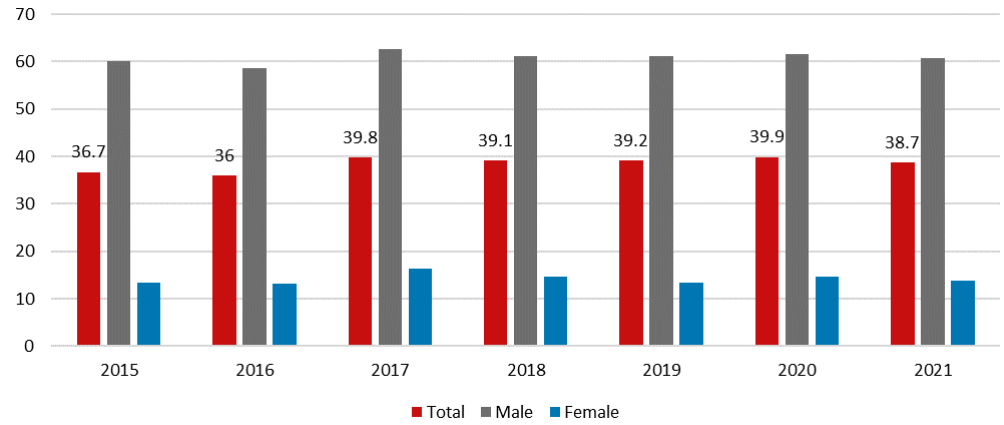
2.3 Jordanian labour market

Labour Force

As shown in Figure 2.6, Jordan's labour force participation rate is persistently low and has remained below 40% since 2015. The primary reason is the low participation rate of women, which mostly remained below 15%, compared to

around 60% for men. The participation gender gap is large and stayed within the range of 45-55 percentage points (pp) in the period 2000-21. Women's participation in the labour market has not seen significant improvements in the past decade, despite young women holding educational qualifications which are at least equal to those of young men (United Nations, 2020). Jordan's female labour force participation rate is the fourth-lowest in the world and the lowest in the region, when considering countries not in conflict. Inhibiting factors to female participation include restrictive social norms, insufficient availability of pre-primary childcare (ILO-International Labour Office, 2018; World Bank, 2022c) as well as a dysfunctional public transport system (WANA Institute, 2020).

Figure 2.6: Labour force participation (% of working-age population)



Source(s): Department of Statistics, Employed Persons Age 15+ Years by Governorate, Sex, Main Current Economic Activity & Nationality (Percentage Distribution).

Presented in 2014, the government's strategic vision 'Jordan 2025 - A National Vision and Strategy' identifies increasing labour force participation as the country's primary challenge to focus on (Government of Jordan, 2014). More recent efforts to tackle structural challenges include reforms to address labour law articles regarding gender bias and the expansion of social security coverage by reducing contributions for specific groups of workers.

The Jordanian labour market is characterised by a large share of public sector employment (23%[2] of employees[3]). Demand for public sector jobs is high, as these offer, generally, better wages, more stability and prestige, than private sector jobs, which are often informal or lacking for young graduates. This affects expectations of young people in terms of wages and compensation, as well as queuing for public sector jobs.

Employment

In 2021, 2.2 million people were employed in Jordan. Employment numbers in Jordan have risen in the years leading up to 2021 (Figure 2.7). Between 2017 and 2020, employment increased by around 150,000 workers (+7%). Although employment numbers increased over the period, the employment rate has mostly declined (red line in Figure 2.7), as population growth (of people aged 15+) exceeded growth in employment by a factor of two in the period between 2017 and 2021.

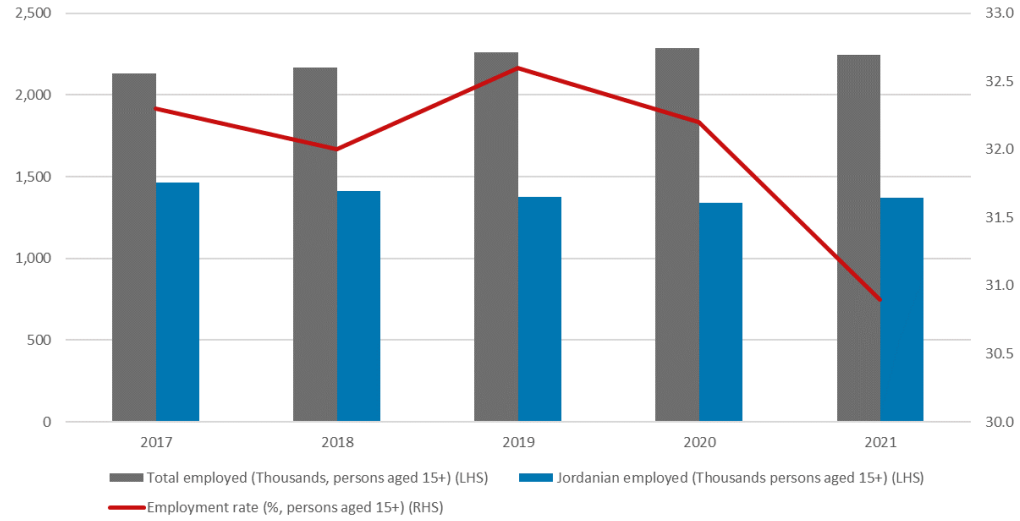
The Covid-19 pandemic did not result in a decline in absolute employment numbers, with employment growing further by 26,000 workers in 2020. The employment rate started falling in 2020 already, as a consequence of the pandemic, and dipped further in 2021 still, to 31%. As in most countries, the

[2] http://www.dos.gov.jo/owa-user/owa/emp_unemp_y.show_tables1_y?lang=E&year1=2021&t_no=80
[3] The share of employees in the public sector represents around 39% of Jordanian employees. http://www.dos.gov.jo/owa-user/owa/emp_unemp_number.show_tables_y?lang=E&YEAR1=2021&T_NO=24

pandemic and related restrictions had serious impacts on business operations and employment, with 40% of enterprises reporting to have laid off employees since the beginning of the pandemic (ILO, 2021).

Employment numbers of Jordanian nationals followed a different trend than total employment: Jordanian employment fell between 2017 and 2020, before recovering slightly in 2021. Migrants represent as much as one-third of the total Jordanian population, according to some estimates (Sweidan, 2018).

Figure 2.7: Total and Jordanian employment (Thousands, left-hand side) and employment rate (%, right-hand side), persons aged 15+



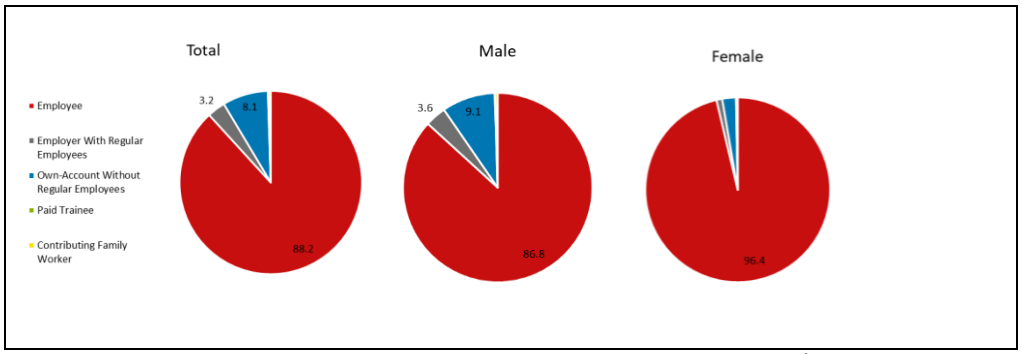
Note(s): Absolute figures on the Department of Statistics website were only available for Jordanians employed. Total employment numbers were calculated by the authors by using the following figures from the Jordanian Department of Statistics: annual estimates of the population aged 15+ (Department of Statistics, Population Statistics Division, Estimated Population of the Kingdom by Sex, Age Group and Sex Ratio 2004-2021); annual percentages of the population aged 15+ that is in employment (Department of Statistics, Employment and Unemployment (LFS), Population Age 15+ Years by Economic Activity Status, Sex, Broad Age Groups & Nationality (Percentage Distribution)).

Source(s): Authors' analysis of Department of Statistics (Labour Force Survey Data; Population estimates).

Employment status

In 2021, nearly nine in ten people employed in Jordan were employees, with the remaining being self-employed workers (Figure 2.8). Three in ten self-employed workers are employers with employees. Male employed are more likely than female employed to be self-employed, with just above 3% of employed females being self-employed.

Figure 2.8: Employment status (%), 2021



Source(s): Department of Statistics, Labour Force Survey Data, Table 4.6[4])

[4] http://www.dos.gov.jo/owa-user/owa/emp_unemp_y.show_tables1_y?lang=E&year1=2021&t_no=80

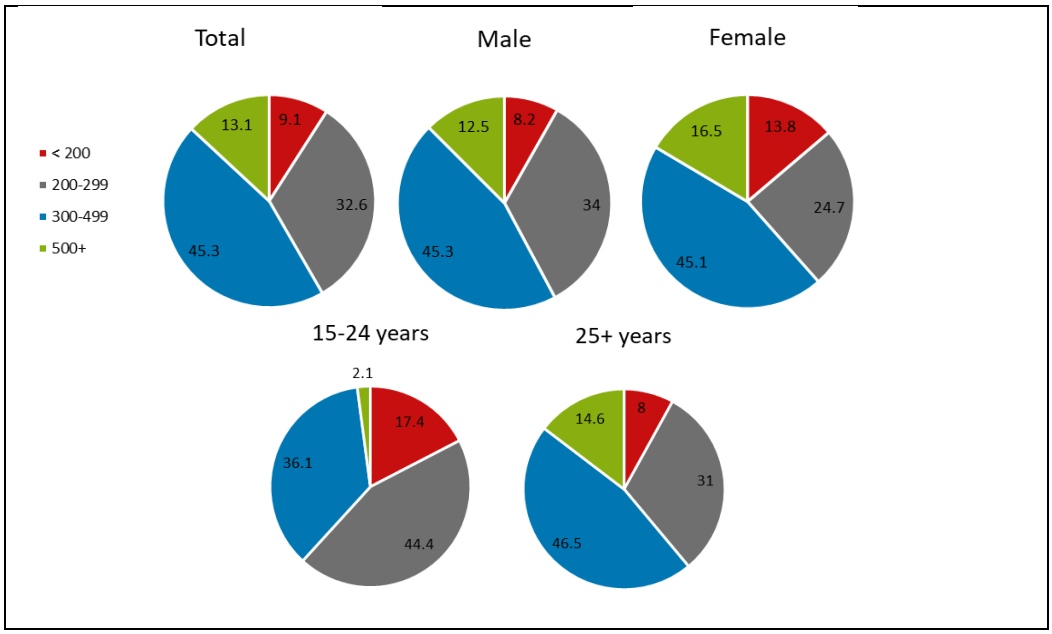
Working Conditions

By law, all workers in the formal sector must be covered by Social Protection and the salary should not be below the minimum wage.

Figure 2.9 offers information on the wage levels earned by workers in Jordan and the differences for men and women as well as for young and older workers. Among all employed, four in ten people earned less than the average monthly earnings of employees in Jordan (Source(s): ILOstat)[5]. This number is similar when comparing earnings for men and women. The share of top earners among women is slightly higher than among men. However, women are much less likely than men to be in employment.

When considering the earnings distribution by age group, earnings of young workers (15-24) more often fall in the lower earnings brackets than for workers aged over 25 years – see Figure 2.9. Among workers aged 15-24, more than 60% receive earnings below the monthly average, while this is the case for only 39% of workers aged over 25. Moreover, around 2% of young workers fall in the highest earnings bracket, while 15% of older workers do.

Figure 2.9: Monthly earnings distribution by sex and age (%), 2021



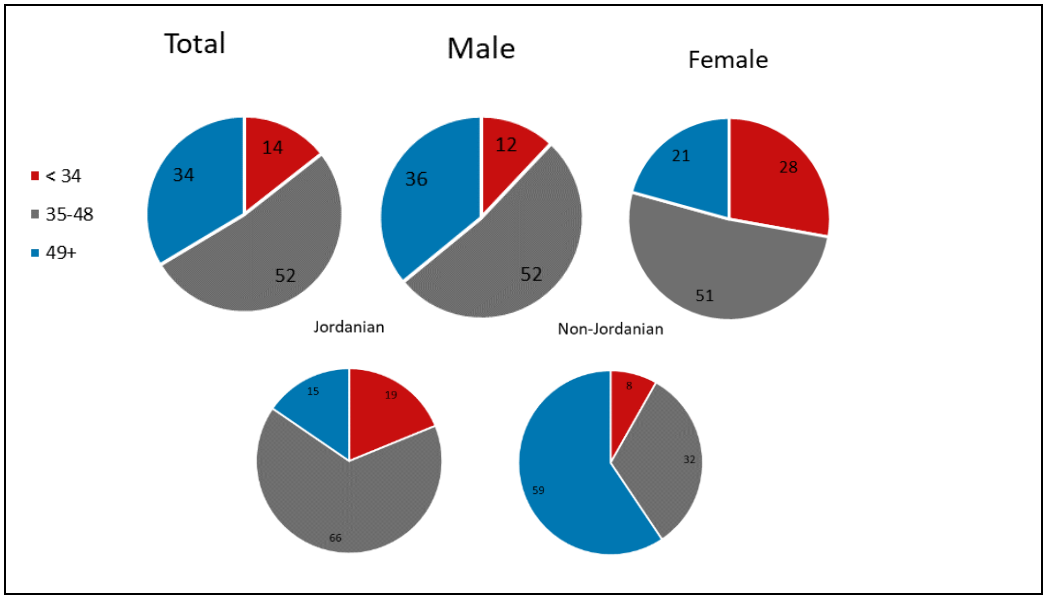
Note(s): Unit of wage brackets is in Jordanian Dollars.
Source(s): Department of Statistics (Labour Force Survey Data, Table 5.4[6]).

Figure 2.10 shows the distribution of weekly hours worked of the employed population, highlighting the differences between women and men as well as between Jordanian and non-Jordanian workers. Clearly, women work fewer hours per week than men. Comparing weekly hours of Jordanians to non-Jordanians reveals stark differences, with the latter being much more likely to more than 49 hours per week.

According to ILO data, the vast majority of employed in Jordan work on a full-time basis (92%). This figure is the same for men and women in employment and also quite similar across age groups. People aged under 25 are slightly more likely to work in part-time employment than older workers.

[5] The average monthly earnings in 2020 stood at 322 Jordanian Dollars.
[6] http://www.dos.gov.jo/owa-user/owa/emp_unemp_y.show_tables1_y?lang=E&year1=2021&t_no=38

Figure 2.10: Actual weekly hours of work distribution by sex and nationality (%), 2021



Source(s): Department of Statistics (Table 4.7: Employed Persons Age 15+ Years by Actual Weekly Hours of Work, Sex & Nationality (Percentage Distribution) - 2021).

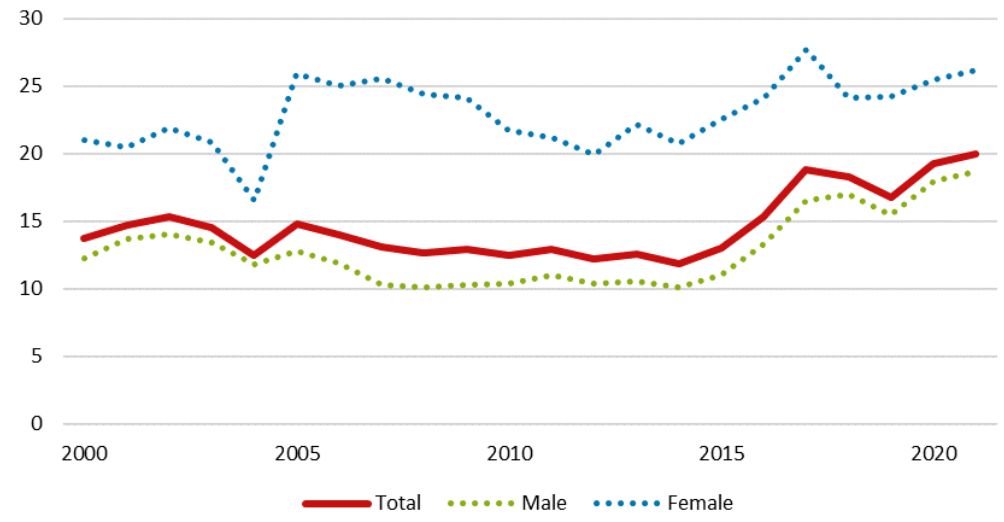
Unemployment

The unemployment rate in Jordan has increased between 2000 and 2021, from 14% to 20% with various dynamics within the period (Figure 2.11). In the decade between 2005 and 2014, the rate steadily fell, reaching its lowest point in the observed period, at 12%. In the following years, unemployment grew at a fast pace and after a show of recovery in 2019, unemployment reached its highest points in 2020 and 2021 due to the Covid-19 pandemic.

Despite a rebound of the economy in 2021, unemployment continued to rise that year, reaching its highest point in decades. As shown above in Figure 2.7, employment numbers fell in 2021, as did the overall share of employed among people aged 15+.

The gender gap in unemployment rates is slightly lower than in 2000 but remains at around 8% in 2021. Female unemployment grew significantly faster in 2005 compared to male unemployment, resulting in a widening of the gap during the following decade.

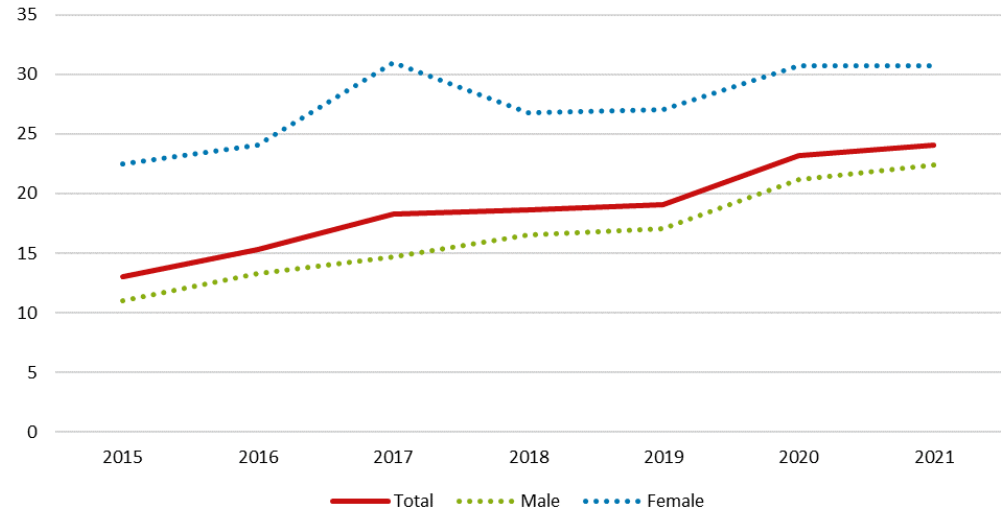
Figure 2.11: Total unemployment (2000-2021), %



Source(s): Department of Statistics (Table 2.6: Population Age 15+ Years by Economic Activity Status, Sex, Broad Age Groups & Nationality (Percentage Distribution) - 2021).

Figure 2.12 shows the unemployment rate among Jordanian nationals since 2015. Unemployment of Jordanians mirrors the trend seen for the total unemployment rate (Jordanians and non-Jordanians) and the gender gap is similarly large. However, the Jordanian unemployment rate is higher than the total rate, by four percentage points in 2021.

Figure 2.12: Jordanian unemployment rate (2015-2021), %

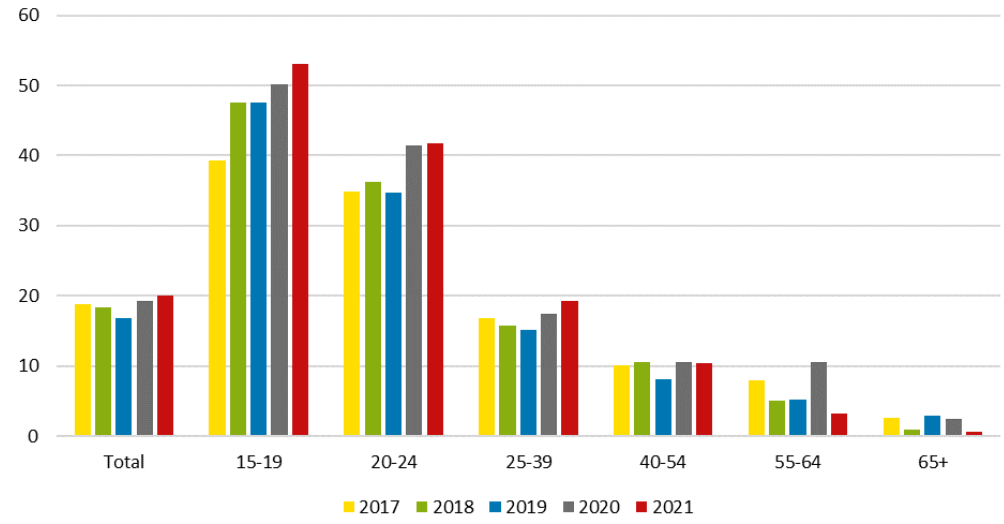


Source(s): Department of Statistics (Table 2.6: Population Age 15+ Years by Economic Activity Status, Sex, Broad Age Groups & Nationality (Percentage Distribution)).

Youth unemployment in Jordan is high (see Figure 2.13) and has surged further in recent years. Between 2000 and 2017, the unemployment rate of people aged 15-24 (as an average of the rates for 15-19- and 20–24-year-olds), has been around 20 percentage points higher than the rate for people aged 25-39. The gap has widened further in the years 2017-21, up to nearly 30 percentage points.

Jordan's population consists of a relatively large share of young people, with 34% aged below 15 years. While this presents an opportunity for the labour market, GDP growth in recent years has not been strong enough to absorb increasing numbers of young people entering the labour force.

Figure 2.13 Unemployment rate (%) by age group, 2021

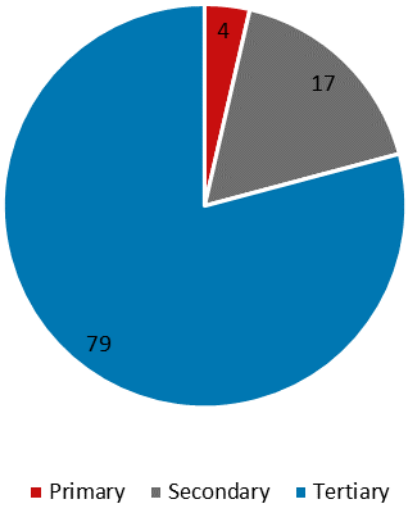


Source(s): Department of Statistics (Table 2.6: Population Age 15+ Years by Economic Activity Status, Sex, Broad Age Groups & Nationality (Percentage Distribution) - 2021).

2.4 Employment by sector

The Jordanian economy is primarily a services-based one with four in five employed people working in the tertiary sector (Figure 2.14). The secondary sector, which includes *Manufacturing* and *Construction* (two of the largest seven employing sectors), remains relevant at 17% of employment. The primary sector, which includes *Agriculture* and *Mining*, employs just around 4% of workers.

Figure 2.14: Employment shares by broad sectors (% of total employment), 2021



Note(s): For information on which sectors are included in Primary, Secondary, Tertiary, consult Annex B.
Source(s): Authors' analysis based on Department of Statistics (Table 4.4: Employed Persons Age 15+ Years by Governorate, Sex, Main Current Economic Activity & Nationality (Percentage Distribution)).

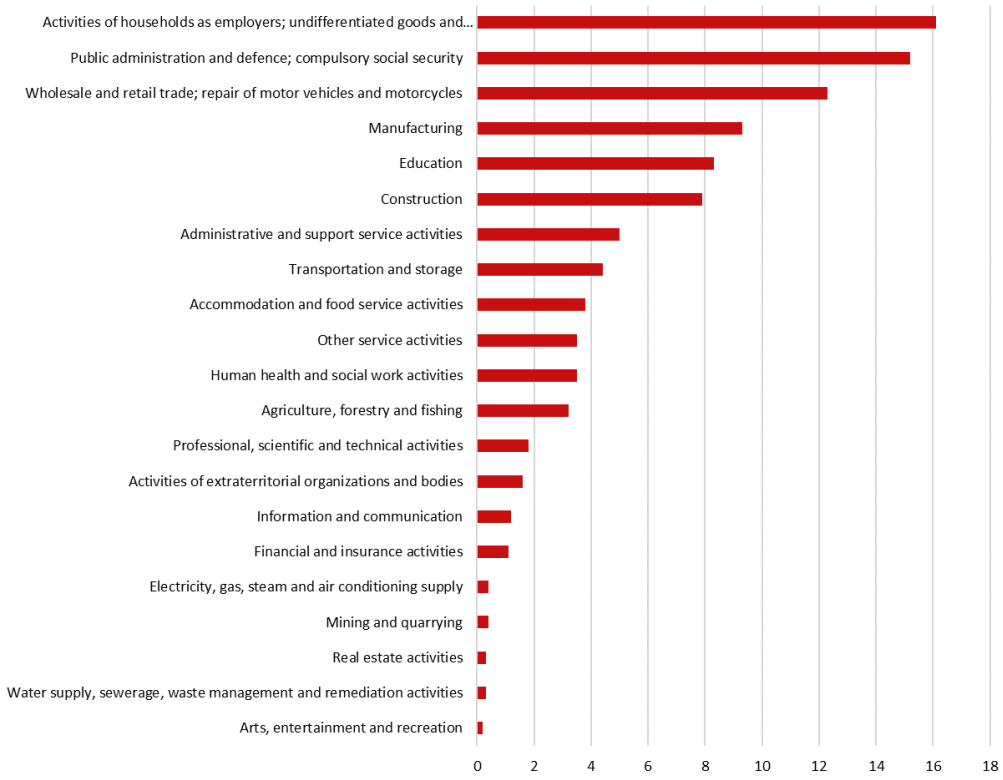
The largest share of total employment in Jordan is found in *Activities of households as employers*, representing 16% of employed (Figure 2.15). Nearly all jobs related to these activities are held by non-Jordanians. Among all non-Jordanians, close to 40% work in *Activities of households as employers*, while this is the case for less than 1% of Jordanians.

Jordan's labour market is characterised by a significant dependence on the public sector, a typical feature of countries in the region. The second-largest employing sector is the *Public administration and defence sector*, with 15% employment share in total employment. Here also, there is a large employment gap between Jordanians and non-Jordanians, with 26% of Jordanians employed in the sector, while this is the case for only 1% of non-Jordanians.

On third place as employer is *Wholesale and retail trade*, with 12% of workers. The *Manufacturing* sector remains a large employing sector in the mainly services-driven economy, being the fourth-largest employing sector (9%). At 8% of total employment, *Education* is the fifth-largest sector.

Since 2017, the share of *Household activities* increased by ten percentage points, likely due to increasing numbers of non-Jordanians in the working-age population, who tend to be much more likely to be active in the sector. Simultaneously, the share of *Public administration* has declined by three percentage points over the same period.

Figure 2.15: Employment shares by sector, 2021

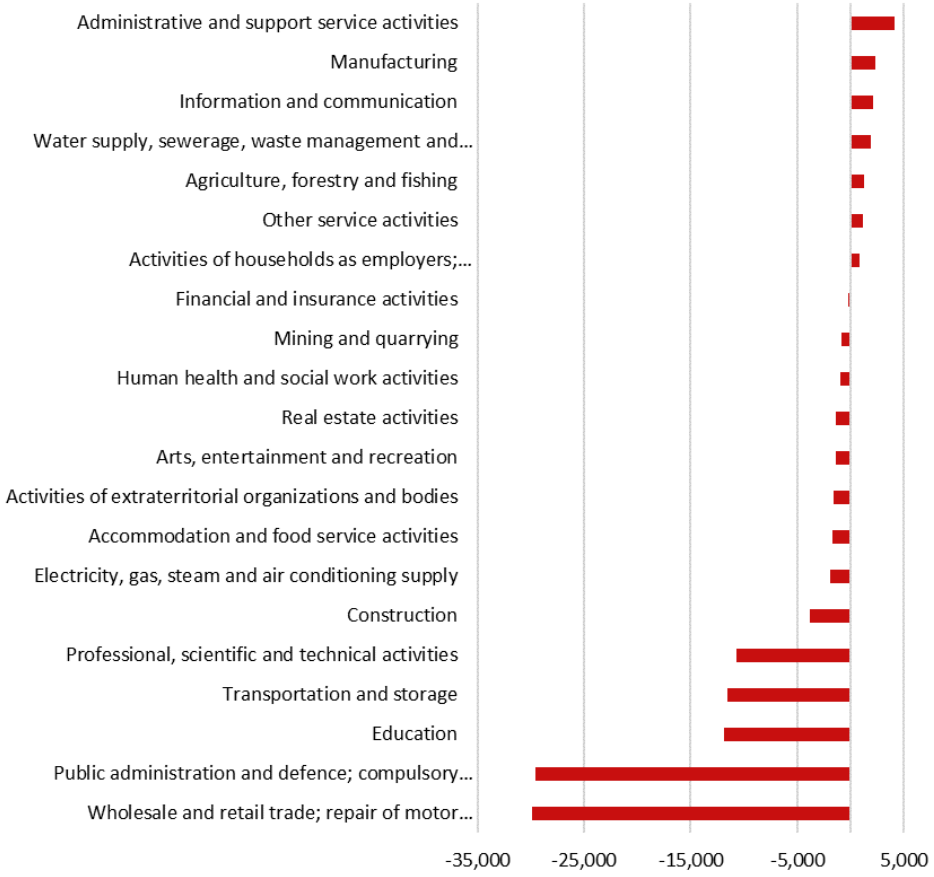


Source(s): Department of Statistics (Labour Force Survey Data, Table 4.4: Employed Persons Age 15+ Years by Governorate, Sex, Main Current Economic Activity & Nationality (Percentage Distribution)).

Employment of Jordanians in absolute numbers declined in most sectors in 2017-21 (Figure 2.16). Around 30,000 jobs were lost in the *Wholesale and retail trade* as well as the *Public administration* sectors respectively. *Education* and *Storage and transport* are also among the sectors where employment fell. At least three of these sectors have been negatively impacted by Covid restrictions.

Among the few sectors in which jobs were created are the Administrative and support services sector, Manufacturing and ICT. Employment in ICT has expanded as a result of government efforts to advance the sector, entrepreneurial innovation, deregulated and competitive market conditions, and increased ICT infrastructure.

Figure 2.16: Absolute job creation between 2017 and 2021 by sector, Jordanians



Source(s): Author's analysis based on Department of Statistics (Labour Force Survey Data, Table 2.5: Jordanian Employed Persons Age 15 + Years by Sex & Main Current Economic Activity).

2.5 Informal activity

When speaking about informality, a distinction should be made between informal economy and informal employment.

Informal economy has also been labelled as "hidden economy", "shadow economy", "black economy", "parallel economy" and "underground economy." The most widely applied definition of informal economy is the one formulated by the ILO (1993) , which states that the informal economy is constituted by "units engaged in the production of goods and services with the primary objective of generating employment and income to the persons concerned" and these units are essentially either (1) informal own account enterprises, i.e. enterprises that are not registered in any form of the national legal system or (2) enterprises of informal employers, i.e. enterprises non registering all or part of its employees.

Therefore, informal economic units can include micro enterprises, family business, and own account activities. Workers in the informal economy may be actual employees of informal economic units, domestic workers without a working contract, occasional, temporary, and part-time workers without fixed employer and working contract, as well as non-registered workers (ILO, 1993).

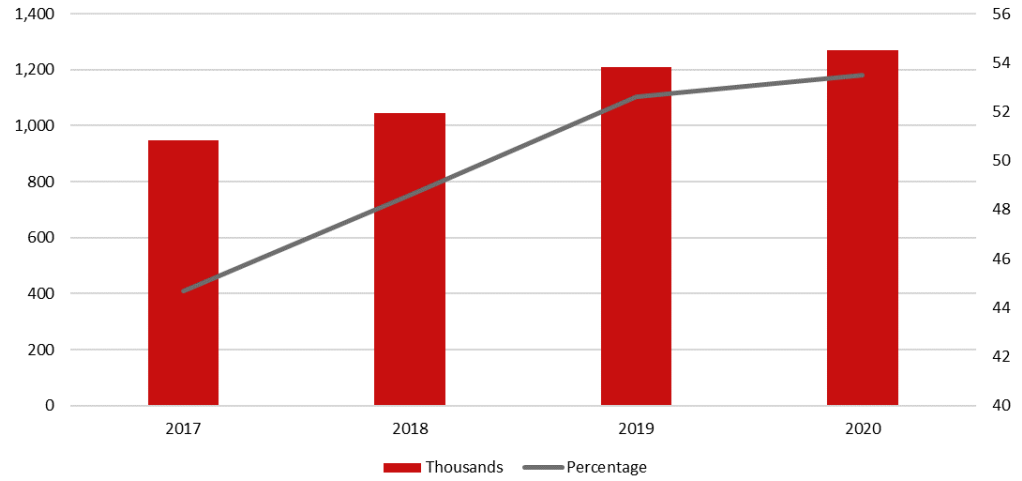
Relying on the Multiple Indicator-Multiple Cause (MIMIC) methodology, Abulfoul et al. (2022) estimate that the size of the informal economy in Jordan has been growing from less than 12% of GDP in 1980 to 18.8% in 2000, to reach 22.4% in 2018.

According to Medina and Schneider (2019), in 2017, the informal economy in Jordan represented about 15% of GDP, implying a loss in tax revenue of JOD 600 million (more than USD 840 million) (IMF, 2018).

Informal employment can be measured as the number of workers without a contract or without social security registration. According to the ILO Employment and Unemployment Survey 2019, informal employment accounts for 54% of total employment (compared to 49% in 2018 and 45% in 2017) (Figure 2.17). According to these estimates, 1.3 million workers in Jordan were in informal employment in 2020. The number of informally employed workers as well as its share in total employment has steadily increased since 2017, by 320,000 or nine percentage points respectively.

Generally, nationals tend to be more likely to hold formal wage jobs than non-natives, who work more often in informal employment. In 2021, the shares of Jordanian employees in the public and private sectors were 39% and 46% of total employed respectively. For non-Jordanians, these shares were 1% and 86% (Department of Statistics - Labour Force Survey Data[7]).

Figure 2.17: Informal employment (levels and percentage of total employment)



Source(s): ILOstat.

Table 2.1 provides further details of informal employment by various categories of workers. Men are more likely to be informally employed than women, although women are in general much less likely to actively participate in the labour market and be employed than men. Among young workers, the probability to be informally employed is slightly higher than that for workers aged over 25. In terms of sectors, while employment in the agricultural sector in general is relatively low, nearly all workers in agriculture – nine out of ten – are working informally. Non-agriculture informal employment represents 94% total informal employment. By employment status, the likelihood to work informally is quite similar and above 50% for employees and self-employed. While self-employed are slightly more often in informal employment than employees, they represent only 12% of total informal employment.

Table 2.1: Informal employment by sex, age, sector, employment status, 2020

	Informal employment (thousands)	Share of informal employment in category (% of total employment in category)	Share of informal employment in category (% of informal employment)

[7] Residual shares are for Self-employed workers, paid trainees and contributing family workers.

Total	1,271	53.5	100
Male	1,138	56.8	90
Female	132	35.6	10
15-24	150	54.8	100
25+	1,120	53.3	88
Agriculture	71	89.9	6
Non-agriculture	1,200	52.3	94
Employees	1,119	53.1	88
Self-employed	149	56.5	12

Source(s): ILOstat[8].

According to estimates by the World Bank based on the Jordan Labour Market Panel Survey 2016, informal employment in the country stood as high as 59% of total employment (Islam, Moosa and Saliola, 2022). Moreover, this share reaches 75% when only considering private sector employment. This indicates that the majority of informal jobs are concentrated in the private sector, with three in four jobs lacking contributions to social security systems, such as pensions. The share of informal employment has remained relatively stable since 2010.

Informally employed workers tend to face lower earnings and job quality compared to those in formal jobs, raising risk and vulnerability in the former group. Overall, informal employment in Jordan is higher than in other countries in the region, such as Lebanon and Saudi Arabia, but lower than in Palestine and Egypt.

In terms of job creation in the private sector, start-ups tend to be responsible for most newly generated job opportunities in Jordan, as existing firms fail to create sufficient numbers of jobs needed to absorb new labour market entrants (World Bank, 2016). These start-ups happen to mostly be informal, micro-sized establishments.

With the retrenchment of public sector job hiring, the probability of labour market entrants taking on informal jobs is increasing and better educated people, such as university graduates are not spared. Informal jobs are often characterised by irregularity, relying on seasonality, and lower income-stability relative to formal wage jobs. In Jordan, those in the lowest wealth quintiles, more often than not work in informal jobs (Islam, Moosa and Saliola, 2022). The probability for workers to transition from informal to formal employment tends to be low.

2.6 Summary

The Jordanian economy is a service-based economy, as can be seen in Table 2.2, summarizing the shares of sectors in total employment and GDP. Notably, some sectors make up a large share of GDP, while employing a relatively small share of workers, e.g. the Finance, Insurance, Real Estate and Business Services sector, or the Manufacturing sector. On the other hand, the Community, Social and Personal Services sector employs the majority of people in Jordan but represents only slightly more than a tenth of total GDP.

The fastest growing sectors over the last decade were the Finance and Insurance, the Community, Social and Personal Services and the Electricity and Water sectors.

Although the economy has proven relatively resilient in the face of multiple external shocks, labour markets suffer from low participation rates and high

[8] https://ilostat.ilo.org/topics/informality/

unemployment, in particular among the large share of the young population and female workers, calling for significant growth in job creation. While the country's young population can prove to be a blessing for the labour market and the economy, recent economic growth has not been strong enough to provide sufficient job opportunities.

Table 2.2 Sectoral shares in employment and GDP, 2021

ISIC Rev 4 code	1-digit ISIC name	Formal employment (thousands)	Share in total employment (%), 2021	Share of GDP (%), 2021	Annual growth 2009-21
A	Agriculture, forestry and fishing	71.8	3.2	5.4	3.2
B	Mining and quarrying	9.0	0.4	2.5	1.4
C	Manufacturing	208.6	9.3	19.2	2.3
D	Electricity, gas, steam and air conditioning supply	9.0	0.4	2.0	4.4
E	Water supply, sewerage, waste management and remediation activities	6.7	0.3		
F	Construction	177.2	7.9	3.1	1.3
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	275.9	12.3	8.8	2
I	Accommodation and food service activities	98.7	4.4	1.4	0.7
H	Transportation and storage	85.2	3.8	9.3	2.4
J	Information and communication	26.9	1.2		
K	Financial and insurance activities	24.7	1.1	8.4	4.5
L	Real estate activities	6.7	0.3	12.4	2.5
M	Professional, scientific and technical activities	40.4	1.8		
N	Administrative and support service activities	112.2	5		
O	Public administration and defence; compulsory social security	340.9	15.2		
P	Education	186.2	8.3	27.6	2.9
Q	Human health and social work activities	78.5	3.5		
R	Arts, entertainment and recreation	4.5	0.2		
S	Other service activities	78.5	3.5		
T	Activities of households as employers; undifferentiated goods and services-producing activities of households for own use	361.1	16.1		

U	Activities of extraterritorial organizations and bodies	35.9	1.6

Source(s): Author's analysis based on Department of Statistics (Labour Force Survey Data; Annual accounts data).

3 Sectoral profiles

3.1 Introduction

This chapter looks at developments within six key sectors of importance to Jordan's Green Growth Strategy 2021-25 (Jordan Government, 2020a, 2020e, 2020f, 2020d, 2020b, 2020c) [9]. For each sector, the impact on sustainability is explored, looking at sector output and employment size, and production methods.

There is no standard definition of green jobs. According to the ILO, green jobs can be found in many sectors of the economy, covering work in agricultural, manufacturing, research and development, administrative and service activities, and are linked to economic activities within sectors that "help preserve or restore the environment by:

- Improving energy and raw materials efficiency
- Limiting greenhouse gas emissions
- Minimising waste and pollution
- Protecting and restoring ecosystems
- Supporting adaptation to the effects of climate change."(ILO, 2016)

To assess the number of green jobs, it is therefore important to first identify those green economic activities within sectors, and then the number of jobs associated with them. Green activities within a sector are generally identified using one of three methods:

1 the process-based method,

2 the output-based method, and

3 the natural resource conservation method.

The process-based method defines green activities as those whose production processes involves lower energy and resource intensity, lower need for virgin inputs and/or using recycled inputs, and/or lower generation of waste. In other words, the product is not necessarily helping to preserve or restore the environment, but the production process is organised with minimal impact on the environment and innovations are actively introduced to eliminate this impact.

The output-based method refers to the environmentally beneficial characteristics of final products or services in the sector. Examples of environmentally friendly products or services include: organic agricultural products (certified), green textiles (green labelling), eco-tourism (certified), green construction (certified) and green financing.

The natural resource conservation method examines activities that directly contribute to nature conservation. Examples of such activities include ecosystem support and natural resource management.

Depending on how strong are the links with the environment, environment-related activities can be considered of having different shades of green. A core green activity would be: 1) sustainable in their production processes (e.g. more efficient in their use of natural resources), 2) produce green outputs, and 3)result in outcomes which support social sustainability. If it meets only one of the criteria, it would be considered non-core green activity.

[9] While this chapter summarises the trends within the six sectors, Annex A of this report contains the detailed and full profiles for each of the sectors.

3.2 Agriculture

Importance of the sector

Representing 5% of Jordan's GDP in 2021 (DoS, 2022d), the agriculture sector grew by 3% per annum since 2009. The sector accounts for 3% of formal employment (around 78,000 people) (DoS, 2022c)[10], although the actual number of agricultural workers is likely much higher (possibly by a factor of 20) when including informal employment (ILO, 2018). Livestock accounts for the majority of agriculture employment (70%) and production (55%) (Jordan Government, 2020a). Although the sector is small in terms of direct, formal employment, it generates a substantial number of jobs along the value chain, such as in processing, packaging, distribution, and transport.

The sector is clearly linked to environmental outcomes through the use of water and pesticides as well as through practices such as overgrazing. Around 80% of Jordan's conserved water is used in agriculture and one-third of groundwater is used for irrigation.

Trends towards sustainability

Water-efficient practices in Jordan's agriculture sector, like wastewater recycling or drip irrigation, exist, but need further development. Around 90% of treated wastewater is reused in agriculture and half of water used for irrigation is recycled wastewater. Although drip irrigation systems are widely used in some areas, technologies like aquaponics and hydroponics are underdeveloped.

The number of organic farms remained low between 2017 and 2020, between 17 and 23, with the organically cultivated land area around 15,000 square meters (DoS, 2022a). The largest portion of organic farmland is used to grow olives, followed by palm. Other agriculture output grown on organic areas include citrus, vegetables, almonds, and grapes.

Green activities and environment-related employment

Activities within the sector were screened for sustainability in their production processes (i.e. they make more efficient use of natural resources) and in their output (i.e. whether they result in green outputs). The following selected sector activities can be described as 'green' activities.

Drip irrigation can be water- and energy-efficient (Shatanawi *et al.*, 2005) (Gonzalez, 2018). Compared to surface water irrigation and irrigation with sprinklers, drip irrigation results in low water losses (Al-Omari *et al.*, 2015). In Jordan, 91-96% of the irrigated area used for vegetables is drip irrigated (DoS, Agriculture statistics). In field crops, drip irrigation is lagging behind (Gonzalez, 2018). Water scarcity is less prevalent among farmers using drip irrigation compared to those with surface irrigation or localised tubes (Van den Berg and Al Nimer, 2016).

Hydroponics is the cultivation of plants in water without soil, while **aquaponics** combines this with fish production in the same water. Both can bring substantial efficiency gains in water-scarce Jordan. A greenhouse using hydroponics grows tomatoes with 40-50% less water input[11]. Upscaling potential in Jordan is large (Jordan Government, 2020a), but challenges in increasing adoption are the investment needs and knowledge development, though initiatives focused on installing greenhouses and skills training exist[12].

Organic farming uses fertilisers of organic origin like compost manure. The re-use of organic waste from agriculture for processing into fertilisers reduces waste and pressure on biodiversity stemming from chemical products. Barriers to adoption of organic farming include elevated production costs and a lack of independent assessment of organic farming produce (Eneizan, 2017).

The classification of green activities goes beyond the adoption of green practices or technologies in a production process. While drip irrigation is

[10] Authors' analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.
[11] https://www.al-monitor.com/originals/2019/06/jordan-hydroponic-agriculture-water-scarcity.html
[12] https://www.lutheranworld.org/news/jordan-saving-water-while-improving-food-security

widely used among farmers, this alone would not classify them as 'core green', as they might still be using chemical pesticides. Organic farmers using water efficient irrigation technology can be described as working in 'core green' activities.

3.3 Manufacturing

Importance of the sector

Manufacturing is the second-largest sector by output, accounting for 17% of GDP in 2021 (DoS, 2022d). Per annum growth since 2009 was 1.4%. The sector represents 9% of formal employment (215,000 people), but might employ more than 400,000 people when accounting for informal employment workers (WANA Institute, 2019). The largest sub-sectors by employment are 'food products', 'apparel', 'metal products', 'furniture' and 'chemical products' (DoS, 2022c)[13].

The industrial sector[14] in Jordan accounts for 17% of primary energy usage and 19% of electricity consumption. With chemical products and textiles being key outputs of the sector, the link to environmental outcomes is likely larger than for other sectors, such as agriculture or tourism, as conventional production processes for such products can typically be detrimental on the environment. On the other hand, recycled manufacturing activities have potential for furthering the circular economy.

Trends towards sustainability

The share of renewable groundwater used in the industrial sector is at around 80% and has remained stable around this level over the past years (DoS, 2022b). Plastic waste generation from industrial activities has remained stable between 2012 and 2020, while the amount of plastic waste recycled during this period has tripled. The manufacturing sector plays a role in furthering progress towards circular economic practices via recycling of materials such as ferrous metals (iron and steel), plastics and (to a smaller extent) cardboard (Hamdan, 2021). Clean technology, which applies processes, products or services that mitigate environmental impacts by enhancing energy efficiency and sustainable use of resources, has been gaining traction in Jordan in recent years (EDAMA, 2017). An estimated 13,000 employees work in Jordan's clean tech sector, 6% of which are in manufacturing.

Green activities and environment-related employment

Activities within the sector were screened for sustainability in their production processes (i.e. they make more efficient use of natural resources) and in their output (i.e. whether they result in green outputs). The selected sector activities can be described as 'green' activities are: recycled plastic, clean teach and resource efficiency.

Plastic products represent 15% of municipal waste in Jordan, highlighting the importance of **plastics recycling**. While a substantial number of plastic manufacturers use recycled raw materials, further progress can be made, as 45% of plastic manufacturers solely use virgin materials in production and the remaining ones use a mix of virgin and recycled materials (GIZ, 2021).

Clean tech produces technologies which are more energy-efficient, less wasteful and, in effect, pose less harm for the environment than alternatives. In Jordan's manufacturing sector, clean tech is gaining in importance and has growth potential. Currently, around 800 people work in clean tech manufacturing in the country, with outputs primarily including manufacture and maintenance of tools and equipment focused on increasing energy efficiency and renewable energy production (EDAMA, 2017).

[13] DoS LSF microdata for 2020.
[14] The industrial sector typically includes manufacturing, utilities and construction. In terms of employment and output, the manufacturing sector represents most of the industrial sector in Jordan.

For the other manufacturing sectors, if production is done in a sustainable manner, e.g. with resource-efficient processes, then the activity in the sector can be considered greener than the conventional activity.

The classification of 'core green' activities goes beyond the adoption of a 'green' practices or technologies in a production process or the output. Use of sustainable water in manufacturing is widespread in Jordan, but this alone would not classify them as 'core green', if efficient use of water is not put in place. Manufacturing with efficient water/energy measures and using other sustainable inputs, such as recycled raw materials, can be described as greener than their conventional peers.

3.4 Energy and electricity

Importance of the sector

The energy and electricity sector represents 1.3% of Jordan's GDP (DoS, 2022d) and accounts for 0.6% of total employment (DoS, 2022c)[15]. Jordan relies on a conventional energy mix, mostly based on (imported) crude oil and natural gas. Most of the energy supply is covered via imports. Between 2005 and 2017, the import of energy represented on average 98.7% of primary energy supply (MEMR, 2020b).

The energy sector plays a major role in climate change mitigation, especially since energy is the primary contributor to total emissions of greenhouse gases.

Trends towards sustainability

The majority of electricity is produced relying on fossil fuels, in particular natural gas (73%) (MEMR, 2021). Still, the share of electricity from renewables in Jordan has been increasing over time, growing from 0.7% in 2014 to over 13% in 2019 (IRENA, 2021), and up to 26% in 2021 (MEMR, 2021). Jordan's potential for renewable energy - specifically solar and wind - is high, with an average of 316 sunny days per year, having wind speeds between 7 and 8.5 m/s (Katz and Shafran, 2019), and having large desert areas with a low population. The expansion in the share of renewables was also enabled by price reductions in the technology, subsidised prices, and financing programs, making solar photovoltaic and wind generation more competitive with conventional sources.

Green activities and environment-related employment

Activities within the sector were screened for sustainability in their production processes (i.e. they make more efficient use of natural resources) and in their output (i.e. whether they result in green outputs). The following sector activities can be described as 'green' activities: electricity generation using renewables and energy efficiency.

Electricity generation from renewable energy carriers, such as solar (using photovoltaic), wind, and hydropower (using water circulation) result in green outputs. Their production does not release greenhouse gas emissions. Combined with the installation energy-efficient technology, this would result in what can be described as a 'core green' activity.

3.5 Water and waste

Importance of the sector

The water and waste sector[16] in Jordan employs merely 0.3% of workers in 2021 (DoS, 2022c), equivalent to around 7,000 people. Together with the electricity sector, the sector contributes around 2% to GDP (DoS, 2022d). The sector grew by 5% per year in 2010-21. The water sector alone generates 0.5% of Jordan's GDP in 2021 and formally employs 6,800 workers (Jordan Government, 2022). Water collection, treatment, and supply account for most of the output from the sector's activities.

[15] DoS LSF microdata for 2020.
[16] Water supply, sewerage, waste management and remediation activities.

Despite its small share in GDP, Jordan's economy is dependent on the water sector. This is due to the dependence on water by the agriculture sector, which uses 49% of water supplied by the water sector. Also, given the country's severe water situation, efficient water supply is crucial in Jordan, in particular in the context of the growing population size and declining per capita water supply (DoS, 2022b) (DoS, 2022e).

The waste sector accounts for 11% of Jordan's total GHG emissions, 99% of which result from methane gas from managed landfills (Jordan Government, 2020e). When accounting for related activities, such as waste collection and transport, the sector's carbon footprint is higher still.

Trends towards sustainability

The quantity of treated wastewater increased by 65% in 2008-21, representing 15% of total water usage, with nearly all treated wastewater (98%) used for irrigation in the agriculture sector (DoS, 2022b). The sector is critical for the sustainability of the agriculture sector, and "failure to sustain and protect water resources […] threatens food security, livelihoods, and life" (Jordan Government, 2020f).

Around 30% of waste in Jordan is comprised of plastics, metals, and paper. Recycling of plastics (except PET) is well-developed in Jordan. Amman's plastic waste recycling sector treats between 4,000 and 6,000 tons of plastic waste per month (Hamdan, 2021).

Green activities and environment-related employment

The green activities are selected based on the sustainability in their production processes (i.e. they make more efficient use of natural resources) and in their output (i.e. whether they result in green outputs).

Wastewater recycling is critical for Jordan's water supply, given the country's severe scarcity of water resources, and its growing population. In light of climate change impacts such as more frequent droughts and reduced precipitation, wastewater collection and treatment activities can be considered a 'green' activity, as their output enhances the country's resilience to climate change.

Waste sorting and recycling in Jordan involves separating waste, for example in landfills, where waste types are mixed. Typically, waste pickers, who most often work informally, collect waste types to sell on to facilities specialised in processing and (sometimes) recycling waste materials for re-use in further production processes. Some types of waste, in particular PET plastic waste, are primarily exported. Organic waste is often mixed with hazardous waste types, which can result in potentially reusable waste becoming unrecyclable, e.g. animal waste for organic fertiliser production.

3.6 Transport

Importance of the sector

The transport sector represents 6.3% of Jordan's GDP and grew by 3% per annum between 2009 and 2019 before it contracted by 5% in 2020 due to the Covid-19 pandemic (DoS, 2022d). The sector employs around 90,000 people or 6% of total employment (DoS, 2022c)[17]. Informal employment is large, with estimates stating that the sector represents 12% of all informal employment (Jordan Government, 2020d). Most of the sector's employment is in 'land transport', with freight transport and passenger transport accounting for nearly all the output. 'Air' and 'water' transport and 'transport via pipelines' have only minor shares.

The transport sector in Jordan represents 49% of primary energy consumption (MEMR, 2021), with private cars accounting for 57% of this. The sector's energy consumption has grown substantially over the last two decades, also due to strong population growth. The sector is also the second largest

[17] DoS LSF microdata.

contributor to greenhouse gases emissions after the energy sector (Jordan Government, 2014).

Trends towards sustainability

A key concept that has emerged in the context of transport is that of 'green transport' and national efforts have risen to adopt policies to switch to it, based on its role in preserving the environment. Green transport includes transport not depending on diminishing natural resources, but relying on renewables and producing minimal or no greenhouse gas emissions.[18]

Electric vehicles (EVs) make for a marginal share of private vehicles. Still, Jordan can be considered as "one of the pioneers in transport electrification in the Middle East" (Shalalfeh *et al.*, 2021), also due to favourable legislation. The share of EVs has been increasing significantly, in particular since 2015, and it is estimated that more than 18,000 EVs were circulating in Jordan in 2018 (Friedrich Ebert Stiftung, 2019). Estimates for 2021 report over 21,500 EVs[19]. To reduce barriers to the ownership of EVs, legislation now requires all new gas stations to install electric charging stations.[20] In 2018, the government signed an agreement with the company E-Charge, to install 10,000 electric charging stations across the country.

Green activities and environment-related employment

Green activities within the sector were selected for sustainability in their production processes (i.e. they make more efficient use of natural resources) and in their output (i.e. whether they result in green outputs).

A broader definition of green transport encompasses "the transportation service with a lower negative impact on human health and the environment compared to existing transportation services" (Björklund, 2011), but can also include the efficient use of traditional fuels, the increased deployment of **electric vehicles**, and strengthening of **public transport** (Lee and Hashim, 2017). According to such a broader understanding of green transport, pipeline transportation would be also considered as a green alternative to road transport of liquid gas and fuels (Shaton, Hervik and Hjelle, 2020).

While EVs can be considered green transport, their production, maintenance and disposal may involve unsustainable processes. Public transport has the benefit of reducing congestion by servicing a larger number of people compared to private vehicles. In combination, various activities can result in 'core green' output.

3.7 Accommodation and tourism

Importance of the sector

The accommodation and tourism sector accounts for 1.3% of Jordan's GDP (DoS, 2022d) and around 4% of total formal employment (92,000 people). Most people in the sector (86%) are concentrated in food and beverage service activities (DoS, 2022c)[21].

In Jordan, tourism contributes to energy use and GHG emissions from the three main categories in order of importance: transport, accommodation, and tourism support activities. In addition, the inflow of tourists is also associated with an increase in solid waste by 0.13% (Ecoconsult, 2022). These effects are directly related to the number of tourists. Mobility restrictions due to the COVID-19 pandemic caused a decrease in the number of individuals entering Jordan. According to Ecoconsult (2022), touristic movements are expected to reach an inflow of 5.5 ml individuals by 2025.

Trends towards sustainability

Ecotourism is defined by the Royal Society for the Conservation of Nature (RSCN) as "the responsible travel to natural areas that conserve biodiversity

[18] https://www.igi-global.com/dictionary/green-transportation/52775
[19] https://www.netherlandsandyou.nl/latest-news/news/2021/06/09/nl-jor-dialogue-sessions-electric-vehicles
[20] https://www.ammancity.gov.jo/site_doc/climate.pdf?fbclid=IwAR063ZYGb7ESWZZFaBjaNxhYn1VKcU0OqU055JhTLGVXQcuw6v4FF2yl86I
[21] DoS LSF microdata for 2020.

and sustain the well-being of local people"[22]. It aims to support environmental protection, create green jobs, and raise awareness of conservation. Ecotourism can be estimated to account for 18% of all touristic activities in Jordan (GIZ, 2019b).

The RSCN established the first biosphere in Dana Natural reserves in 1994 and is operating 23 initiatives and projects in the field of ecotourism adopting a sustainable development approach. Projects range from the management of campsites, eco-lodges, and restaurants to promote activities with strong links to preserved ecosystems, such as canyoning, cycling and hiking. According to GIZ (2019b), the reserves receive around 100,000 visitors per year. Further attractions linked to ecotourism are Wadi Rum (177,569 visitors in 2017), the Jordan Trail (7,500 visitors in 2017), the Dead Sea, and Aqaba. According to the study by USAID (2017), ecotourism and adventure tourism are capable of generating up to 500 formal jobs USAID (2017).

Green activities and environment-related employment

Green activities within the tourism and accommodation sector were identified based on for sustainability of their production processes (i.e. they make more efficient use of natural resources) and of their output (i.e. whether they result in green outputs). The selected sector activities can be described as 'green' activities.

Ecotourism could be considered as 'core green', as it aims to preserve natural resources and, in some instances, even reverse negative effects through conservation/restoration efforts. Ecotourism raises awareness of conservation efforts and allows for the collection of funds to be used in furthering environmental protection. Coupled with resource-efficient and waste-mitigating processes, such as the case for green accommodation, this would be characterised as a 'core green' activity.

When thinking about classifying activities prevalent in ecotourism, in theory, these could cover any activities within the tourism sector. To determine the extent of 'core green' tourism activities, therefore, requires detailed information about the volume of ecotourism activities in Jordan.

[22] https://www.rscn.org.jo/ecotourism

4 Direct green employment

4.1 Introduction

This chapter reports on the estimate of green jobs. In the sectoral profiles(see Chapter 3), green activities in a sector were differentiated from the rest of the sector using output-, process-, and conservation-of-nature-based perspectives. Accordingly, green jobs are defined as jobs in activities whose output and/ or process is more sustainable than its traditional counterpart, as well as all activities resulting into conservation of natural resources and preservation of ecosystems.

The ILO further emphases that green jobs should be decent. This means that a green job is sustainable from an environmental perspective, and inclusive and equitable from a social perspective, by offering fair wages and social security. In the absence of reliable information, in this report only those employees with a formal employment contract are considered being in decent jobs without taking into account other aspects such as wages, working conditions etc. As a result, informal jobs, even if they help preserve or restore the environment are not considered to be green jobs. Among the decent work indicators, the share of informal employment was used as a proxy for decent work.

Table 4.1 presents the summary of the number of possible green jobs by green activity. The details of the estimation for each sector are described in the sections below.

Table 4.1: Summary of estimated green jobs (current)

Sector (activity)	Current employment*	Method	Green jobs	
Agriculture (crop production)	18,349	output method and process-based method	10,145	10,179
Energy	9,435	output method	4,750	
Energy efficiency	Not available	output method	1,686	
Manufacturing - Plastic	11,875	process-based method	3,713	
Manufacturing - Food processing	59,646	process-based method	61	
Manufacturing - Clean technology	Not available		1,178	
Manufacturing - Textile	68,489	process-based method	66	
Manufacturing - Packaging	11,875	process-based method	4,160	
Manufacturing – Pharma &Chemicals	26,655	process-based method	592	
Tourism	12,418	process-based and output method	3,166	5,416
Waste	Not available	output method	6,400	
Water	7,966	output method	1,957	
Transport	81,031	process-based method	30,920	63,500

Note(s): *Current employment is based on a variety of sources.
Source(s): Cambridge Econometrics estimation.

4.2 Agriculture

For the green jobs assessment in agriculture, the green activities were chosen based on both methods, as summarised in Table 4.2. The last two activities are not part of agricultural sector, per se, but rather part of the supply chain.

Table 4.2: How green activities were chosen in Agriculture

Green activity	Method
Adoption of drip irrigation technology for crops	process-based method – water efficiency
Hydro-/aquaponics	process-based method – water efficiency
Organic farming	output-based method
Fertigation	process-based method
Production of organic fertiliser/ pesticides	output-based method
Drip irrigation technology for crops	output-based method

Source(s): Cambridge Econometrics.

Within the agricultural sector, the focus is on crop production since very little information was found on sustainable forestry (small sector), fishing activities (small sector) or animal production.

Agriculture is one of the sectors most affected by informal employment. For green jobs, only permanent workers are considered since it is assumed they are more likely to be in formal employment.

One of the main issues in crop production in Jordan is water scarcity. Drip irrigation is considered a sustainable practice from a water efficiency perspective, and can also reduce the energy costs of water pumping[23].

According to the Agricultural Statistics 2019[24], 44% and 51% of the area for winter and summer vegetables, respectively, is irrigated using drip irrigation. Assuming 34 permanent workers per durum of irrigated area cultivated with vegetables, as much as 10,049 workers per year could be involved in the green activity of drip irrigation in vegetable cultivation.

Hydroponics and aquaponics are new agricultural processes for water efficiency in greenhouses. The stakeholder consultations revealed that all strawberries are produced in hydroponic greenhouses. According to FAOSTAT, area harvested with strawberries in 2020 in Jordan was 155 hectares. Assuming a labour intensity of 3.71 workers[25] per hectare, 42 jobs could be considered green in the hydroponic greenhouses. No information is available on types of labour contracts. According to the stakeholder consultations, on average there are at least 2 permanent workers per hydroponic greenhouse.

According to Ministry of Agriculture, there are 16 crop organic farms and 6,163 durum cultivated in Jordan. The stakeholder interviews revealed that the number of permanent workers per medium organic farm are between 2-3. This would mean between 54 and 72 green jobs in total.

[23] McPhee, John, Jochen Eberhard, Alice Melland, Jasim Uddin, Lucinda Dunn, Sarith Hin, Vanndy Lim, Veasna Touch, Phimmasone Sisouvanh, Inthong Somphou, Tounglien Vilayphone, Phaythoune Mounsena, and Stephen Ives. 2022. "Simple ETo-Based Rules for Irrigation Scheduling by Smallholder Vegetable Farmers in Laos and Cambodia" Water 14, no. 13: 2010. https://doi.org/10.3390/w14132010

[24] http://dosweb.dos.gov.jo/products/agricultural-statistics-2019/

[25] Source(s): https://migration.ucdavis.edu/rmn/blog/post/?id=2668

The number of farms seems low compared to the area cultivated. For example, in Eneizan (2017) 54 organic farms were reported in 2017. If the cultivated area would be used and assuming a labour intensity of 7 workers per durum[26], then as much as 546 workers might be employed in organic farming. Out of them, it is difficult to assume how many are green jobs as measured by the ILO definition.

For the other green activities mentioned in Table 4.2, no information is found to distinguish the number of green jobs from the rest of the sector(s).

Table 4.3: Estimated green jobs in agriculture and related industries

Economic Activity	Employment in 2021	Out of which are possible green jobs
011 Growing of non-perennial crops	14,186	
Drip irrigation in area cultivated with vegetables		10,049
Strawberries hydroponics greenhouses		42
Organic farms		54 - 72
201 Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics, and synthetic rubber in primary forms	8,173	unknown
282 Manufacture of special-purpose machinery	0	NA

Source(s): Cambridge Econometrics.

4.3 Manufacturing

For the green jobs assessment, the green activities under manufacturing identified are recycled plastics manufacture and clean technology. Following the stakeholder consultations, some of the enterprises in the manufacturing sector exporting their products have acquired ISO certification related to the environment: ISO 14001 and 50001. That means that they implemented measures and changes in the production process that allows them to have more sustainable production process. The only data available is based on the Jordan Chamber of Industry (2022)[27].

For the plastics sector, the categorisation of core green activity uses a process-based approach, considering the sustainability of the raw material used. The GIZ (2021) study on circular economy reports that 54% of Jordanian manufacturers for industrial plastic, and 32% for consumer plastic products, use recycled plastics ‘to some extent’ in their production processes. This does not identify, however, the proportion of raw material which is recycled vs virgin. Stakeholder consultations revealed that the proportion of recycled plastic depends on the product: 0% for food packaging and water pipes[28] to 100% for plastic furniture.

[26] Value for Spain (average for 2007-09) taken from https://agriculture.ec.europa.eu/system/files/2019-12/agri-farm-economics-brief-04_en_0.pdf
[27] Jordan Chamber of Industry (2022) Waste Management Network in Jordan's Industrial Sector.
[28] Restriction based on legislation rather than producers’ choice.

The Labour Force Survey does not report any employment in the plastics sector (C 222) in the years 2017 to 2022. The level of employment is therefore taken from Jordan Chamber of Industry (2022)[29].

The number of possible green jobs is then estimated by multiplying the share of manufacturers who use some recycled plastics as raw material by employment in the sector. This estimate is likely to be an upper limit, given that the manufacturers might only use a small proportion of recycled plastic in their total raw material use. Uncertainty is also high because: 1) data is available only for the share of manufacturers who use recycled material, not the market share of those manufacturers; and 2) lack of data on employment in the plastics sector[30].

The number of jobs in clean technology are given in the EDAMA (2017) study 'Jordan Clean Technology Sector Report'. The values reported in Table 4.4 correspond to the study data which excludes utilities (jobs in utilities should be accounted under energy or water and waste). Data is also adjusted to only include the jobs which are within Jordan (76%).

The jobs reported under clean technology are likely to be included in the direct jobs estimates reported in the GIZ (2021) study on the energy sector.

In the case of packaging, the stakeholder consultations revealed that almost all enterprises producing metal and cardboard packaging use recycled raw material. Therefore, 4,160 workers from these enterprises are considered as green jobs.

In food processing, textile and pharma and chemicals, the Jordan Chamber of Industry review of waste management processes revealed that few enterprises have an ISO 14001 Environment Management certificate[31] and even fewer an ISO 50001 Energy Management certificate[32]. The number of enterprises is based on a small sample size survey, and green employment in these sectors is calculated using average number of workers per establishment. Therefore, the real number could be much higher.

Table 4.4: Estimated green jobs in manufacturing

Economic Activity	Employment in 2021	Out of which are possible green jobs
C Manufacturing	218,322	
C 222 Manufacture of plastic products*	11,875	3,800 - 6,413
Clean technology – renewable energy		247
Clean technology – energy efficiency		342
Food processing*	59,646	61
Textile*	68,489	66
Packaging*	11,875	4,160
Pharma and chemicals*	26,655	592

Note(s): (*) taken from Jordan Chamber of Industry (2022).
Source(s): Cambridge Econometrics.

[29] Jordan Chamber of Industry (2022) Employment in the Industrial Sector, Research and Development Unit.
[30] The LFS microdata does not have employment data for C22 Manufacture of rubber and plastic products.
[31] Certification to ISO 14001 standards helps organizations improve their environmental performance through more efficient use of resources and reduction of waste.
[32] Certification to the ISO 50001 standard, for example, ensures that the organization has a healthy energy management system, reducing energy consumption, environmental impact and increasing profitability.

4.4 Energy

Jordan has ambitious targets for the share of renewable as part of the final energy consumption.

For 2021, in the study on job creation through the green energy transition in Jordan, eclareon GmbH and ETA-Max for Energy & Environmental Solutions (2021) estimated 2,785 direct jobs in the solar PV, 250 in the wind energy, and 11 in the biogas. The study reveals that these are both construction and operation maintenance jobs. It is unclear how many of them are green jobs per the ILO definition.

In the hydropower sub-sector, based on the current installed capacity, the number of direct jobs in operation and maintenance is estimated at 7.

In the case of energy efficiency, eclareon GmbH and ETA-Max for Energy & Environmental Solutions (2021) estimated around 1,686 direct and indirect jobs existing in 2021. Around 21% of them would come from industry, while the rest is increasing energy efficiency of new and old buildings. Also, in this case, it is unclear how many of them could be labelled as green jobs per the ILO definition.

Table 4.5: Estimated green jobs in energy

Economic activity	Employment in 2021	Out of which are possible green jobs
351 Electric power generation, transmission, and distribution	8,710	
Solar PV (transmission grid and distribution)		2,785
Wind energy		250
Hydropower		7
Biogas		11
Energy efficiency		1,686*

Note(s): (*) it includes both direct and indirect jobs.
Source(s): Cambridge Econometrics mostly based on eclareon GmbH and ETA-Max for Energy & Environmental Solutions (2021).

4.5 Water and waste

For the green jobs assessment, the sectors within ISIC aggregate sector E ‘Water supply; sewerage, waste management and remediation activities’ are considered. All activities within this ISIC aggregate have strong links to the environment. This section discusses water and waste as two areas of assessment.

For water, the green activities identified are: 1) supply of water from sustainable sources; and 2) collection and treatment of wastewater from households and industry for re-use. In selected assessments, all jobs within the water sector have been considered green (e.g., ILO (2014) for Mauritius); this categorisation follows from concluding the sustainable policies are used within the public water supply sector. In Jordan, however, a portion of the sector is unsustainable, namely supply from groundwater and surface water resources.

Table 4.6 presents the estimation of the proportion of supply which can be considered sustainable. Calculations use data from Table 9.9. The total supply attributable to ISIC E is calculated as the sum of: 1) all supply to municipal and industrial sectors; and 2) ‘treated wastewater’ supplied to irrigation and

livestock uses. Water supply from groundwater sources to irrigation and livestock uses are assumed to fall outside the boundaries of the water supply sector, that is, the agricultural sector extracting the resource directly. The water supplies that are considered sustainable are treated wastewater and desalinated water from the sea.

Table 4.6: Estimation of 'sustainable' water supply activity

Water supply attributable to ISIC E (2021, million m^3)	168
'Sustainable' supply attributable to ISIC E (2021, million m^3)	719
Share of ISIC E considered 'sustainable'	23%

Source(s): Cambridge Econometrics based on official sources.

The estimation of green jobs in water sector is presented in Table 4.7. The 'possible green jobs' estimate for E 36 are estimated by multiplying total employment in the sector by the proportion of supply considered sustainable (23%). All jobs in the sewerage sector are considered 'green'; the sewerage sector is engaged in treatment of wastewater which can be categorised as a core green activity.

Table 4.7: Estimated green jobs in the water sector

Economic activity	Employment in 2021	Out of which are possible green jobs
36 Water collection, treatment, and supply	7,840	1,830
37 Sewerage	126	126

Source(s): Cambridge Econometrics.

For waste, all activities can be considered core green activities. The ISIC E37 and E38 codes cover waste collection, treatment, disposal activities and material recovery. In Jordan, employment in this sector is largely informal. In the LFS data, no employment is recorded in E37 or E38 for the years 2017 to 2021. The Ministry of Environment's strategy paper 'Waste Sector Green Growth National Action Plan 2021-2025' provides estimates of employment in the sector, identifying three distinct categories of job.[33]

Table 4.8 presents an assessment of potential green jobs, using the Ministry of Environment estimates. The employment in the formal waste sector are possible green jobs. The Ministry report notes that most of these jobs are for municipalities, and therefore we can conclude these jobs are likely of good quality. The jobs in the informal sector cannot be counted as green jobs. These jobs are not decent given the informal nature, but also because of the substantial health and safety risks involved.

The National Action Plan report notes that the linking of households to businesses reselling waste is a service which could be formalized and be profitable. According to the interview with Ghabawi Municipal Solid Waste (MSW) Landfill, a pilot is in place to sort waste manually and 20 employees manage to sort 250 tonnes per day. Other such pilots are envisaged.

[33] The jobs identified in the Ministry of Environment's report could be categorised in ISIC codes outside of E. Street sweepers likely fall under N 81, specifically N8129 'Other building and industrial cleaning activities'. Certain waste collection jobs could potentially be accounted under G4669 'Wholesale of waste and scrap and other products n.e.c.'.

Based on the interview with GAM, there are 4,500 street collectors and 1,800 truck drivers.

Table 4.8: Estimated green jobs in the waste sector

Economic activity / Job	Employment	Out of which are possible green jobs
Formal waste sector (waste collectors, street sweepers)	6,400	6,400
Waste collectors – landfills and dumpsite (informal)	6,000 – 7,000	0
Waste collectors – collection from street litter and direct from households (informal)	6,000 – 7,000	0
Sorting waste pilot		20

Source(s): Jordan Government (2020e), Cambridge Econometrics.

4.6 Transport

The green activities identified in transport are: 1) public transport; 2) railway transport; and 3) electric vehicles.

The number of possible jobs in public transport are estimated using data on the number of vehicles operating in the sector. The World Bank (2022d) (2022) report 'Jordan Public Transport' reports that public transport vehicles operating in Jordan are approximately 1,400 buses, 4,000 minibuses, over 4,000 service taxis, and over 16,000 conventional taxis. We include only service (shared) taxis in the estimate of possible green jobs, not conventional taxis. We estimate jobs by assuming 1 job per service tax and 2 jobs per bus/minibus[34].

Based the interviews with GAM, the ratio of workers to 100 buses is of 320. So at least 1,920 green jobs from GAM are considered. To this are added 7,000 workers in service taxis (two workers per taxi) and 22,000 taxi drivers. Based on the transport sector indicators received from Ministry of Transport, 63,500 workers were employed in 2019 in public transport for passengers.

The number of jobs in railway transport are taken directly from Labour Force Survey Data.

Table 4.9: Estimated green jobs in transport

Economic Activity	Employment in 2021	Out of which are possible green jobs
H Transportation and storage	102,914	
H 491 Transport via railways	763	763
Public transport		30,920 – 63,500

Source(s): Cambridge Econometrics based on GAM and Ministry of Transport.

Jobs in the electric vehicle green activity requires further research. A private taxi which is electric could be considered a core green activity, and a green job. The World Bank report notes that after private car owners, Uber is the

[34] This is assuming a single bus/minibus could support two jobs if driven in alternating shifts. This may be an overestimate.

second largest use segment for electric vehicles. Postal and courier firms which use electric vehicles could also be categorised as core green activities.

Further jobs attributable to electric vehicles would be accounted in other sectors:

- Manufacture of electric vehicles - C Manufacturing (29 'Manufacture of motor vehicles, trailers, and semi-trailers')
- Sale and repair of electric vehicles – G Wholesale and retail trade; repair of motor vehicles and motorcycles (45 'Wholesale and retail trade and repair of motor vehicles and motorcycles')
- Manufacture and installation of electric vehicle charging points – C Manufacturing

4.7 Accommodation and tourism

For the green jobs assessment, the hotel and recreational services within sector I and R from ISIC Rev4 are examined. The focus is on the following green activities: green hotels; eco-lodges; eco-camping; and eco-tourism. These activities were selected based on the use of sustainable practices. Green practices include among others energy and water conservation strategies, and waste recycling and reuse.

There is not enough data available to examine the tourism activities using a process-based method, i.e., assessment of water and electricity efficiency. Thus, the definition of these activities is used to assume they are green activities. For example, green hotels are defined as hotels and other hospitality premises with a green certification, and/or relying on renewable energy power supplies, as well as adopting other green economy practices. Ecotourism aims to generate income to support protection, create nature-inspired jobs that do not exert pressure on the natural resources of the area, change attitudes towards conservation, and to help people understand and value their natural heritage."[35]

According to the Labour Force Survey, there are around 12,400 workers working in accommodation related activities. To assess if the work in this sector is decent, several questions from the LFS were used to capture the magnitude of informal employment. Table 4.10 shows that most workers have contracts where the employer is paying social contributions, so we can assume that most jobs are decent from this point of view.

Table 4.10: Share of employment in "551 Short term accommodation activities" - informality questions

Question	Share of answer "Yes"
"Is the business/establishment where [NAME] works registered with the Jordanian Tax Authority or commercial registry?"	98.1%
"Does [NAME]'s employer pay contributions on [NAME]'s behalf to Social security fund?"	92.6%
"Does [NAME]'s employer pay contributions on [NAME]'s behalf to health insurance fund?"	35.8%

Source(s): Cambridge Econometrics based on LFS 2021.

Table 4.11 summarises the number of jobs in the overall sector and the potential number of green jobs that can be found among them. Since the data on green jobs is estimated using different assumptions and there is potential

[35] https://www.rscn.org.jo/ecotourism

overlap among these green activities, the number of green jobs should be considered as indicative.

Based on stakeholder interviews, between 350 (direct beneficiaries reported) and 690 workers (assuming 23 eco-lodges) are employed at eco-lodgers and/or eco-camping within Royal Society for the Conservation of Nature (RSCN) ecotourism initiatives. According to RSCN Annual Report 2021, 226 workers are employed in the natura reserves. We assume that all of them are in decent employment.

According to GIZ (2019) report on Jordan's tourism sector[36], 18% of the tourism activities are eco-tourism. In the absence of more information, it can be assumed that also 18% of the jobs, i.e. 2,235 jobs, within the sector are eco-tourism. Eco-tourism includes also recreational activities such as canyoning, cycling, hiking trails, ziplines, giant swing, and climbing and descending, so an additional 27 jobs liked to the accommodations in eco-lodges might exits.

Table 4.11: Estimated green jobs in tourism

Economic activity	Employment in 2021	Out of which are possible green jobs
551 Short term accommodation activities (all)	12,418	
Green Hotels		2,250 - 4,500
Eco-lodges and eco-camping		350 - 690
932 Other amusement and recreation activities	149	27 - 350
Nature reserves	NA	226

Source(s): Cambridge Econometrics.

[36] Maysaa Shahateet and Kai Partale (2019) - Jordan's Tourism Sector: Analysis and Strategy for Sectoral Improvement, GIZ JORDAN EMPLOYMENT-ORIENTED MSME PROMOTION PROJECT (MSME), https://d-nb.info/1195898355/34

5 Estimation of indirect, and induced employment from green activities

5.1 Introduction

This chapter reports on the estimation of indirect, and induced green employment. This work follows Task 4 in the ILO's methodology. This work employs input-output table analysis to capture the interaction of green activities with the rest of the economy.

Data

The key data in this work is the 2018 input-output table from the Department of Statistics. The table is reported in a manner such that it is 'balanced'; that is, the gross output implied by column and row sums are equal. No 'balancing' of the input-output table was carried out in this task.

The other key data for this work is employment per unit of output. This analysis uses 2021 data, constructed based on the LFS microdata. This is used to estimate the employment multipliers.

The classification used follows that reported in the input-output table. Additional data required in calculations (e.g., employment) was converted to match this classification.

The multipliers are calculated for each sector within the input-output table classification. The multipliers are only reported for sectors in which green activities are identified.

5.2 Supply chain adjustment for green activities

The multipliers are estimated for sectors in which green activities have been identified. Where the aggregate sector is identified as green, the sector multiplier can be used without adjustment. Where there are green activities within aggregate sectors with identifiable supply chain differences, the aggregate, green, and non-green multipliers are estimated. The table below details the methodology and decision by green activity.

Table 5.1: Summary of the methodology to adjust economic multipliers

Economic Activity	Methodology
Drip irrigation technology for crops	Assume green activity consumes 25% less water per unit of economic output than aggregate sector.
Organic agriculture	Assume green activity substitutes all demand from the chemicals sector (fertiliser) to animal production (manure).
Food processing	No adjustment made to supply chain, given estimation of potential green jobs is based on certification. There is uncertainty regarding changes to production processes post-certification.
Packaging	No adjustment. As noted in Chapter 4, the stakeholder consultations revealed that almost all enterprises producing metal and cardboard packaging use recycled raw material.
Clean technology	No adjustment. Green activity is output rather than process based. Insufficient information to separate sub-sector.
Pharmaceuticals	As food processing.

Plastics	Assume that the green activity within plastics purchases 15% less from the chemicals sector per unit of economic output than the aggregate sector. This demand is substituted to the waste management sector to represent recycled feedstock.
Textiles	As food processing.
Water and waste	Sector is a single aggregate in the input-output table. Insufficient information to disaggregate.
Ecotourism	Assume green activity consumes 25% less energy per unit of economic output than aggregate sector. Also consumes 50% less water per unit.

Source: Cambridge Econometrics.

5.3 Output multipliers

The output multiplier for an industry is defined as the ratio of total increase in output across the economy to the direct output increase due to a unit increase in final demand in the industry.[37] That is, if a 1,000 unit increase in demand for construction resulted in a 2,500 unit increase in total output in the economy, the output multiplier is 2.5.

The calculation of the output multiplier is given by the column sum of the Leontief matrix, as shown in Equation 5.1. A full explanation of the calculation, including the Leontief, can be found in the ILO methodology.

Equation 5.1 Output multiplier

$$output\ multiplier_j = \sum_i L_{i,j}$$

There are two types of multiplier:

- Type I – includes direct and indirect effects.
- Type II – includes direct, indirect, and induced effects.

The Type II multiplier includes induced effects. That is, it includes the effect of output changes on household income and then expenditure. The Type II multiplier is therefore always larger than the Type I multiplier.

Table 5.2 presents the estimated Type I and Type II output multipliers for each sector.

Table 5.2: Estimated output multipliers

Economic activity	Type I	Type II
AA0 - Crop production	1.158	1.234
AA0 - Crop production – drip irrigation, green	1.155	1.230
AA0 - Crop production – organic, green	1.158	1.234
AA0 - Crop production - non-green	1.165	1.242
C1A -Manufacture Processing and preserving of meat and fish	2.143	2.243
C1B - Manufacture of other food products	1.550	1.632
C1C - Manufacture of bakery products	1.762	1.950
C1D - Manufacture of beverages and tobacco	1.477	1.570
C1E - Manufacture of wood and paper and printing	1.764	1.960

[37] https://www.gov.scot/publications/about-supply-use-input-output-tables/pages/user-guide-multipliers/

C21 - Manufacture pharmaceutical products	1.590	1.794
C22 - Manufacture of rubber and plastics products	1.371	1.490
C22 - Manufacture of rubber and plastics products - green	1.371	1.492
C22 - Manufacture of rubber and plastics products - non-green	1.370	1.490
C2A - Manufacture of basic metals and fabricated metal products	1.501	1.617
C2C - Manufacture of wearing apparel, textiles, and leather	1.330	1.495
E00 - Water supply; sewerage, waste management and remediation activities	1.662	1.941
I55 - Accommodation	1.557	1.847
I55 - Accommodation – ecotourism, green	1.540	1.827
I55 - Accommodation - non-green	1.562	1.852

Source: Cambridge Econometrics starting from DOS Input-Output table.

5.4 Employment multipliers

The employment multiplier for an industry is defined as the ratio of total change in employment across the economy to the direct employment change.[38] That is, if a 1,000 unit increase in demand for construction created 10 direct jobs, and total employment change in the economy is 15, the employment multiplier is 1.5.

The calculation of the output multiplier is given by the sum-product of the Leontief matrix and employment-output coefficients, divided by the sector employment coefficient. The employment-output coefficient ($w_{i,j}$) is equal to job per unit of output in the sector. This is shown in Equation 5.1. A full explanation of the calculation can be found in the ILO methodology.

Equation 5.2 Employment multiplier

$$employment\ multiplier_j = \frac{\sum_i w_i . L_{i,j}}{w_j}$$

Table 5.3 presents the estimated Type I and Type II employment multipliers for each sector.

Table 5.3: Estimated employment multipliers

Economic activity	Type I	Type II
AA0 - Crop production	1.109	1.205
AA0 - Crop production – drip irrigation, green	1.107	1.203
AA0 - Crop production – organic, green	1.110	1.207
AA0 - Crop production - non-green	1.112	1.211
C1A -Manufacture Processing and preserving of meat and fish	6.701	7.909
C1B - Manufacture of other food products	1.992	2.329
C1C - Manufacture of bakery products	1.508	1.855
C1D - Manufacture of beverages and tobacco	2.296	2.934
C1E - Manufacture of wood and paper and printing	2.032	2.602
C21 - Manufacture pharmaceutical products	2.549	3.932
C22 - Manufacture of rubber and plastics products	1.691	2.135
C22 - Manufacture of rubber and plastics products - green	1.699	2.147

[38] https://www.gov.scot/publications/about-supply-use-input-output-tables/pages/user-guide-multipliers/

C22 - Manufacture of rubber and plastics products - non-green	1.687	2.129
C2A - Manufacture of basic metals and fabricated metal products	1.753	2.179
C2C - Manufacture of wearing apparel, textiles, and leather	1.210	1.318
E00 - Water supply; sewerage, waste management and remediation activities	1.885	2.644
I55 - Accommodation	1.444	1.900
I55 - Accommodation – ecotourism, green	1.436	1.888
I55 - Accommodation - non-green	1.447	1.903

Source: Cambridge Econometrics starting from DOS Input-Output table.

5.5 Discussion

The estimated values of multipliers in this analysis shows that specific identification of green activities within sectors affects multipliers. The varied differences between green and non-green activities within each sector mean that in some sectors green activities return higher multipliers, whilst in others, smaller multipliers.

In cases in which the green activities achieve an efficiency in a supply chain, the multipliers for the sector will likely be lower than for the non-green part of the sector. An example is the ecotourism sector, which has lower multipliers than the aggregate (and non-green) sector, because the ecotourism supply chain reduced demand for both energy and water. Expansion of the green activity will not necessarily lead to lower economic activity, however. The efficiency saving might require capital investment to achieve, a stimulus which is not considered in the multipliers' calculation. Further, the cost savings might pass through either to higher wages (increasing the Type II multiplier) or to lower prices. This full assessment requires a more detailed methodology, as applied in the 'What-if scenarios' in Chapter 6.

The differences between multipliers for green and non-green activities may be marginal. Whilst multipliers may be similar, this can represent shifts in value created by sector. For example, whilst the Type I employment multipliers for the green and non-green activities within 'C22 - Manufacture of rubber and plastics products' are 1.699 and 1.687 respectively, the green activity creates value in the waste management sector, which is created in the chemicals sector in the non-green activity.

The employment multipliers are characterised by substantial variation, and the values should be treated with caution. There are dynamics in the data which should are not considered:

- Informal employment: The employment data may be better at capturing the informal economy. This means that the employment data may count jobs where economic activity is not recorded in the national accounts and the input-output table. This results in estimation of a lower value for 'jobs per unit of output' and 'average compensation per job'. The implication would be that employment multiplier effects may be over-estimated.
- Part-time work: The employment data counts jobs. A lower-than-expected average compensation in a given sector may reflect the fact that a share of workers is part-time. The implication is that care must be taken in interpretation of results, and clear labelling of employment effects as jobs rather than full-time equivalents.

6 What-if scenarios

6.1 Introduction

The aim of this chapter is to show how selected green initiatives can contribute to the economic growth. It is forward-looking, in the sense that it uses potential future investments in green activities, that could help Jordan to achieve its Modernization Vision 2033. Using a macroeconomic model, the future employment impact of these investments is then assessed through the simulation of 'what-if' scenarios.

Scenarios show an alternative pathway to the baseline by identifying which sectors gain or lose from investing in either the adoption of or substitution with new technology, or substitution of inputs. In this report, they are called 'What-if scenarios' because they are not forecasts of the most likely future outcomes, but simulations of what could happen if an investment in a certain promising green activity is introduced. The analysis is driven by assumptions and aimed at estimating the direct, indirect, and induced employment impact by 2030 from the chosen potential investment.

The *what-if analysis* relies on the FRAMES model. FRAMES is a single-country macroeconometric model designed to examine the socio-economic and environmental economy-wide effects of changes in investment and/or policy. FRAMES can be considered a simplified version of the global dynamic E3ME model developed by Cambridge Econometrics over several decades. The E3ME model is a global, macro-econometric model designed to address major economic and economy-environment policy challenges.; E3ME simulates a demand-led economy with supply constraints based on time series econometrics. FRAMES does not include the supply constraints that are included in E3ME. E3ME and FRAMES are *simulation* tools, well-suited for comparing a baseline (business-as-usual) projection with outcomes of alternative scenarios.

The results of the what-if scenarios are summarised in Table 6.1. There is employment growth over time in the baseline, but the aim of the scenarios is to assess whether the investment would lead to higher or lower employment compared to the business-as-usual investment and economic patterns reflected by the baseline.

Table 6.1: Summary of the what-if results (difference from baseline)

Year	Direct green jobs	Indirect and induced jobs	Investment (m JOD)
2023	13	8,374	450.9
2024	53	7,013	423.8
2025	345	6,872	422.5
2026	349	6,754	430.5
2027	392	6,720	438.7
2028	383	6,560	428.6
2029	367	931	75.8
2030	359	357	42.2

Source(s): Cambridge Econometrics.

6.2 Baseline scenario

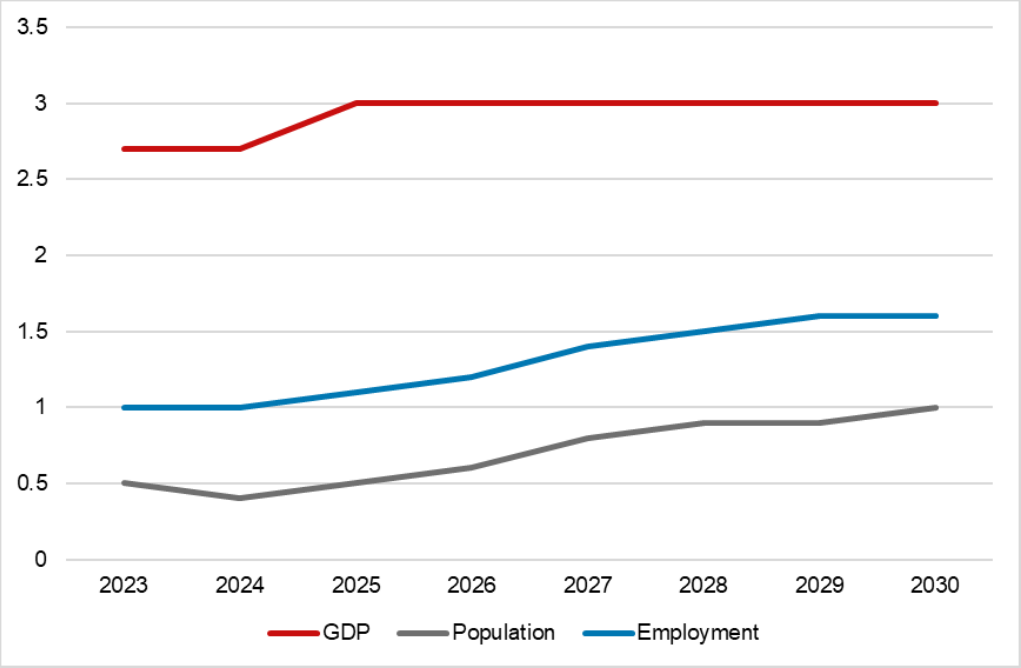
There is no publicly available employment projection for Jordan. To implement the modelling approach, a baseline projection (business-as-usual) is first

derived. The main sources for the baseline are IMF economic outlook (IMF, 2023) and UN World Population Prospects (United Nations, 2022).

The baseline projection for Jordan is summarised in Figure 6.1.

In the baseline, we assume an annual growth of the Jordanian economy of 2.7% pa to 2024 and 3% pa from 2025 to 2030, in line with the IMF's economic outlook for Jordan projections (IMF, 2023). Each sector of the economy is expected to grow in line with the allocation of GDP components growth by sector (based on past trends). Both population and employment are expected to grow by 2030.

Figure 6.1: Summary of the baseline scenario (annual growth rates %)



Source(s): Cambridge Econometrics based on different official sources.

6.3 Scenario 1: Recycled plastic

The aim of the scenario is to measure the employment impacts of an increase in plastic waste used as recycling material in manufacturing.

Context

This scenario focuses on the development of recycling for post-consumption PET plastic in Jordan. There is currently no facility for polyethylene terephthalate (PET) plastic recycling in Jordan. The 2021 report 'Feasibility Study for Establishing Polyethylene Terephthalate Recycling Facility in the Jordan Valley' states that: '*On contrary to other plastic industries, there is no local industry that are using recycled PET waste with limited exporting opportunities. As a result of this situation, the collection and recycling PET bottles business are not active and the waste bottles are sent to landfills or even not collected and left in open which is harming strongly our environment'* (Hijjawi, 2021, p. 14).

Estimates suggest that a minimum of 1,148 million bottles are wasted every year, equal to 34,500 tons of waste (Hijjawi, 2021). The development of a recycling facility would incentivise the collection of that PET waste, and could provide a local supply of polyester staple fibres (PST). Jordan imported an average of 4,800 tons of PSF in the years 2019-20, and producing PSF locally could substitute part of those imports.

The total value of pre-consumption plastic waste exported for recycling elsewhere was 1.5 million JOD in 2019 (ACTED, 2021, p. 26). Plastics is

categorised as a first order priority sector in the analysis of recycling activity in Jordan (Chemonics International, 2021).

Policy relevance

- Increased circularity of the economy.
- Reduction in plastic waste.
- Greening of the plastic products manufacturing sector.
- Increase in employment in the waste sector.

Assumptions

The assumptions made in the scenario are partly based on Hijjawi (2021). Assumptions were discussed and – where needed – updated based on experts' feedback to the preliminary results during a workshop held on 15 May in Jordan.

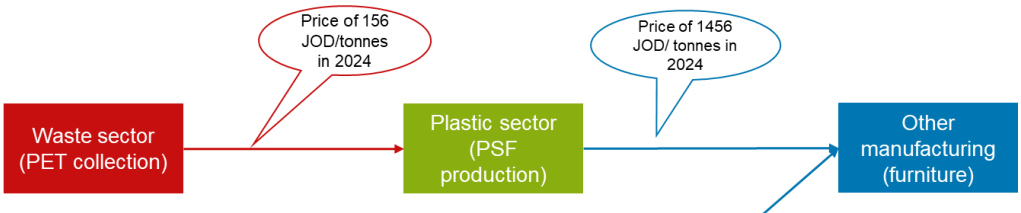
The scenario uses the following data/ assumptions:

Table 6.2: Summary of the assumptions

Assumption	Information to be used
Investment costs for the technology needed to use the recycled plastic as input.	No information is found. It is assumed that PSF from recycled PET is perfectly substitutable with current imported PSF.
Investment costs for the technology to produce PSF from PET waste	Hijjawi (2021) includes a baseline scenario based on a production capacity of 6000 tonnes of PSF by one facility. The total capital cost to build the facility is 2.5m JD.
Current level of PSF used in manufacturing.	According to Hijjawi (2021), Jordan imported an average of 4,800 tons of PSF in the years 2019-2020 (page 24).
Baseline forecast level of PSF used in manufacturing.	The baseline assumption is that domestic PSF demand is continued to be met by imports (i.e. no PET recycling and no domestic production).
Future needs of recycled plastic needed in manufacturing.	Hijjawi (2021) Table 24 provides future forecasted demand for PSF in Jordan. PSF demand is forecasted to increase from 4,800 tons in 2020 to 6.1 in 2025, and 7.8 in 2030.

Figure 6.2 summarises the logic of the scenario as it was implemented in the FRAMES model.

Figure 6.2: Recycled PET - Scenario logic



Scenario	Investment (2023)
Plastic (one plant)	2,529,560

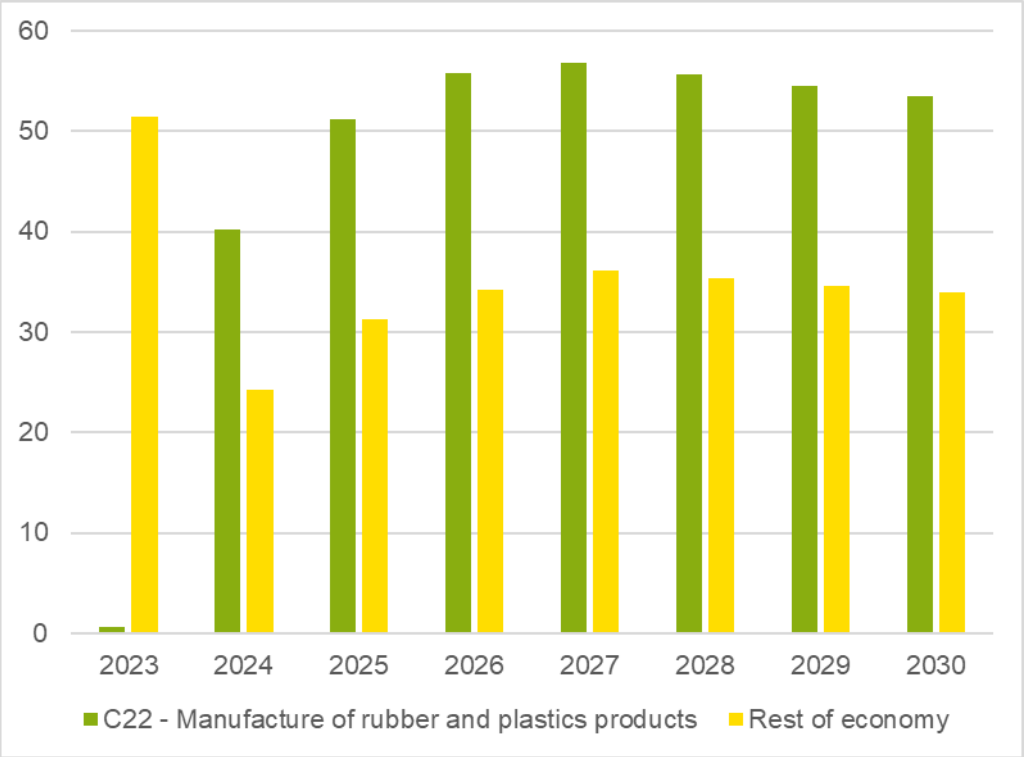
Source(s): Cambridge Econometrics.

Investment is carried out in 2023 by the plastic sector through loans, which are repaid over the period 2024-26. In the modelling, it is assumed that the new recycling facilities are able to operate competitively and substitute imports of PSF.

Results

This section presents results from FRAMES-based scenario analysis.

Figure 6.3: Additional jobs from recycled plastic (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

Figure 6.3 shows the employment impact of the investment and operations costs of implementing PET recycling by 2030. Around 54 new green jobs will be created in the plastic sector. The impact of the investment to build the facility is captured in 2023 still, while this may be unfeasible in practice. It is assumed that the facility will produce at 70% of its capacity in 2024, 90% in 2025 and 100% in 2026. The capacity of the facility will from that point be 6,000 tons of PSF production per annum.

The indirect and induced effects are observed largely in construction during the initial phase. At least 33 new jobs will be created in the rest of economy. In the operational phase (2026-30), the benefits of increased output of the plastic sector are observed in supply chain effects (such as transport, and wholesale trade).

6.4 Scenario 2: Textile recycling

The aim of the scenario is to measure the impact of an increase in the quantity of fabric waste used as input material into manufacturing.

Context

Ready-made garments (RMG) factories in the Al-Hassan Industrial Estate (HIE) produce 33.6 tonnes of waste daily, with waste being sent to the Al-Ekeider landfill (Adelphi Consulting and Senture Consulting, 2022). ACTED (2021) reports that the HIE produces 40 tons of textile waste daily, with poor waste management, including frequent illegal burning.

Policy relevance

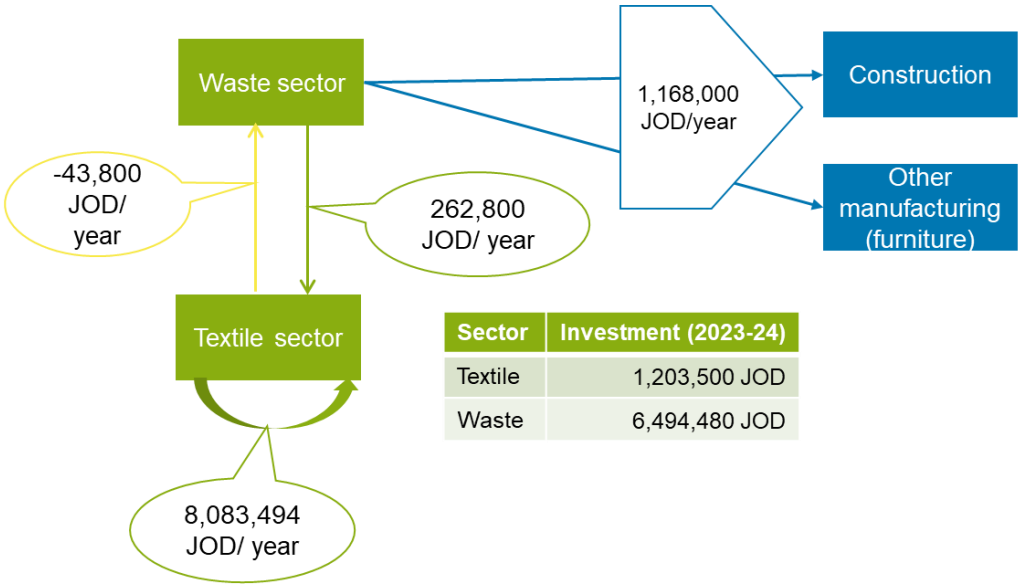
- Increased circularity of the economy.
- Reduction in textile waste.
- Greening of the textiles manufacturing sector.

Assumptions

The assumptions are based on a series of circular business cases in the ready-made garment (RMG) sector developed by the GIZ-implemented GAIN project. Two types of recycling are assumed to take place in the textile and waster sectors under this scenario: i) mechanical recycling for industry symbiosis, so 'waste to felt', ii) and mechanical recycling for fibre-to-fibre yarn production. It is assumed first that a sorting facility in the waster sector is built in 2023-24, and that from 2025, 25 tons of textile waste per day are processed into felt. The fine sorted waste is sold for felt fluff production (construction and furniture sectors), and for yarn production (textile sector).

The scenario will use the following logic and assumptions:

Figure 6.4: Textile recycling - assumptions and scenario logic



Sector	Investment (2023-24)
Textile	1,203,500 JOD
Waste	6,494,480 JOD

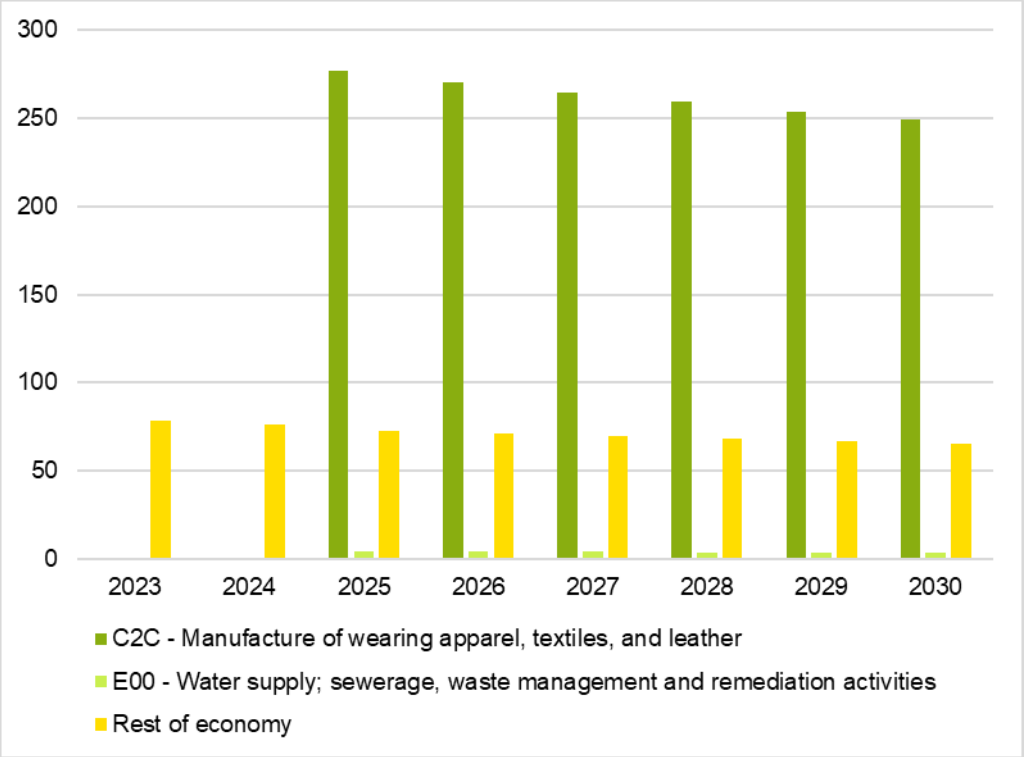
Source(s): Cambridge Econometrics based on Adelphi Consulting and Senture Consulting (2023a, 2023b)

Results

The results from FRAMES-based scenario analysis are summarised in Figure 6.5. By 2030, 249 additional green jobs could be expected in the textile sector, relative to the baseline.

The employment impact of adopting circularity in the textile sectors would also green the entire sector under the process-based method. By 2030, the modelling calculates 249 expected new jobs in the textile sector from increased recycling capacity at the scale assumed. Most of the additional jobs are driven by the production of extra output (i.e. recycled yarn) which, in turn, leads to the generation of more output by the entire textile industry (benefiting from domestic raw material).

Figure 6.5: Additional jobs from recycled textile (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

These changes in the production process will lead to changes in the demand and supply from other sectors, such as waste collection, and therefore have positive indirect and induced effects leading to even further employment gains. By 2030, 4 additional green jobs in waste sector, relative to the baseline.

Indirect effects are expected in supply chains of textile and waste sectors. By 2030, 66 new jobs in the economy. The increase in energy demand will also lead to a small increase in employment in the electricity sector. Induced effects in service sectors from increase domestic income are also accounted for.

6.5 Scenario 3: Resource efficiency in food processing

The aim of the scenario is to estimate the impact of an increase in the number of companies implementing resource efficiency measures in food-processing.

Context

High energy bills for production are one of the main challenges confronting Jordan's industrial sector. Hundaileh and Fayad (2019) notes that one of the main factors negatively affecting the competitiveness of the food sub-sectors is the cost of utilities such as energy and water.

Policy relevance

- Mainstreaming resource efficiency as an adaption tool to climate change
- Greening in food processing by implementing resource efficiency (reduction in energy, water, and material intensity).

Assumptions

The assumptions in the scenario are based on the investment and cost savings reported in several collected audits, particularly those undergone by manufacturers as part of their engagement with the GIZ-implemented GAIN project.

The scenario uses the following data and assumptions:

Figure 6.6: Summary of assumptions for the resource efficiency in food processing scenario

Assumption	Information to be used
Baseline number of companies introducing the resource efficiency measures	Resource efficiency remains the same, i.e. no new efficiency measures are introduced.
Scenario number of companies introducing the resource efficiency measures	60% of medium and large companies in the sector. By the Jordanian I-O sector classification, this includes: • 'C1A -Manufacture Processing and preserving of meat and fish' • 'C1B - Manufacture of other food products' • 'C1C - Manufacture of bakery products' • 'C1D - Manufacture of beverages and tobacco'
Investment costs for the technology adoption, across all companies	10,294,830 JOD
Cost reductions achieved across all companies from the measures	Water: 35.7% reduction in expenditure on water in 2024 (60% of companies), 2,352,899 JOD Electricity: 17.2% reduction in expenditure on electricity in 2024 (60% of companies), 2,942,311 JOD
After investment repayment, cost savings are redirected	Food sector prices are assumed to be equal across baseline and scenario. Cost savings are initially used to pay for the investment in resource efficiency. Savings are then used for expansion of the sector.[39]
Import substitution of domestic household consumption on food products.	Expansion of the sector allows reduction in imports of the food sector, with demand being met by domestic production.

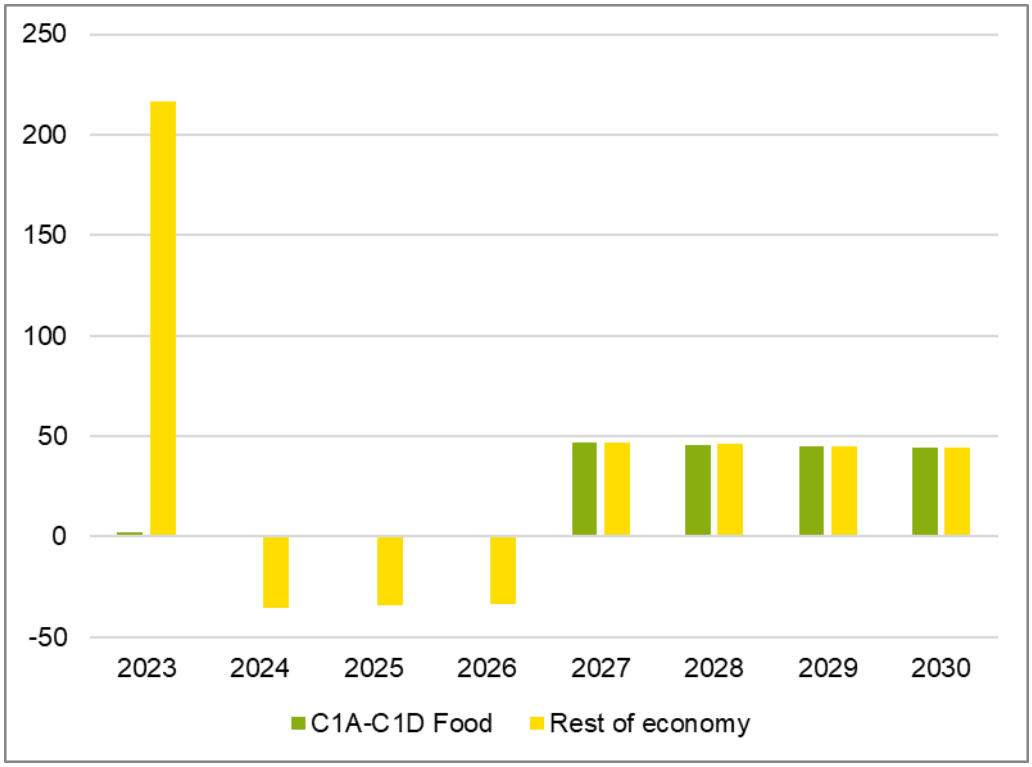
The investment is carried out by the sector with a 3 year repayment period from 2024 to 2026.

Results

The results from the FRAMES-based scenario analysis are summarised in Figure 6.7.

[39] Expansion is estimated by summing savings from reduced intermediate demand for water and electricity, and dividing by the ratio of the sum of intermediate demand and compensation of employees (excluding taxes on products) to total output.

Figure 6.7: Additional jobs from resource efficiency (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

The investment and operational costs of implementing resource efficiency measures in the food-processing sector leads to positive employment outcomes by 2030. The impact of the investment in technology is captured in the figures for 2023. A reduction in costs for electricity and water from 2024 onwards is assumed.

It is assumed that the 60% of the medium and large sized manufacturers invest to become energy and water efficient from 2024 onwards. By 2030, 44 new green jobs could be added to the sector. By introducing these efficiency measures, all the jobs in these companies (from the baseline) become green. In addition to these green jobs, 44 additional jobs could be added to the sector.

If the reduction in demand for water and electricity is not offset by demand from other sectors (e.g. electric cars), then it could lead to a small reduction in employment in those sectors (and their supply chain). Additional jobs are created in the economy and the net aggregate employment impact is 89 jobs by 2030. The strongest employment impact is in the initial year in which there is an investment demand stimulus; in 2023, aggregate employment increases by 219, with 132 more jobs in construction and 37 in manufacturing based on the modelling.

6.6 Scenario 4: Sustainable value extraction of sludge

The aim of the scenario is to measure the impact of developing value addition through economic and ecological sustainability of sludge management.

Context

According to a study conducted by Alokab Consulting in 2022, an estimated 105,000 solid tons of dried sewage sludge were produced in 2020[40], with most of this quantity dumped onsite or transported to unsanitary landfills currently. The assumptions used in this scenario are based on the market analysis and

[40] The estimation of sludge amount in 2020 was prepared by Water, Environment, and energy centre at University of Jordan, through GIZ-SSM project.

sales channels for sludge-based products (Alokab Consulting, 2023) and the expert's feedback on the preliminary results. Different scenarios for sludge utilization were assumed including 54,000 tonnes of sludge that is produced from Al-Samra WWTP to be sold as energy carrier.

Positive externalities for the environment from greening of the water sector through the reuse of sludge are not captured in the modelling of the scenarios. These are likely to outweigh the employment effects.

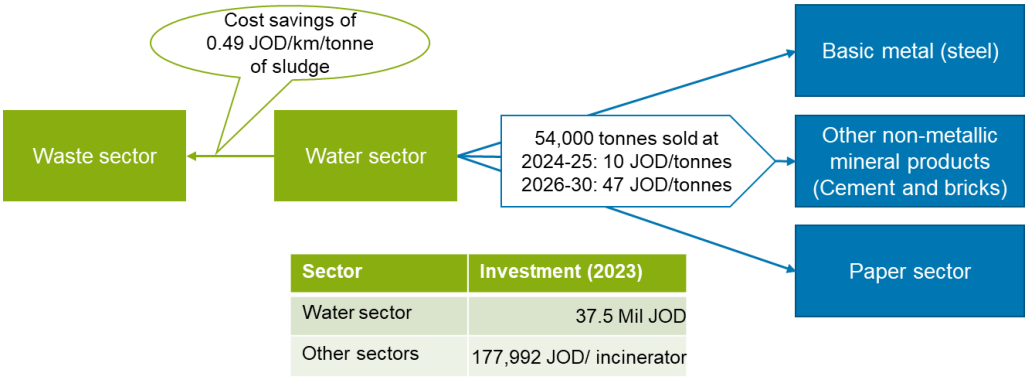
Policy relevance

- Reduction in waste
- Employment creation in water treatment plants, and manufacturing
- Utilization of alternative fuels in Industry (as per NDCs).

Assumptions

The scenario assumptions and how it was implemented in the modelling framework are described in Figure 6.8.

Figure 6.8: Sustainable sludge - assumptions and scenario logic



Sector	Investment (2023)
Water sector	37.5 Mil JOD
Other sectors	177,992 JOD/ incinerator

Source(s): Cambridge Econometrics based on Alokab Consulting (2023).

The investment in sludge management is paid for by the water treatment companies and is repaid over 20 years via an increase in water prices.

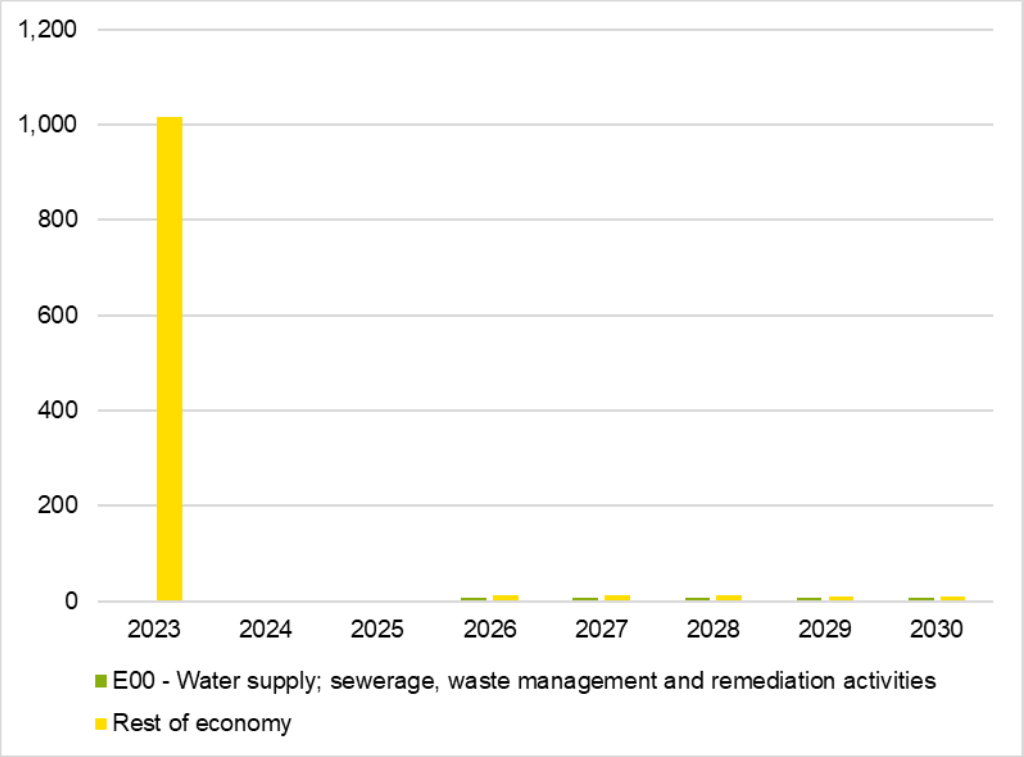
The investment in the incinerators is carried out by each of the sectors buying the incinerator and is repaid in the same year by the sector.

No adjustment is made for the demand reduction for waste management by the water sector to account for the elimination of need to dispose of the sludge.

Results

The results from the FRAMES-based scenario analysis are summarised in Figure 6.9.

Figure 6.9: Additional jobs from sustainable sludge (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

The sustainable value extraction of sludge is expected to add at least seven green jobs to the water sector by 2030 in addition to baseline employment. The greening of the water and other sectors through investment is expected to bring higher employment in the short term.

Short-term job impacts in the economy are large because of the scale of construction activity needed to build the facilities to dry the sludge. Construction will benefit from these effects. Switching from diesel to sludge also benefit eight companies from manufacture of wood and paper and printing, manufacture of other non-metallic mineral products and manufacture of basic metals and fabricated metal products.

Longer-term job impacts are lower owing to low labour requirements for operation and longer-term efforts to recoup water sector investment costs.

6.7 Scenario 5: Enhancing water efficiency

The aim of this scenario is to assess the impact of combinations of selected water supply investments and water efficiency interventions to increase the water supply.

Context

The Water Sector Green Growth National Action Plan 2021-2025 notes that extreme water scarcity is one of Jordan's greatest sustainability challenges (Jordan Government, 2020f). ACTED (2021) notes that 'as one of the most water-scarce countries in the world, water use reduction and recycling initiatives yield high potential in Jordan'.

Policy relevance

- Address increasing water scarcity
- Improve resilience to climate change
- Increase employment in water sector

Assumptions

Inputs were originally taken directly from Scenario 3 from the report 'World Bank Country Climate and Development Report (World Bank, 2022b, pp. 63–65)'. This World Bank scenario comprises four sub-scenarios resulting from a

combination of high-cost/low-cost interventions in desalination/conveyance and non-revenue water reduction. These combinations aim to resorb 200 MCM of additional water scarcity in Jordan, corresponding to a 20% reduction in water scarcity, as in the Water in Balance report.

In May 2023, the assumptions used for the modelling and the initial set of results were discussed with national experts in the field and amendments were made based on the feedback received. It was advised that the investment numbers in the World Bank scenario were insufficient. Table 6.3 presents the updated input assumptions taken from USAID(2022), EIB(2022) and Ammon News(2023). The investment values are spread evenly across the period of investment. The electricity purchases by the water sector are made annually from 2029.

Table 6.3: Inputs used in the modelling (Mil JOD difference from baseline)

Variable	Value	Year/s
Investment in water sector (CAPEX) – NRW (total)	231	2023-2029
Investment in water sector (CAPEX) – desalination (total)	1,917	2023-2028
Increase purchases of electricity by the water sector (annual)	60	2029-30

Source(s): Cambridge Econometrics based on published information.

The investment in the desalination is done by the water company. A portion of this cost is met by international aid, and the remainder is repaid over the investment period via an increase in water prices. For the NRW investment, it is assumed that USAID provides 177.5 m JOD, with the remaining 53.25 m JOD requiring funding through the water price. For the desalination investment, of the 1,917 m JOD, 852 m JOD is funded, leaving a funding gap of 1,065 m JOD. This is funded through water prices, though it is likely infeasible that water prices could be increased to the necessary degree.

Results

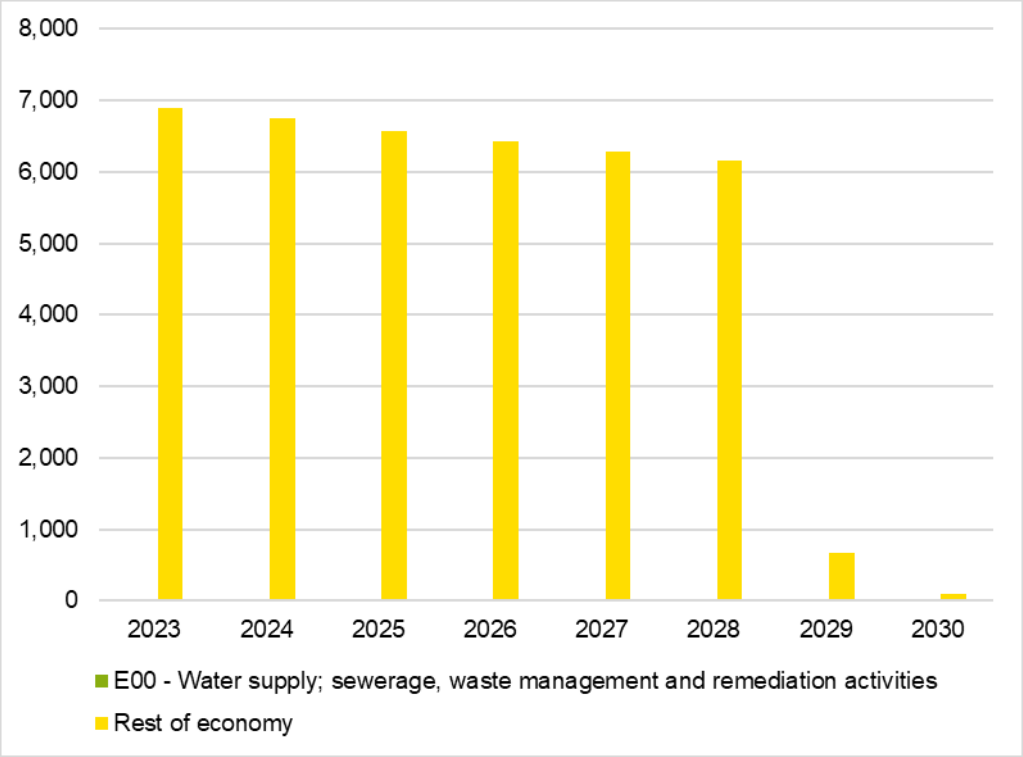
The results from the FRAMES-based scenario analysis are summarised in Figure 6.10. The number of additional direct jobs in the water sector is small, while the indirect and induced effects of the investment and lower costs are large.

The employment impact of the investment and operations expenditure required to implement the water adaptation measures is large in the short term. The water sector is investing in increased efficiency of the water infrastructure as well as the supply of water through desalinisation. The operating costs involved are linked to increased electricity consumption by the water sector.

Therefore, in the water sector, no change in direct employment is expected. The direct impacts are very small, as the modelling does not assume higher water demand from the rest of the economy, relative to the baseline. However, the investment demand is increasing the employment elsewhere in the economy, e.g. construction, mechanical engineering and logistics. The modelling results suggest that over 6,000 new jobs could be added during the construction phase (short-term) of the investments in the water sector.

The effects of higher water supply on households and the effect on the price of water are not captured.

Figure 6.10: Additional jobs from sustainable sludge (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

6.8 Scenario 6: Greening of public transport

The aim of this scenario is to measure the impact of promoting the adoption of e-mobility in the public transport sector. The level of ambition of the scenario is to replace the current fleet of internal combustion engine (ICE) buses used for public transport with e-buses so that by 2030 they represent close to 50% of the buses used for public transport (both government and privately owned).

Context

Transport represents a relatively high proportion of energy consumption within Jordan. In 2021, the sector accounted for '43% of the total energy mix' (MEMR, 2023).

An EDAMA (2023) study notes that limiting factors of EV usage in Jordan include the underdeveloped infrastructure, the lack of awareness of the impact of e-mobility on the environment, and a limited number of public charging stations on highways and inside cities.

In the Jordan Green Growth National Action Plan 2021-2025, one of the objectives is to 'implement electric vehicle charging stations and service provision in GAM through a PPP' (Jordan Government, 2020d). In 2018, the E-Charge company signed an agreement to install 10,000 electric charging stations in Jordan (Amman City, 2019).

Policy relevance

- Green transportation
- Employment creation in the maintenance and repair of EVs
- There are considerable benefits for air quality and health from reduced emissions.

Assumptions

The scenario uses the following data and assumptions:

Table 6.4:Summary of assumptions

Assumption	Information to be used
Investment in the public fleet	We assume that the fleet of buses used for public transport is gradually replaced to reach a

	47% of the fleet being electric by 2030 – see Table 6.5. The total number of public buses grows over time to keep up with projected population growth at the current ratio of 0.5 per thousand inhabitants. ICE buses are gradually retired from the fleet and replaced with E-buses. No more ICE buses are added to the fleet. The assumed cost of an EV bus is around $300,000/bus. The assumed cost of and ICE bus is around $135,000/bus. In the absence of local production capacity, it is assumed that all e-buses are imported from abroad.
Maintenance of the public fleet	We assume a maintenance cost for each bus in the fleet. E-buses require less maintenance than diesel buses, therefore total maintenance costs go down as the number of EVs in the fleet grows. The following costs are assumed: For a diesel bus: $4,760/year For an E-bus: $2,303/year
Investment in infrastructure, i.e. charging stations.	We assume that charging stations are deployed at the same rate e-buses are deployed, with 1 charging point per 2 buses. The cost with installation is assumed to be $54,284 per charging point.
Mileage and fuel consumption	It is assumed that one bus drives 48,000 km every year. This is more or less 200km, 250 days in a year. A diesel bus can drive 2.3 km/l on average. At the average mileage of 48,000 km this means 21,739 litres of diesel annually. It is assumed that an e-bus uses 288 kWh per day on average. This means 86,400 kWh annually. With diesel being more expensive than electricity, using e-buses is expected to lead to savings in spending on fuel.
Financing sources and repayment	Investments in power infrastructure and grid capacity are paid for by the power sector and passed on to consumers through a small increase in electricity prices. 26% of the investments in buses and charging infrastructure are paid for by the government through revenues from a carbon trading scheme within the power sector. This means that the government pays for its own buses (26%) and associated charging infrastructure. 74% of the investments in buses and charging infrastructure are paid for by the road transport

	sector (private owners of public buses) using 10 year loans. Savings in fuel expenditure and maintenance costs benefit the road transport sector.

Table 6.5 provides an overview of the projected number of public buses in Jordan for the period 2023 to 2030. The total number of buses grows over time as the population, and therefore the demand for public transport, grows.

To measure the impact of the electrification/greening of the fleet in the scenario, the number of e-buses is set to zero in the baseline while information suggests there may be a small number of e-buses operating in Jordan already. By 2030, close to 50% of the public buses will be e-buses in the scenario. This means that no more diesel buses can be bought from today and diesel buses reaching 15 years of operation need to be replaced by an e-bus. If not, it will be hard to come close to a 50% target for e-buses.

Table 6.5: Assumptions on fleet of buses for public transport

Scenario	Type	2023	2024	2025	2026	2027	2028	2029	2030
Total	Public buses	5,602	5,625	5,654	5,690	5,734	5,783	5,837	5,896
Baseline	Diesel buses	1,456	1,463	1,470	1,479	1,491	1,504	1,518	1,533
	Diesel minibuses	4,145	4,163	4,184	4,210	4,243	4,280	4,319	4,363
	E-buses	0	0	0	0	0	0	0	0
Scenario	Diesel buses	1,385	1,308	1,219	1,117	1,000	889	839	789
	Diesel minibuses	4,028	3,808	3,555	3,264	2,930	2,614	2,472	2,329
	E-buses	189	510	880	1,309	1,805	2,280	2,527	2,779

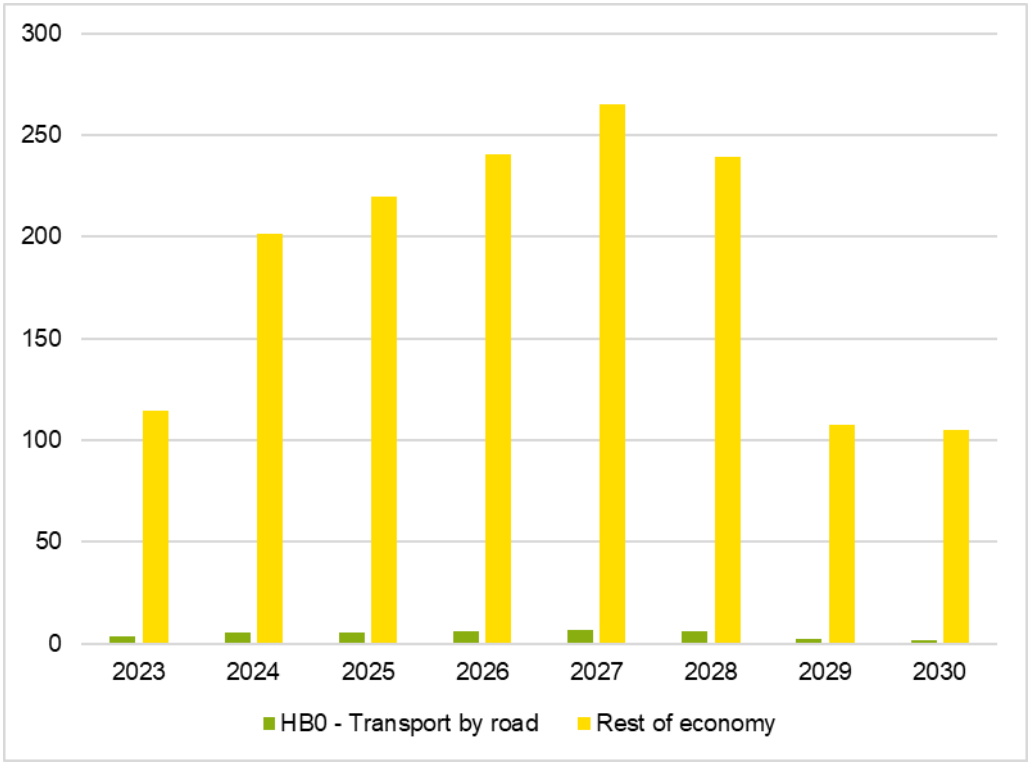
Source(s): Cambridge Econometrics.

Results

Figure 6.11 shows the employment impact from the investment and operations costs of greening the public fleet by 2030. It is assumed that a carbon trading system for the power sector is put in place in Jordan[41] and revenues from the system are used to help the government / local authorities purchase e-buses and chargers. Privately held buses and corresponding chargers are paid for by the private sector.

[41] According to the World Bank, Jordan has built digital infrastructures that include monitoring, reporting, and verification (MRV) systems that link greenhouse gas emissions and emission reduction data to national or international registries, see (World Bank, 2022a).

Figure 6.11: Additional jobs from greening the public transport (as difference from baseline)



Source(s): Cambridge Econometrics based on FRAMES-based analysis.

Data suggests that 5,400 buses (including large buses and minibuses) were in use in 2020-2021 and that only 24% are owned by the public sector (World Bank, 2022d). This suggests that there are currently 0.5 buses per thousand inhabitants available in Jordan, well below the target of 1.5 per thousand inhabitants by 2025 as stipulated in the 'Green Growth National Action Plan 2021-2025' (Jordan Government, 2020). The growth in the number of buses for our assessment is set to maintain the 0.5 ratio over time and grow in line with Jordan's population.

Greening public transport leads to more employment across the economy in net terms. The switch from diesel busses and minibuses to e-busses is expected to maintain the current level of green jobs in public transport, which was estimated to be between 30,920 and 63,500. By 2030, the additional jobs in road transport will arise mostly through supply chain effects of the investment in the charging and grid infrastructure.

The deployment of e-buses requires investment into charging infrastructure, and therefore leads to higher employment in mechanical engineering, electronics, and construction. The highest positive employment effects are observed in these sectors that benefit from the investments in charging infrastructure.

Increased demand for electricity requires investments into electricity generation and grid reinforcements, and therefore more activity and employment in this sector. However, because of the carbon trading system increasing the cost of electricity generation with fossil fuels relative to electricity generated with renewables, the price of electricity is projected to go up by a small margin, leading to small negative effects in other sectors.

On the one hand, the increase in the electricity demand also increases employment in its supply chain sectors, even if the share of RES is going to increase over time. On the other hand, the fuel switching leads to considerable

savings in spending on diesel, and cost savings overall. As crude oil is mostly imported, this also means a reduction of international dependencies.

As e-buses require less maintenance and are imported, this leads to a small negative employment effect in related sectors (repairs of motor vehicles), but these are offset by the positive effects of the investment stimulus.

All effects considered, the greening of the public bus fleet leads to more employment, not less. This is in addition to the considerable benefits for air quality and health from reduced emissions. Higher benefits would be reaped if the extra electricity demand would be met by renewable-based electricity generation.

7 Policy implications

Jordan's EMV fosters the ambition of Jordan "to be a low-carbon, resource efficient and socially inclusive nation that serves as a regional hub for green entrepreneurship and innovation" (Jordan Government, 2022). It targets the creation of one million jobs by 2033, activating eight main drivers of growth in 35 sectors, via a broad portfolio of 366 initiatives.

The results of desk research, data analysis and expert consultations in the frame of the present green jobs assessment enabled the identification of some key sectors which appear to be particularly promising in terms of a job-rich greening of the economy. In line with the EMV, the considered sectors are manufacturing (with specific attention on plastics, textiles, food processing), water and waste, transportation, as well as energy, agriculture, and eco-tourism. The above selection was reconfirmed and reconfirmed by the steering committee.

Water sector

The water sector is a strategic sector for the Jordanian economy and with a high number of green jobs. Despite a good performance in terms of wastewater reuse, there is still need and potential for improving water efficiency and quality, including the use of non-conventional water sources to compensate for the extreme water stress in the country.

In line with the government's plans for NRW reduction and the Aqaba-Amman desalination plant, the what-if scenario shows that the investment will lead to additional jobs during the construction phase (up to 2028) compared to baseline. There is a modest employment increase in the water sector, where all the employment in the water treatment plants can already be considered green.

Manufacturing sector

The manufacturing sector is the second largest in terms of output creation and employs 9% of the labour force in Jordan. The promotion of environmentally friendly practices, energy efficiency, and the use of sustainable water in manufacturing and industrial sector are among the goals of the EMV and of the Jordanian government's green growth strategy. In parallel, efforts should be invested into the availability of green skills and in fostering public awareness of climate change related issues.

Plastic sector

The main potential for green jobs based on the above modelling lies with the use of recyclable plastics. Green jobs can already be found in the companies which are using recyclable plastic as raw material. This assessment illustrates that investing in the recycling of PET to produce PSF can generate additional green jobs and economic activity. PSF production is one example - and there are other ways in which PET waste could be recycled and reused in Jordan (e.g. resins), likely with similar employment effects.

Stakeholders emphasised that a more reliable and better supply of scrap and recyclable materials would be crucial to ensure the availability of sufficient inputs to production to feed a growing recycling business. The plastics sector is looking at this with growing interest. Furthermore, with waste collection currently dominated by informal workers, these are not currently considered to be green jobs whereas they could be, if formalised. Both to support the potential that plastic waste recycling holds and grant decent (green) job opportunities for a growing share of individuals; the formalisation of waste collection would make a large contribution. To achieve this, the government could provide incentives in the form of tax exemptions and/ or attractive social protection schemes. Besides reducing the size of the informal economy, this may yield a more transparent flow of recyclables and reduced environmental pollution while generating new economic activity in the domestic economy.

Textile sector

A further promising green business for Jordan is recycled textiles. Green jobs can already be found in the RMG companies which hold an environment management certification. The current scenario analysis shows that investing in textile waste collection and recycling it into felt and then yarn would benefit both the waste and textiles sectors. In addition to creating green jobs, the production of felt and yarn will reduce the import dependency of Jordanian manufacturers.

One of the challenges relating to recycled textiles is the need to create appropriate skills. The stakeholders suggested to capitalise on existing capacity building interventions and to direct them towards the creation of green skills. Better professional profiles of green textile specialists could also result into attracting more Jordanians to work in the sector.

Food processing

Green initiatives should target resource efficiency in food processing. This will help alleviate the high cost of production (in particular, energy) and may, in line with the EMV, improve environmental compliance by food manufacturers.

The scenario analysis illustrates that by investing in resource efficiency, Jordanian food-processing manufacturers can create green jobs. The cost savings will help both the sector to expand their output, and indirectly the households which would benefit from higher local production through raised incomes.

Stakeholders suggested that, for implementing resource efficiency measures, skills are crucial and currently represent a bottleneck to greening the sector. Therefore, increasing attention should be dedicated to skills and capacity building as well as to building workers' awareness of green processes in food production.

Sludge

As a by-product of the expansion and improvements in wastewater, sustainable management of sludge is becoming a further priority, being connected with the high cost of disposal. The scenario analysis shows the additional green employment generated in the water sector from improved practices. The high investment benefits the entire economy in the short term, with additional employment being generated to build the facility to dry the sludge.

In addition to the benefits explored by the what-if scenario on using sludge for energy production in other sectors, the experts recommended its use for electricity generation in water treatment plants. Experts estimate that this would yield a reduction of electricity cost in wastewater facilities by 30%. More wastewater treatment plants adopting sustainable management of sludge should heighten the relevance and profitability of this option. Investments in R&D are a precondition for improving sludge management and should be accompanied by capacity and skills development. Better sludge management will also result in higher demand for new professional occupations, such as sludge managers and technicians and both academic and vocational training institutions should respond swiftly to support this new trend.

Public transport

Transport is one of the key sectors targeted by the EMV, aimed at fostering increased adoption of clean energy in transport and improving public transport. Current barriers are connected to the inadequacy of a reliable network of transportation for both people and goods, in particular in light of growing population and connectivity needs. Growing mobility demand in Jordan has not been met with the required development of public transport to enable passenger movement and accessibility (World Bank, 2022b), while road transport remains the only available way of transporting commodities in Jordan.

In line with the EMV's ambition for the sector, the what-if scenario postulated increased adoption of e-buses for public transport and e-charging facilities

throughout the Kingdom, resulting in significant indirect, and induced employment effects. To support this change, authorities should develop an appropriate regulatory framework including progressive plans and clear targets for the decarbonisation of mobility. Considering that, except for the Greater Amman Municipality, public transport is mostly licensed to private providers, financial incentives to compensate investment in more expensive e-buses should be designed and, in parallel, charging infrastructure should be built throughout the country. The results suggest that this holds considerable potential to add green jobs to the economy.

Agriculture

The agricultural sector is depicted as one of the strategic sectors of the EMV, also due to its link to food security, resilience, and income opportunities of rural communities, as well as to its significant water use. Water scarcity, fragmentation of land ownership, low levels of investment, low productivity, and informality of operations are all factors constraining the growth of the sector (Jordan Government, 2022).

Based on the NDCs, improving the efficiency of irrigation should be achieved by boosting adoption and building capacity for water harvesting techniques, but also by increasing acceptance among farmers of using treated wastewater, and expanding drip irrigation. The use of drip irrigation makes agricultural production greener. The current green jobs estimated in agriculture are linked to vegetable production. By extending this green process to other types of crops, Jordanian agricultural sector could increase the number of green jobs in the sector.

Energy

Despite observing encouraging improvements in the deployment of renewable energy, Jordan's energy mix is still dominated by conventional (imported) fuels. Authorities are envisioning a green transition of the sector and energy is at the core of the Jordan Energy Strategy 2020-2030 (MEMR, 2020a).

Reviewing the structure of the sector, energy efficiency improvements should guide a fully-fledged portfolio of interventions, targeting companies, as well as private individuals. Public awareness and a streamlined certification process should be regarded as a precondition for the success of this line of interventions. Green jobs are found in the part of electricity generation using renewables and in the adoption of energy efficiency technologies. The higher the share of renewables in electricity generation, the higher will be the number of green jobs in the sector.

Eco-tourism

According to the EMV, tourism is both addressed as a driver of growth within the Destination Jordan flagship initiative and within the Quality-of-Life framework. The COVID-19 pandemic had a significant negative impact on tourism and led to major job losses in the sector.

Green jobs are currently found in eco-tourism and in green hotels. The green transition of the tourism sector necessitates investment and emphasises the value of corporate social responsibility. Government incentives for getting the certification may be crucial in facilitating this change and increasing the green jobs potential of the sector. For example, initiatives directed towards awareness and tailored marketing for eco-tourism in Jordan could be implemented and, once again, skills for qualified eco-tourism operators need to be fostered. Investing in awareness and skills can also benefit the entire supply chain, with potentially important employment and income effects among typically marginalised social groups, such as farming communities and agro-pastoral workers in rural areas.

8 Conclusions

In order to green the economy, this report concludes that key sectors of the Jordanian economy, notably water and waste, energy, transport, agriculture, manufacturing and tourism, would benefit from additional capital investments in green technologies. Green investment promotion will play a pivotal role in creating and sustaining green jobs, as well as supporting a widespread transition towards a green economy in Jordan.

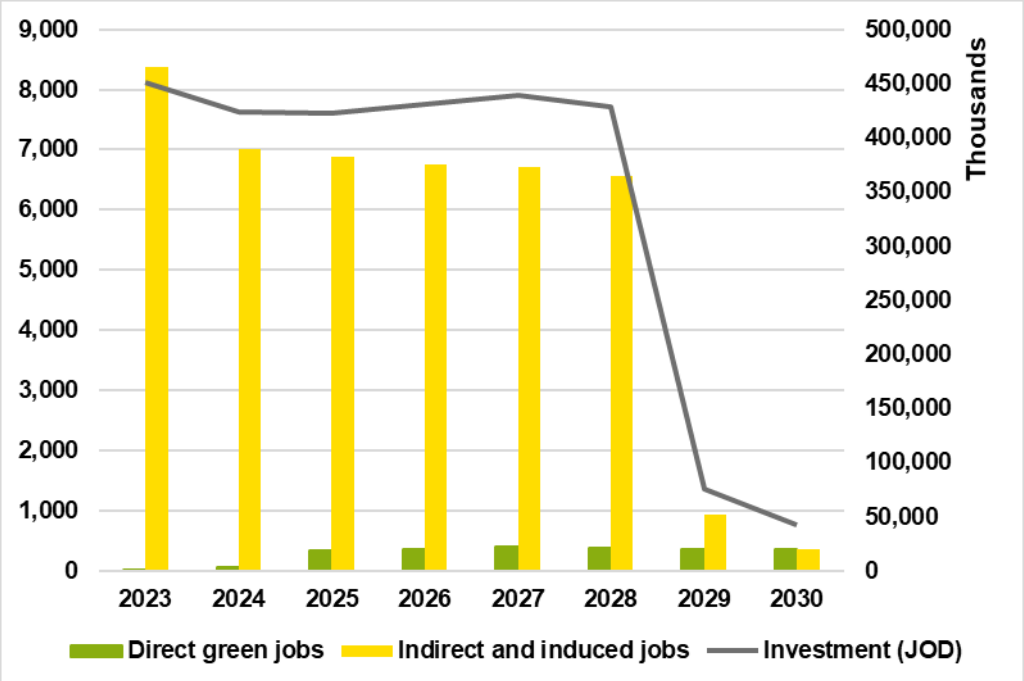
The current level of green employment in the six key sectors considered is between 74,135 and 95,060 jobs. Transport and agriculture are the sectors with the highest number of green jobs.

National strategies and individual sector green initiatives are expected to increase employment above the business-as-usual case. Six sector-level green initiatives were selected for simulation with a macroeconomic model, showing that direct investments in the green economy can indeed yield economic benefits while helping to preserve and restore the environment at the same time.

By 2030, over 350 direct green jobs could be created from investment in specific green initiatives. Additional employment (indirect and induced) in the rest of the economy during the investment/ construction phases ranges from 6,500 to 8,300 jobs. By 2030, around 350 additional indirect and induced jobs in the economy will be generated by the operational phase of the green initiatives.

Substantial investment is required to generate employment. Figure 8.1 shows that the extra capital investment in the construction phase generate high short-term indirect and induced employment in the economy. The number of green jobs is much smaller but more stable over the forecast period. Moreover, the investment does not only generate additional employment but also leads to greening of sectors, changes to the task content of jobs and overall sustainable development.

Figure 8.1: Additional direct, indirect and induced jobs, and investment (difference from baseline)



Source(s): Cambridge Econometrics what-if scenarios.

Such investments need to be supported with a robust legal framework that creates enabling conditions for green financing, technology transfer, and capacity development of human resources in addition to market-based incentive systems that encourage the private sector to generate green jobs.

This current assessment serves as a foundation for more economy-wide and sector-specific scaling up of green jobs assessments, using new data sources and more in-depth investigation. Enabling economic and social policies should be explored to create the proper conditions for green job creation, greening of current jobs and the enhancement of practical skills in the labour force in Jordan to realise the emerging potential for green jobs.

While the analysis shows that the green transition has the potential to increase net jobs, the pattern of job gains and losses suggests that careful design of an appropriate policy package (including legislative changes) will be important to manage a smooth jobs transition. For example, it would be desirable to enact energy efficiency, EV deployment and renewables take-up as a package to support stable energy and employment demand, while also pursuing effective decarbonisation. Implementing a package of policies facilitates synergies and can help ensure that jobs created in one sector absorb the jobs losses in another sector. Education and training providers will also play a crucial role in the smooth transition of workers between the sectors/roles.

The impacts of new technological trends could either support or deter green job creation, depending on the strategic approach taken by both the public and private sectors. Technology will also redefine some jobs, so re-skilling opportunities would help current workers remain in employment as skills requirements change.

The transition to a green job market is a long process that requires political commitment, wide-ranging scope of policy reforms, tools for measurement of green jobs creation and the adoption of appropriate technologies. If such commitments could be made, Jordan seems well-positioned to unlock the role of the green economy in generating employment opportunities.

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Appendix A Annex A – Detailed sectoral profiles

A.1 Sectoral profile – Agriculture

Economic structure

Economic size

The agriculture, hunting, forestry and fishing (hereafter: agriculture) sector (ISIC Rev 4 codes 01 - 03) in Jordan represented 5% of the country's GDP in 2021[42]. Between 2009 and 2021, the sector grew by 3% annually on average, which makes it the fourth fastest growing sector over the period, after the finance, electricity and water, and community and social services sectors. In 2020, the agriculture sector generated USD 2.3 bn in value added, an increase of 85% since 2013[43].

Jordan is a net importer of food products, despite a large quantity of agricultural exports by the country. Around 80% of animal fodder is imported (Jordan Government, 2020a). Agriculture accounts for 15% of total exports and 25% of imports (World Bank, 2021).

Employment

In 2020, 3% of formally employed people in Jordan worked in the agricultural sector, equivalent to 78,000 people[44]. However, as in most countries, the agriculture sector in Jordan is comprised of a substantial number of informal workers. An ILO survey among agricultural workers in Jordan carried out in 2018 finds that between 83 and 95% of surveyed workers were not enrolled in social security (ILO, 2018). This could mean that the actual number of agricultural workers in Jordan is up to 20 times as high as the number of formally employed workers. A large share of agricultural workers are migrant workers, with people previously having fled from Syria making up a significant number, a share that has been growing over recent years as a result of the war in neighbouring Syria (Mahmoud and Breisinger, 2018). Most formal workers in the agriculture sector are Jordanian natives however, as migrants and refugees typically face more barriers to formal employment.

Most people work in livestock production

In 2020, livestock production employed around 55,000, or 70%, of agricultural employment[45]. Household members represent 70% of all livestock workers, followed by permanent employees (21%), casual employees (6%) and seasonal employees (3%). In 2020, 74% of employees in livestock production were Jordanian. However, non-Jordanians are the majority of permanent employees in livestock production, while most Jordanian livestock employees are household members.

The majority of formally employed agricultural workers are skilled agricultural forestry and fishery workers (83%), followed by workers in elementary occupations (9%), and services and sales workers (5%)[46].

Nearly all agricultural workers in Jordan in 2020 are active in crop and animal production, with non-perennial crop growing (ISIC Rev 4 code 011) representing two-thirds of formal agricultural employment, followed by animal production (ISIC Rev 4 code 014) and perennial crops (ISIC Rev 4 code 012)[47].

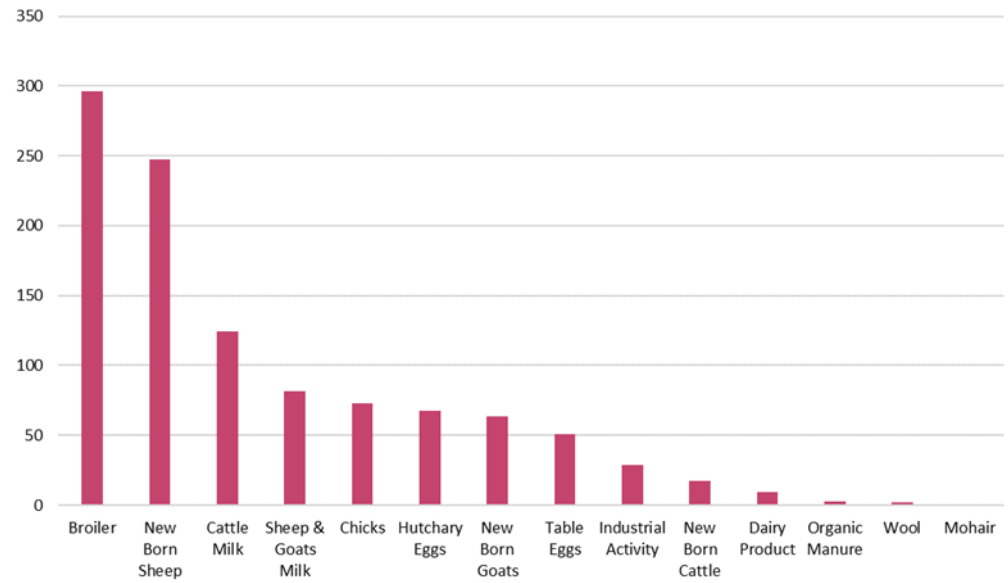
[42] http://dosweb.dos.gov.jo/databank/yearbook/YearBook_2021/National_Account.xlsx
[43] https://www.theglobaleconomy.com/Jordan/value_added_agriculture_dollars/
[44] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.
[45] http://dosweb.dos.gov.jo/agriculture/livestock/number-of-employees-in-livestock/
[46] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.
[47] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.

Only around 2%[48] of the country's land is suitable for agricultural activities, given the semi-arid climate (Department for International Development, 2019).

Production

Livestock represents around 55% of agriculture production in Jordan (Jordan Government, 2020a). Figure 9.1 shows the value of livestock production. Around half of livestock production in terms of value is broiler and sheep grazing.

Figure 9.1: Livestock production value, 2020 (million JOD)



Source(s): Department of Statistics (Livestock Production Value and Quantity).

In vegetable production, the majority of cultivated area and production is represented by tomatoes, potatoes, squash, watermelon and onions. up to 53% of the area and 61% of all production in 2021[49].

In fruits production, olives constitute 70% of the area used for fruit trees in 2021, representing 29% of production[50]. Other fruits largely cultivated in Jordan are, dates, grapes, peaches, lemons, and bananas.

In field crops, barley (75%) and wheat (17%) make up most of the area used in 2021, although clover represents most of field crop production at 54% despite only using 4% of the area used for field crops[51].

The area used for agriculture has increased between 2011 and 2014, after which the area fell up to 2019 (Table 9.1). Field crops represent most of the area, followed by fruit trees and vegetables. In terms of production, vegetables constitute a main output, followed by fruit trees and field crops.

[48] https://www.theglobaleconomy.com/Jordan/arable_land_percent/
[49] http://www.dos.gov.jo/owa-user/owa/FOCAL_AGR.agr_kk?LANG=E&dis=1
[50] http://www.dos.gov.jo/owa-user/owa/FOCAL_AGR.agr_kk?LANG=E&dis=3
[51] http://www.dos.gov.jo/owa-user/owa/FOCAL_AGR.agr_kk?LANG=E&dis=2

Table 9.1: Agricultural area and production by type

Table 1. Agricultural areas development in Jordan from 2011 to 2019 per thousand donums

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019
Field Crops	1129	1155	1278	1385.5	1314	1354.9	736.7	963.7	1071.7
Fruit Trees	850	859	836	845.3	864.2	867	780.7	784.2	796.6
Vegetables	429	423	495.4	508.7	487.7	505.5	376.9	374.4	334.1
Irrigated areas	964.5	931	1034.4	1050.5	1034.8	1065.3	1190.7	836.7	790.1
Non-irrigated Areas	1443.2	1506	1575	1689	1631.1	1662.1	703.5	1285.4	1412.3
Total	2408	2437	2609.4	2739.5	2665.9	2727.4	1894.2	2122.4	2202.4

Source: Department of Statistics (2021).

Table 2. Agricultural production development in Jordan from 2011 to 2019 per thousand tons

Item	2011	2012	2013	2014	2015	2016	2017	2018	2019
Field Crops	188	243.2	354.4	382.1	349	453.1	205.9	191.4	234.7
Fruit Trees	426.5	455.1	436.3	454.2	621.2	575.7	532.7	516.2	603.2
Vegetables	1928.3	1707.7	1845.2	1930.1	2047.4	2318.3	1737.1	1824.2	1473
Total	2,542.80	2,406.00	2,635.90	2,766.40	3,017.60	3,347.10	2,475.70	2,531.80	2,310.90

Source: Tarawneh, Radi A. 'The role of Jordanian Agricultural Policies in Climate Change Responding Affecting Agricultural Production' (2021).

Agro-processing, i.e. processes which use agriculture products, agri-waste and intermediate products for the production of transformed, new products, represents around 13% of Jordan's value-added (Mahmoud and Breisinger, 2018). The majority of agro-processing is agrifood production[52] (60%) and apparel production (29%) (Jordan Government, 2020a). Despite the agricultural sector's low share in formal employment, combined with agro-processing, the share in formal employment reaches about 14% (World Bank, 2021). Moreover, the sector generates a substantial number of jobs along the value chain, such as in processing, packaging, distribution, and transport.

Environment-economy linkages: primary, secondary

Activities in the agricultural sector have an impact on the environment in various ways. Pesticides used in growing food products may have negative environmental impacts depending on their nature, e.g. chemical pesticides vs. non-chemical pesticides. Livestock production needs land for grazing. Irrigation of crops requires substantial water use and therefore depends on the sustained availability of water resources.

Water usage

Jordan has the second-highest level of water scarcity globally and the 10th lowest rainfall levels[53]. Groundwater constitutes more than half of Jordan's water supply. Nearly 80% of Jordan's conserved water is used by the agricultural sector, despite the low contribution to national GDP and formal employment by the sector. Irrigation constitutes one-third of groundwater used in Jordan in 2021, significantly higher than groundwater usage by the industrial sector (5%), but lower than municipal use of groundwater (61%)[54].

Unsustainable water use in agricultural production is identified to be among the factors obstructing effective adaptation to water scarcity and droughts in Jordan (Hussein, 2018). Insufficient water supply for irrigation of crops, as well as reduced soil quality, and limited biodiversity can be substantial barriers to productivity in the agriculture sector.

In the context of worsening water scarcity, efficient water use and management are key in sustaining the agricultural sector in Jordan. Various sustainable agriculture initiatives in the kingdom focus on water efficiency, i.e., instead of risking water waste by planting and growing crops in arid landscapes, reservoirs are used in some places to irrigate crops and act as

[52] Agrifood production involves the processing of agricultural products into prepared food products.
[53] https://borgenproject.org/water-scarcity-in-jordan/
[54] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

fishponds at the same time[55]. Studies suggest that water use in agricultural production could be reduced by as much as 36%, by strategically shifting the mix of crops produced domestically and/or imported[56].

Water-efficient practices exist, but need further development

Wastewater recycling is growing among some rural farming communities, but progress is slow. Wastewater treatment plants in Jordan received substantial investments to transport treated wastewater for agricultural use (Jordan Government, 2020a). Around 90% of treated wastewater is reused in the agricultural sector (World Bank, 2021). Nearly half of water used for irrigation is recycled wastewater. Drip irrigation is widely used in the Jordan Valley, but other technologies are not well developed (e.g. aquaponics, hydroponics, rehabilitation of irrigation networks). As part of the government's green growth strategy, water efficient technologies in agriculture are to be increased, such as soilless systems and drip irrigation. Moreover, sustainable energy sources, such as solar photovoltaic for water pumping and agro-processing facilities, can enhance energy efficiency.

Overgrazing in livestock production causes deterioration in soil quality and capacity

As a majority of agricultural production is livestock, overgrazing is a substantial contributor to land degradation. The capacity of rangelands has decreased by up to 70% since the 1970s, with overgrazing being a main factor (Jordan Government, 2020a). Moreover, livestock production is beyond sustainable capacity of rangelands due to subsidisation of imports of other agricultural products, such as barley (World Bank, 2021). The value of electricity inputs for livestock production increased by 50% between 2013 and 2020, reaching close to JOD 7 mn[57]. Water input remained relatively stable over the same period, with a value of JOD 10.5 mn in 2020. Fuel cost for production dropped by 6% since 2013, down to JOD 26 mn in 2020.

Agriculture in Jordan produces large quantities of organic waste, such as from slaughterhouses, fruit and vegetable markets, animal manure. These can potentially be used as inputs to further the circular economy by generating biogas used for energy (Jordan Government, 2020a).

Organic farming

The number of organic farms in Jordan remained between 17 and 23 in the years 2014 to 2020, with the organically cultivated land area around 15,000 square meters[58]. The largest portion of organic farmland is used to grow olives, followed by palm. Other agriculture output grown on organic areas include citrus, vegetables, almonds, and grapes[59].

Jordanian agriculture production, in particular potato harvest, is impacted negatively by extreme weather events, rising temperatures, declining precipitation, and depends on high quality of environment (World Bank, 2021). Conversely, water and soil quality and biodiversity are impacted by agriculture in Jordan, for example via the use of inorganic fertilisers, which harm biodiversity and cause pollution.

Under its Nationally Determined Contribution, Jordan set out targets relating to land use in 2017, which include the improvement of the agricultural sector's contribution to climate adaptation, among others, through addressing water scarcity and crop vulnerability. Moreover, the targets included afforestation of 25% of barren forest areas in the rain-belt areas (Department for International Development, 2019).

[55] https://www.globalgiving.org/pfil/1360/projdoc.pdf
[56] https://jordantimes.com/news/local/jordan-can-reduce-agricultural-water-use-third-research-finds
[57] http://dosweb.dos.gov.jo/agriculture/livestock/value-of-physical-inputs-used/
[58] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__State_Quality__EarthCover__EarthCover/agri2.px/
[59] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__State_Quality__EarthCover__EarthCover/agri3.px/

Greenhouse gas emissions

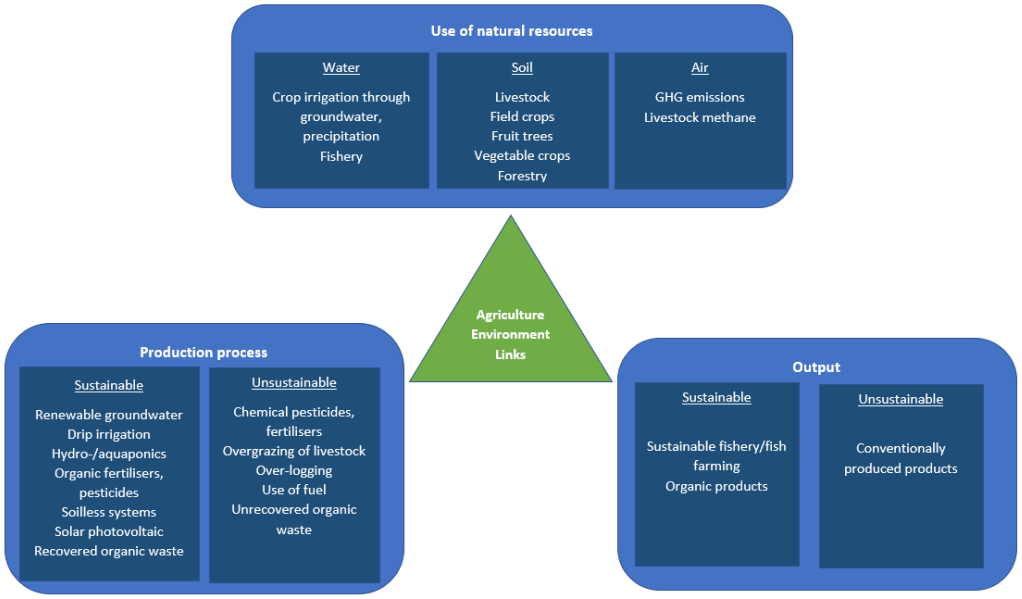
The Jordanian agriculture sector contributed 5% to total emissions in Jordan in 2014, with an additional 3% attributed to land use and forestry[60]. Agricultural sources leading to greenhouse gas emissions are primarily enteric fermentation, manure left in pasture, nitrous emission from soils, as well as indirectly attributable emissions resulting along value chains (World Bank, 2021).

The World Bank (2021) identified and proposed investment packages with various so-called Climate-Smart Agriculture (CSA) practices which would be relevant for the Jordanian agriculture sector to achieve further progress towards sustainable agriculture practices. These include, rainwater harvesting, hydroponic and aeroponic practices, local feed production and cold storage powered by renewable energy, reforesting by planting trees and shrubs, increasing irrigation water productivity by shifting to high-value cash crops and applying precision agriculture. Investments in CSA in Jordan would boost growth and support high-end jobs, although requirements for implementation in Jordan might still be lacking.

Summary of linkages

Figure 9.2 shows an overview of the linkages between agricultural activities and the environment in Jordan.

Figure 9.2: Agricultural activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems: environment, climate, social

Environment

Water scarcity due to limited natural water sources poses a major challenge for the Jordanian agricultural sector, for which most of the country's water resources are used. Consequently, furthering water-efficient practices, such as broader usage of treated wastewater at industrial and household level is of primary concern. The government faces difficulties in convincing farmers to use recycled wastewater, with farmers' reservations posing obstacles in the adoption process.

Climate

Climate change is reducing the amount of precipitation and, in effect, the quantity of water resources available for crop irrigation in agriculture. More frequent droughts and extreme weather events is harming crop yields. The

60 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Contaminants__Air_emission/Air_01.px/

lack of comprehensive drought monitoring and early warning systems limit Jordan's ability for adaptation and food security (ACT Alliance, 2018).

Social

Sustainable land use for agriculture activities in Jordan is hampered by land fragmentation, where farmers own discrete pieces of land dispersed over a large area. Inefficient land-use planning systems, as well as uncertainty on land tenure policies exacerbate the issue of land fragmentation in Jordan (Jordan Government, 2020a). A result is increased complexity in agricultural development planning and limited possibilities for economies of scale, which leads to inefficient use of natural resources, such as soil.

Farmers in Jordan tend to invest in cheap labour and face high input costs for seeds and fertilisers. They often lack access to resource efficient technology, hampering their ability for economies of scale and profit stability.

As agricultural activities are often interlinked with forest areas, the enforcement of logging and grazing control poses difficulties for authorities in Jordan.

Other issues are: continuous urban expansion at the expense of agricultural land and declining arable land, non-sustainable use of environmental resources, and decline in underground water stocks.

Subset of core green activities or selected environmental-related and socially sustainable activity

Based on the analysis of sectoral activities in Jordanian agriculture and their links with the environment, Table 9.2 presents a set of activities which can be described as 'green' activities. These activities are either sustainable in their production processes (e.g. more efficient in their use of natural resources), produce green outputs, or result in outcomes which support social sustainability.

Table 9.2: 'Green' activities in the Jordanian agriculture sector

Activity	Description	Environmental impact	Extent	Jobs	Potential mapping to detailed ISIC Rev 4
Adoption of drip irrigation technology for crops	Adopting a system to allow water to drip slowly to plant roots	Water efficiency	91-96% of irrigated land for vegetable cultivation[61]		Growing of non-perennial crops (011) Growing of perennial crops (012) Irrigation projects (operating irrigation systems for agricultural projects) (016103) Manufacture and assembly of machines and equipment of pivotal irrigation devices (282115)
Hydro-/aquaponics	Soilless agriculture technology	Water efficiency, soil efficiency			Growing vegetable in green houses (011306) Aquaculture for production of vegetable (011308) Installation of greenhouses (016105)

[61] http://dosweb.dos.gov.jo/DataBank/Agri/Agr_2019.pdf

Organic fertiliser/ pesticides	Naturally produced (e.g. compost manure)	Circularity/resource efficiency, Reduced impact on soil, water, air	24 organic farms, 15,000 m^2 (62)	Activities of companies that certify organic products (016105) Manufacture of basic organic chemicals, includes Astelin except azotic fertilizers and compounds (nitrogen) (201110) Production of compost from organic waste (382104) Growing of non-perennial crops (011) Growing of perennial crops (012)

Source(s): Cambridge Econometrics.

Drip irrigation of crops is potentially very water-/ and energy-efficient, in particular well-designed and managed systems in the open field (Shatanawi *et al.*, 2005) (Gonzalez, 2018). Compared to surface water irrigation and irrigation with sprinklers, drip irrigation systems result in low losses (Al-Omari *et al.*, 2015). In Jordan, drip irrigation is widely used among farmers, with 91-96% of the irrigated area used for cultivation of vegetables using this method in 2019[63]. In the case of field crops, the adoption of water-efficient irrigation practices is lagging behind (Gonzalez, 2018). A survey among Jordanian farmers finds that the share of farmers facing major water scarcity problems is lowest for those applying the drip irrigation method compared to farmers using surface irrigation or localised tubes (Van den Berg and Al Nimer, 2016).

Hydroponics is the cultivation of plants in water without soil, while aquaponics combines this method with the production of fish in the same water. As such, hydro-/ and aquaponics can bring substantial efficiency gains in the water-scarce country. One greenhouse using hydroponics technology grows tomato plants with 40-50% less water input compared to traditional cultivation methods[64].There remains significant potential to upscale the use of such technologies in Jordan, as the practice is still rather uncommon, in particular on a larger scale (Jordan Government, 2020a). Challenges in increasing adoption in Jordan are the investment needed and knowledge development. Moreover, more generally, hydroponics systems are highly energy-dependent and require constant supervision due to faster spread of diseases[65]. Initiatives focused on installing greenhouses and skills training exist[66].

Organic farming involves fertilisers or organic origin like compost manure, while synthetic substance use for farming purposes is limited or non-existent. The re-use of organic waste from agriculture for processing into organic fertilisers reduces generation of waste and alleviates pressure on biodiversity stemming from the use of chemical products, which pollute water sources. This is particularly relevant for Jordan, given its severe water situation. Barriers to the adoption of organic farming in Jordan include elevated costs of

62 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__State_Quality__EarthCover__EarthCover/agri2.px/

63 http://dosweb.dos.gov.jo/DataBank/Agri/Agr_2019.pdf

64 https://www.al-monitor.com/originals/2019/06/jordan-hydroponic-agriculture-water-scarcity.html

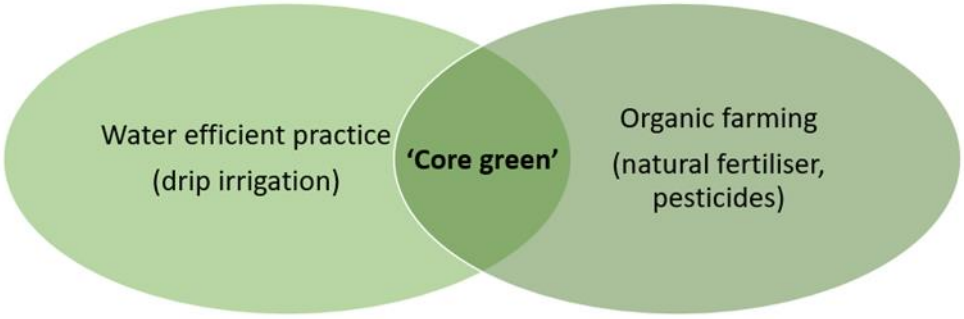
65 https://www.accesstoaquaponics.com/hydroponics-benefits-challenges/#:~:text=Challenges%201%20Capital%20Intensive.%20Hydroponic%20gardening%20requires%20high,Energy%20Dependent.%20...%204%20Faster%20Disease%20Spread.%20

66 https://www.lutheranworld.org/news/jordan-saving-water-while-improving-food-security

production as well as a lack of independent assessment of organic farming produce (Eneizan, 2017).

The classification of 'core green' activities goes beyond the adoption of a 'green' activity in a production process, but also looks at other practices used along the production, as well as the output from the production. Figure 9.3 provides an example of this, looking at 'green' farming practices. While drip irrigation is widely used among Jordanian farmers, this alone would not classify them as 'core green', because they might still be using chemical pesticides. Organic farmers using water efficient irrigation technology can be described as working in 'core green' activities.

Figure 9.3: Illustration of 'core green' activity classification as a combination of 'green' activities in production process



Source(s): Cambridge Econometrics.

Reforms and investment: policies, R&D technology

In 2020, the Jordanian government, in their Agriculture Sector Green Growth Action Plan 2021-2025 (Jordan Government, 2020a), identifies 14 priority actions to achieve green growth in agriculture with an estimated cost of USD 193.9 million. These activities, which vary in length of implementation and costs, include, amongst others, the following actions:

Action	Period	Investment	Goal/target
Different projects and policy recommendations to increase use of **aqua and hydroponics** in urban and rural areas	2021-23	USD 15 mn	Increase irrigation efficiency; 30,000 m^2 of greenhouses; reduce water usage by 50-80%
Promote **organic agriculture** through knowledge exchange and market development	2021-23	USD 1.7 mn	Increase number of certified organic farmers
National **Afforestation** program	2021-25+	USD 40 mn	Ten million trees planted
Develop a flexible **crop planning** and variety selection methodology and decision-making process based on crop-per-drop and economic competitiveness	2022-25	USD 7.5 mn	Increase crop-per-drop efficiency for water
Upgrade **packaging, scaling, storage, and cooling** of fruits and vegetables	2021-23	USD 12.2 mn	Construction of six packaging and gradation units in the Jordan Valley and highlands

Support **rural green growth and employment** through **ecosystems restoration**	2021-24	USD 6 mn
Mainstream **green growth into the provision of agriculture extension services** and explore options to improve their long-term sustainability	2021-24	USD 5 mn

Source(s): Jordan Green Growth National Action Plans 2021-2025: Agriculture sector[67]

Next to these planned actions, the World Bank, in September 2022, approved a USD 125 million program in support of Jordan's agriculture sector. The loan aims to enhance the sector's climate resilience, increase inclusion and competitiveness, and ensure food security. Specifically, between 2022 and 2027 it will provide "30,000 farming households with financing to adopt **climate-smart and water-efficient agriculture practices**, provide needs-based training, and generate about 12,000 employment opportunities, focusing on Jordanian women and youth"[68].

Barriers to green adoption

Various general challenges to green adoption are hindering quicker progress in this area in Jordan. These include the lack of a long-term national strategy for climate change, which addresses financing needs for projects of larger scale. Moreover, national strategies are not yet mainstreamed in relevant sectoral and sub-sectoral policies. Regulations, in particular in the legal framework for public-private partnerships, would benefit from improved clarity and consistency as well as by increased incentivisation of the adoption and use of new technologies. Overall, green growth interests, given the novelty of the topics involved, remain to be integrated in Jordan's institutional framework.

Green adoption in Jordan would be accelerated with the implementation of green-skills capacity building activities, which are needed to develop environmental frameworks within relevant institutions. The development of effective and impactful projects addressing climate challenges would also be facilitate. Furthermore, public awareness relating to climate change and environmental challenges could be enhanced, in order to curb unsustainable consumption choices.

Relating to the agriculture sector in particular, "unplanned urbanisation and inefficient land-use planning resulted in high levels of urban sprawl into protected areas and agricultural land plots and green spaces" (Jordan Green Growth Strategy). Another challenge is to overcome the reservations of farmers to use treated wastewater in irrigation, a crucial barrier to overcome in enhancing water efficient practices in the sector.

A.2 Sectoral profile - Manufacturing

Economic structure

GDP

The manufacturing sector (ISIC Rev 4 codes 10 – 33) is the second largest sector in Jordan, representing 17% of GDP in 2021[69]. Average growth between 2009 and 2021 was 1.4%, among the sectors with the slowest growth. Gross output of the sector in 2019 was 13.1 billion JOD, down by 8% since 2015[70]. Manufacturing gross value added (GVA) amounted to 4.2 billion

[67] Jordan Green Growth National Action Plans 2021-2025: Agriculture sector — Global Green Growth Institute (gggi.org)
[68] https://www.worldbank.org/en/news/press-release/2022/10/11/us-125-million-to-support-jordan-s-agriculture-sector-and-improve-its-climate-resilience
[69] http://dosweb.dos.gov.jo/databank/yearbook/YearBook_2021/National_Account.xlsx
[70] http://dosweb.dos.gov.jo/databank/yearbook/YearBook_2020.pdf

JODs, a decline of 21% over the same period[71]. Compared to GVA in the agriculture sector, manufacturing GVA is nearly twice as large.

Employment

In 2020, 9% of total formally employed people in Jordan work in the manufacturing sector, equivalent to 215,000 people[72]. The extent of informal employment in the sector is lower than in the agriculture and construction sectors but could still be as high as 48% of estimated workers (WANA Institute, 2019), equivalent to 192,000. This implies that total employment – formal and informal – in the sector could be estimated above 400,000 people.

The most prevalent broad occupations in the sector are craft and trades-related workers, plant and machine operators and assemblers, professionals and elementary occupations[73].

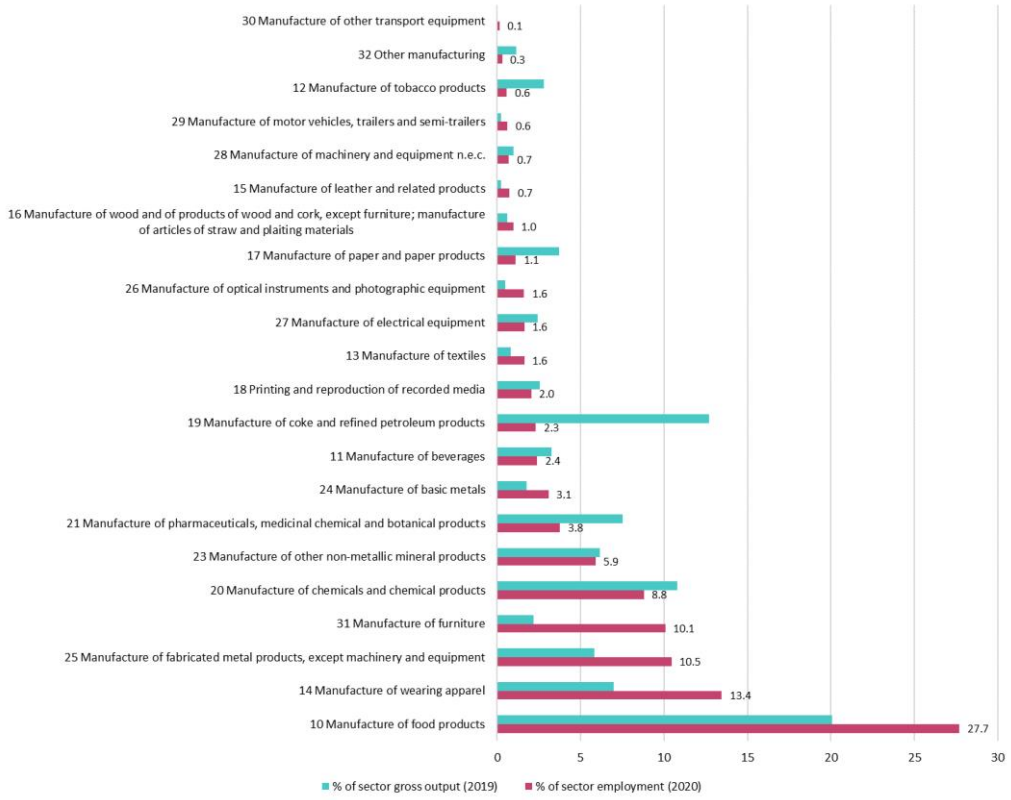
Sub-sectoral activity

Figure 9.4 shows employment and gross output of sub-sectors within the manufacturing sector. The five largest sub-sectors in terms of share of sectoral employment make up 71% of employment in manufacturing and are: (ISIC 2-digit: 10) manufacture of food products (28%), (ISIC 2-digit: 14) manufacture of wearing apparel (13%), (ISIC 2-digit: 25) manufacture of fabricated metal products (11%), (ISIC 2-digit: 31) manufacture of furniture (10%), and (ISIC 2-digit: 20) manufacture of chemical products (9%). However, in terms of their share in the sector's gross output, the picture looks slightly different. While food products represent also the largest sub-sector in terms of gross output (20%), other large sub-sectors are: (ISIC 2-digit: 19) manufacture of coke and refined petroleum products (13%), manufacture of chemical products (11%), (ISIC 2-digit: 21) pharmaceuticals (8%), and manufacture of wearing apparel (7%).

Some sub-sectors exhibit a relatively substantial discrepancy between their share in sectoral employment and gross output. Manufacture of coke and petroleum products represents merely 2% of manufacturing employment, while accounting for a tenth of gross output. The opposite situation can be observed in manufacture of furniture. Although manufacture of food products is the largest sub-sector when considering either indicator, the employment share is significantly larger than gross output in the sector.

[71] Own calculations based on gross output and intermediate consumption from: https://jorinfo.dos.gov.jo/Databank/pxweb/en/DOS_Database/START__10__1001__1101/FIN_T1/
[72] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.
[73] These occupations make up 47%, 14%, 13% and 11% of ISCO 1-digit occupations in the manufacturing sector, as analysed from DoS LFS microdata for 2020

Figure 9.4: Employment and output within manufacturing by ISIC 2-digit sectors (% of sector)



Source(s): Department of Statistics LSF microdata. Department of Statistics Jordan Statistical Yearbook 2020.

Environment-economy linkages: primary, secondary

Various linkages between manufacturing sector activity and the environment exist in Jordan. With chemical products and textiles being key outputs of the sector, the link to environmental outcomes is likely larger than that of other sectors, such as agriculture or tourism, as conventional production processes for such products can typically be detrimental on the environment. On the other hand, recycled manufacturing activities have potential for furthering the circular economy.

Energy usage

The industrial sector[74] in Jordan accounts for 17% of total primary **energy usage** in 2019. Primary energy usage has grown by 46% since 2010[75]. Compared to household consumption and usage in transportation, the industrial sector consumes less primary energy and its growth of usage is slower. Electrical energy usage of the industrial sector represents 19% of total consumption in Jordan in 2020. Consumption has increased by only 7% since 2010, compared to a 44% increase of total consumption in Jordan (mostly driven by increased household consumption)[76].

[74] Figures are for the industrial sector, which typically includes manufacturing, utilities and construction. In terms of employment and output, the manufacturing sector represents most of the industrial sector in Jordan.

[75] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Energy%20Resources__Production%20and%20consumption%20of%20energy/

[76] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Energy%20Resources__Production%20and%20consumption%20of%20energy/

Use of natural resources

Water usage in the industrial sector has fallen by 30% between 2010 and 2020[77], as did the generation of waste water[78]. The share of **renewable groundwater** used in the industrial sector is at around 80% and has remained stable around this level over the past years[79]. Industrial processes contributed around 9% to total emissions in 2014 in Jordan[80]. Plastic waste generation from industrial activities has remained stable between 2012 and 2020, while the amount of plastic waste recycled during this period has tripled (i.e. increased by 373%[81]).

The value of **raw materials** used as intermediate consumption in manufacturing fell by 5% between 2011 and 2019[82]. Food products manufacturing represents nearly one-fifth of raw material consumption by the manufacturing sector, followed by coke and refined petroleum product manufacturing (19%) and chemicals production (8%). In terms of raw materials extracted from natural resource stocks, Jordan's primary output is phosphate. Manufacturing inputs from fossil fuels, such as crude oil, are mostly imported.

The manufacture of **food products** industry is the largest sub-sector within manufacturing. Companies within this sector in Jordan are responsible for a large portion of waste water generation and concrete action for recycling waste water is lacking. A shortage of clean water could pose a substantial challenge for the food products sector (GIZ, 2019a).

The **chemical** industry in Jordan also constitutes a large portion of the sector's employment and gross output. The main sub-activities within the chemical industry are oil refining products, inorganic chemicals, organic chemicals, and fertilisers (GIZ, 2019d). Organic chemical production accounts for a much smaller share than inorganic chemicals, with 1% of chemical exports in 2018 being of organic nature (GIZ, 2019d). Inorganic chemical materials contribute around half of the chemical industry's total capacity, whereas value added of production is usually low, with products typically constituting basic inputs in global manufacturing value chains.

Jordan's **garment** manufacturing sector is a large part of the industrial sector and has grown considerably since 2000, with Jordan being among the United States' top 20 suppliers. Fabric waste represents 4.3% of solid waste generation in Jordan (GIZ, 2021).

As regards to the **pharmaceutical** industry, which accounts for 8% of gross output of manufacturing, increasing electricity and water costs pose a bottleneck (GIZ, 2019c). No data is available on the electricity and water consumption by the pharmaceutical industry.

Recycling in manufacturing

The manufacturing sector plays a role in furthering progress towards **circular economic practices** via recycling of materials such as ferrous metals (iron and steel), plastics and (to a smaller extent) cardboard (Hamdan, 2021). In the capital Amman and Zarqa, there are between five to eight metal recycling industries, such as aluminium smelters and steel mills. At national level,

[77] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Contaminants__Wastewater__Discharge%20_%20Waste/

[78] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Contaminants__Wastewater__Discharge%20_%20Waste/

[79] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

[80] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Contaminants__Air_emission/Air_01.px/table/tableViewLayout2/

[81] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Contaminants__Generation%20of%20Waste__Waste%20generation/

[82] https://jorinfo.dos.gov.jo/Databank/pxweb/en/DOS_Database/START__10__1001__1101/ECO_T10/

around 600 plastic industries and manufacturers apply recycling technologies to produce various products such as water tanks, chairs, buckets, packaging for food, textiles, and bags. These manufacturers also play an important role in providing input materials to other industry sectors in Jordan. Manufacturing firms recover and process between 4,000 and 6,000 tons of nearly all types of plastic waste each month to produce new recycled plastics products. PET recycling is currently not existent in Jordan.

Plastics recycling is fairly well-developed

The Jordanian's **plastics industry** is relatively large, which results in pollution, but also offers opportunities for enhancing marketability of recycling practices. According to a survey among Jordanian plastic product manufacturers, more than half use a mix of virgin and recycled materials (excluding PET) for production inputs (GIZ, 2021). However, 45% of the sample only use virgin raw materials in their production process, with most virgin material inputs (80%) are imported from abroad. Oil price volatility impacts the decision to opt for virgin plastic raw materials or recycled alternatives. Generally, recycled plastics become relatively more affordable when oil prices are relatively high.

Clean tech manufacturing

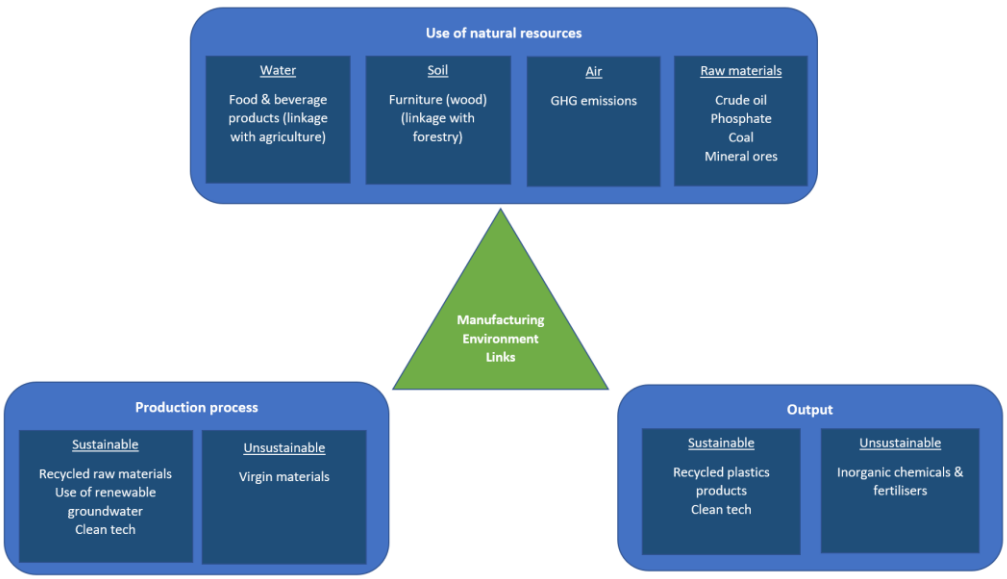
Clean technology, which applies processes, products or services that mitigate environmental impacts by enhancing energy efficiency and sustainable use of resources, has been gaining traction in Jordan in recent years (EDAMA, 2017). An estimated 13,000 employees work in Jordan's clean tech sector, 6% of which are in manufacturing. Over a tenth of clean tech sector's revenues and just over 1% of clean tech investments are attributed to manufacturing. Most clean tech manufacturing in Jordan is found in the following activities: maintenance of equipment, tools, facilities specialised in energy efficiency and renewable energy production; manufacture of other electrical equipment specialised for energy efficiency or renewable energy production; and manufacture of electric motors, generators, transformers and electricity distribution and control apparatus specialised for energy efficiency and renewable energy production.

The Jordanian government's green growth plan as part of its Vision and Strategic Roadmap 2022-2033 identifies the promotion of eco-friendly practices, energy efficiency and usage of sustainable water in the manufacturing sector. The document calls for scaling up resource efficiency in the sector through measures to reduce manufacturing firms' consumption of water, energy and raw materials as well as reduce GHG emissions.

Summary of linkages

Figure 9.5 shows an overview of the linkages between manufacturing activities and the environment in Jordan.

Figure 9.5: Manufacturing activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems: environment, climate, social

Climate, environment

The Jordanian government's Strategic Vision 2033 identifies high energy costs as a major challenge for the manufacturing sector in Jordan, suggesting consequently to focus more on products with low energy intensity. The document further finds the manufacturing sector's high carbon footprint and a limited access to green financing to be challenges to greening the sector.

Regulatory, social

Challenges to growth in the recycled manufacturing sector include lacking regulations and quality standards and large portions of the recycling value chain being driven by informal and unregulated transactions (Hamdan, 2021). Higher energy costs of recycling processes compared to production using virgin raw materials presents an obstacle for manufacturing firms to increase the quantity of recycled inputs.

Incorporation of waste into manufacturing firms' production is inhibited by gaps in energy, water and technology (GIZ, 2021). A further challenge to profitability of recycled manufacturing stems from preferences of consumers who tend to assume higher product quality from virgin than from recycled products. Similarly, a large share of plastics companies consider plastics recycles to be of low quality and that final product quality is lower when recycles are used in production.

Subset of core green activities or selected environmental-related and socially sustainable activity

Based on the analysis of sectoral activities in the Jordanian manufacturing sector and their links with the environment, Table 9.3 presents a set of activities which can be described as 'green' activities. These activities are either sustainable in their production processes (e.g. more efficient in their use of natural resources), produce green outputs, or result in outcomes which support social sustainability.

Table 9.3: 'Green' activities in the Jordanian manufacturing sector

Activity	Description	Environmental impact	Extent	Jobs	Corresponding ISIC Rev 4 sector
Recycled plastic products	Recovered raw material production inputs instead of virgin materials	Circular economy/ resource efficiency			Manufacture of plastics products (222)
Clean tech manufacturing	Process/product aimed at enhancing energy/resource efficiency	Energy- & resource efficiency		~ 800 employees	Manufacture of auxiliary plant for use with steam generators for purposes of energy efficiency or renewable energy production (251301) Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus specialised for energy efficiency or renewable energy production (271001) Manufacture of clean-tech rechargeable batteries for energy storage (272001)

Manufacture of household appliances specialised for energy saving (275001)
Manufacture of other electrical equipment specialised for energy efficiency or renewable energy production (279001)
Maintenance of equipment, tools, facilities specialised in energy efficiency and renewable energy production (331901)

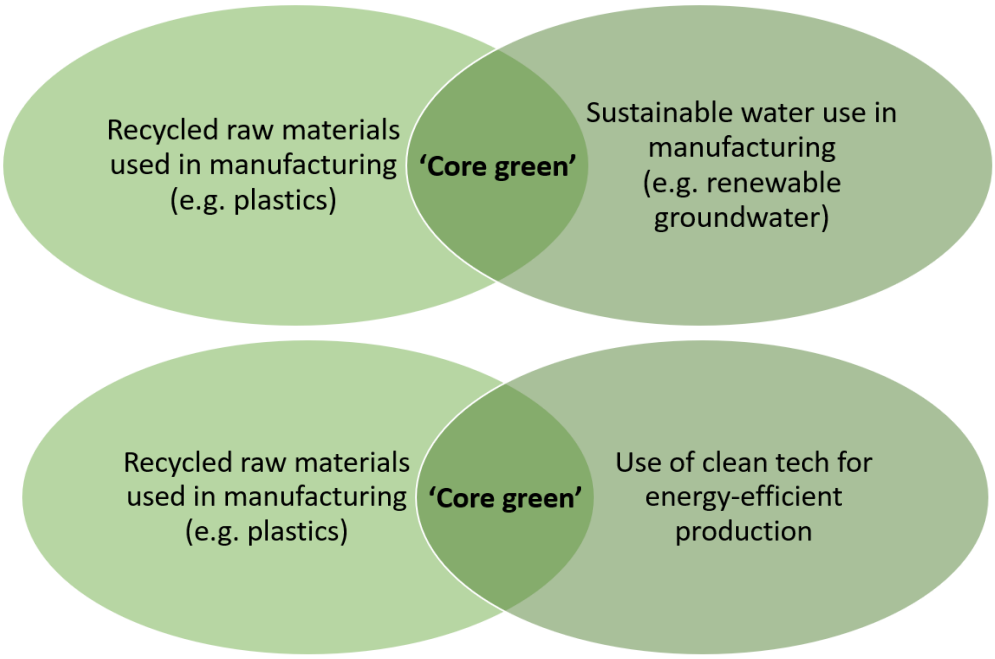
Source(s): Cambridge Econometrics.

Plastic products represent around 15% of municipal waste composition in Jordan, which highlights the importance of plastics recycling in furthering the circular economy. While a substantial number of plastic manufacturers use recycled raw materials, further progress can be made, as 45% of plastic manufacturers solely use virgin materials in production and the remaining ones use a mix of virgin and recycled materials (GIZ, 2021).

Clean tech as a sector manufactures technologies which are more energy-efficient, less wasteful and, in effect, pose less harm for the environment than alternatives. In Jordan's manufacturing sector, clean tech is gaining in importance in recent years and has growth potential. Currently, around 800 people work in clean tech manufacturing in the country, with outputs primarily including manufacture and maintenance of tools and equipment focused on increasing energy efficiency and renewable energy production (EDAMA, 2017). When the production of such technology is done in a sustainable manner, e.g. with resource-efficient processes, clean tech manufacturing can be considered a 'core green' activity.

The classification of 'core green' activities goes beyond the adoption of a 'green' activity in a production process (i.e. use of clean technology), but also looks at other practices used along the supply chain, as well as the output. Figure 9.6 provides an illustration of how we could look at 'core green' manufacturing activities. For example, the use of sustainable water in manufacturing is widespread in Jordan – not least as a response to the severe water scarcity -, but the adoption of this practice alone would not classify them as 'core green', because they might still be using unsustainable production processes related to other inputs. Manufacturers which make use of sustainable water as well as using other sustainable inputs, such as recycled raw materials, can be described as working in 'core green' activities. In a similar line of reasoning, a plastics manufacturer which uses recycled raw materials as production inputs, might still apply unsustainable practices along the supply chain. Coupled with the use of clean technology, which enhances energy-efficiency of production, the result may be considered a 'core green' activity in the sector.

Figure 9.6: Illustration of 'core green' activity classification as a combination of 'green' activities in production process



Source(s): Cambridge Econometrics.

Reforms and investment: policies, R&D technology

The Jordanian government identified various priority actions to focus on in their strategy towards greening the economy. Specifically in relation to the industrial sector, progress is to be achieved by 2025 in implementing "circular economy practices in industrial activities by supporting transition to resource efficiency and cleaner production with a focus on eco-industrial parks" (Economic Modernisation Vision). Moreover, transparency and sustainability of supply chains are focus areas for action identified by the government.

Planned investment of an estimated USD 30 million between 2022 and 2024 in improvement of e-waste recovery (Jordan Government, 2020e).This action has the potential to generate more than 100 green and sustainable job opportunities, while reducing the number of informal recycling activities among waste pickers.

Barriers to green adoption

The various general challenges to green adoption in manufacturing sector were mentioned already in this chapter. They can be split in two main categories: lack of a long-term national strategy for climate change; and low availability of green skills and low public awareness on climate change related issues.

A.3 Sectoral profile – Energy and electricity

Economic structure

Energy and electricity (ISIC Rev 4 code 35) is an important sector for the Jordanian economy, creating in 2019 a Gross Output of 946 million JOD and 782 million JOD value added. This corresponds to around 1.3% of GDP. The sector employs a total of 13,005 individuals (Jordanians and Non-Jordanians), representing a share of 0.55% of total employment[83]. In 2020, the electricity

[83] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.

sector created a total of 109 new jobs (Department of Statistics, Job Creation Survey, 2021).

Jordan relies on a conventional energy mix, mostly based on (imported) crude oil and natural gas. Most of the energy supply is covered via imports. Between 2005 and 2017, the import of energy represented on average 98.7% of primary energy supply. As a result of the efforts in diversifying the sources of energy and of the investment in renewable energy, imports decreased in 2018 to make up 94% of the primary energy supply (MEMR, 2020b). Increasing international prices, regional instability, and sustained growth of energy demand point to the urgency of formulating a new vision for the energy sector and to further increase the share of domestic sources of energy, primarily renewables, but also shale oil to complement the mix (Sandri, Hussein and Alshyab, 2020). In 2021, the cost of imported energy amounted to 1.86 bl JOD (MEMR, 2021), which is equivalent to almost 6% of GDP. Reducing dependency on imports would also be crucial to relaunching employment in the sector.

Table 9.4 shows employment and gross output of the sector electricity, gas, steam, and air conditioning supply, which correspond to category 35 of ISIC-4. The statistics published by DoS provide data at 2-digit level only.

Table 9.4: Employment and gross output in electricity, gas, steam and air conditioning supply by ISIC 2-digit level

ISIC 2-digit	Employment (2020)	Gross output, thousand JOD (2019)*
35. Electricity, gas, steam and air conditioning supply	13,005	946,576

Note: Gross output value for electricity, gas, steam and air conditioning supply for 2020 has not been published at time of drafting.

Source(s): Department of Statistics LSF microdata. Department of Statistics Jordan Statistical Yearbook 2020.

The electricity generation sector underwent a reform starting in 1996, when the National Electric Power Company (NEPCO) was established to take the role of the Jordan Electricity Authority. In 1997, NEPCO was split into three different independent companies respectively in charge of generation, transmission, and distribution activities. The rationale of the reform was to increase efficiency in the electricity sector by increasing competition. There are currently nine licenced electricity-generating companies. Construction, operation, and maintenance of the transmission system within the country are the exclusive responsibility of NEPCO, which is a public shareholding company fully owned by the state. Distribution is operated via three further shareholding companies: Jordan Electric Power Company—JEPCO, Irbid District Distribution Company—IDECO, and Electricity Distribution Company—EDCO (Sandri, Hussein and Alshyab, 2020).

Environment-economy linkages

In Jordan, around 39% of primary energy is used for electricity generation (EDAMA, 2019). This shows that the cost of energy is closely related to the production of electricity.

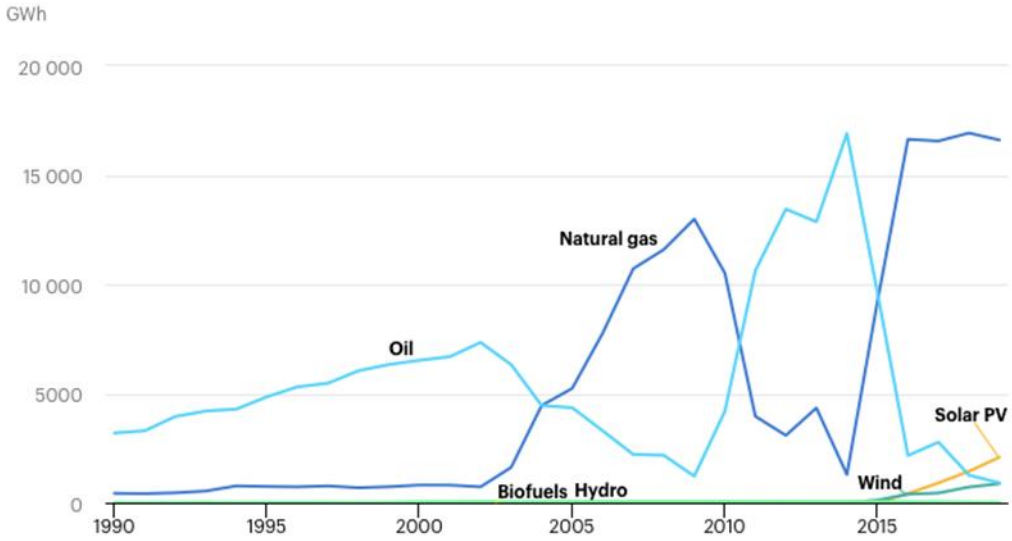
Direct link to environment via energy usage

As shown by Figure 9.7, the majority of electricity is produced relying on fossil fuels, in particular natural gas (73%) (MEMR, 2021). Nonetheless, the share of electricity from renewables in Jordan has been increasing over time: it grew from 0.7% in 2014 to over 13% in 2019 (IRENA, 2021), and up to 26% in 2021 (Figure 9.8) (MEMR, 2021). The expansion in the share of renewables deployment in electricity generation has also been made possible by price

reductions in the technology, subsidized prices, and financing programs, making solar photovoltaic and wind generation more competitive with conventional sources.

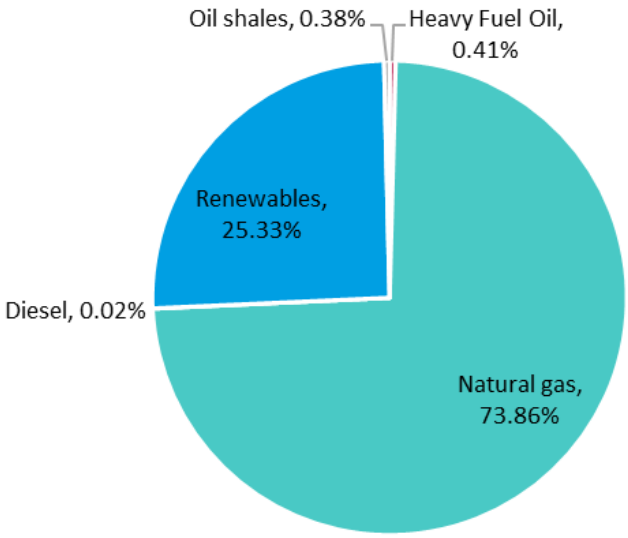
The Jordan Renewable Energy and Energy Efficiency Fund (REEE) was created in 2012 and became operational in 2015 with the objective of providing the funds for renewable energy and energy efficiency measures, in coordination with local and international stakeholders. Its programmes include credit, credit guarantees, equity financing, and subsidies. Further, also the Central Bank Facility can be used to obtain loans at facilitated rates for investments in different sectors, including renewable energy and energy efficiency (REEE homepage).

Figure 9.7: Electricity generation in Jordan by source between 1990 and 2019 (Units: GWh)



Source(s): IEA, Database, 2022. Available online: https://www.iea.org/data-and-statistics

Figure 9.8: Electricity production by type of fuel in 2021



Source(s): NEPCO (2022). https://www.nepco.com.jo/en/statistical_info_en.aspx

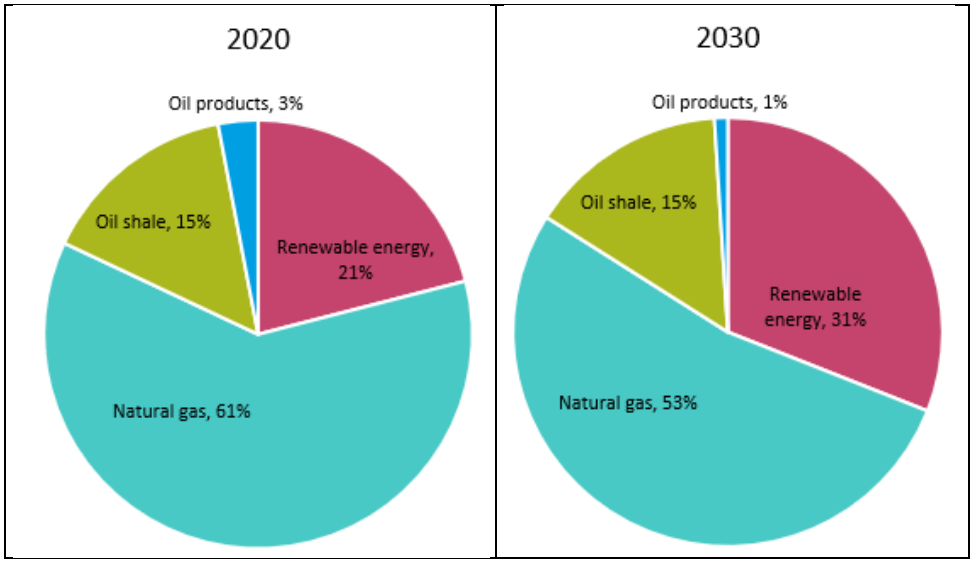
Use of natural resources

The energy sector plays a major role in climate change mitigation, especially since energy is the primary contributor to total emissions of Greenhouse Gases.

Jordan's potential for renewable energy - specifically solar and wind - is high, being located in the sun belt and enjoying an average of 316 sunny days per year, having wind speeds ranging between 7 and 8.5 m/s (Katz and Shafran, 2019),and having large desert areas with a low population.

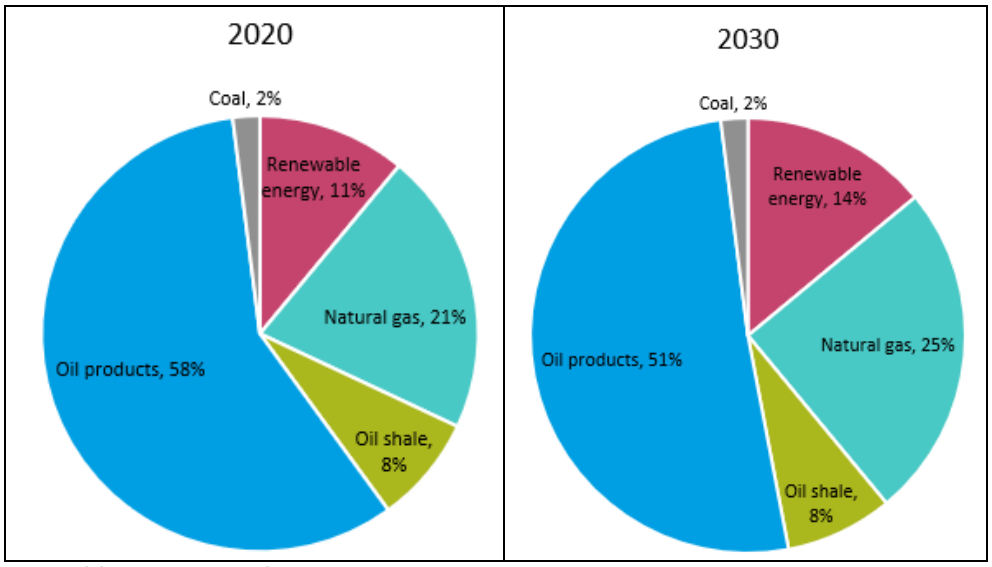
The authorities have been calling for a green transition of the energy sector, in general, both as part of the commitment towards GHG emission reductions and as part of its strategy towards energy security. The updated Master Strategy for the Energy Sector 2020-2030, developed by the Ministry of Energy and Mineral Resources (MEMR), calls for a sustainable future energy supply, diversification of the national energy mix, increased dependency on the share of domestic energy resources, enhanced energy security, and reduced energy dependence and cost of electricity supply. The strategy targets a 31% share of renewables in total power generation capacity and 14% of the total energy mix by 2030 (Figure 9.9 and Figure 9.10).

Figure 9.9: Targeted ratios of fuel contribution to the electricity generation (2020 -2030)



Source(s): MEMR, Jordan Energy Strategy 2020-2030.

Figure 9.10: Actual and 2030 target composition of total primary energy mix by fuel



Source(s): MEMR, Jordan Energy Strategy 2020-2030.

Moreover, Jordan's Nationally Determined Contribution (NDC) to Climate Change Reduction, which was released by the Ministry of Environment in

October 2021, targets the reduction of greenhouse gas emissions by 31% compared to 2012 until 2030[84].

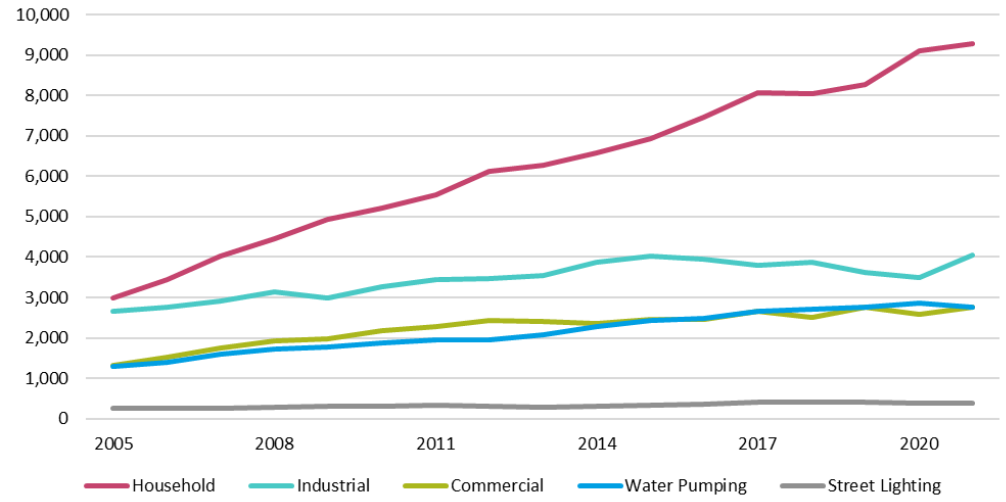
In general, official documents, strategies, and initiatives for the electricity and energy sector show a clear commitment towards a green transition. A list of the most important renewable energy projects, as of September 2021, is presented in Section A.3 in the Appendix.

Further to mention are the increasing number of small-scale renewable projects, in particular for establishments like universities, large enterprises, government institutions, schools, and hospitals (MEMR, various Annual Reports). The Ministry of Energy and Mineral Resources (MEMR) reports 5,542 photovoltaic projects below 2 KW installed to support vulnerable groups of the population (MEMR, 2021).

Electricity consumption by sector

In Jordan, access to electricity is facilitated to the entire population, both in urban and rural areas. With population growth, electricity consumption has been steadily increasing and the largest share of electricity generated is consumed by households (Figure 9.11). This share has increased from 46% in 2018 to almost 53% in 2021. Among the reasons for this increase is an increased reliance on electric devices within the digital society (Sandri and Alshyab, 2022) and an increase in the number of electric cars. The second largest share of electricity is used by industries (23%), followed by water pumping and commercial activities (16% each), and street lighting (2%).

Figure 9.11: Jordan's electricity consumption by use between 2005 and 2021



Source(s): Data from MEMR, various Annual Reports and Energy Brochures.

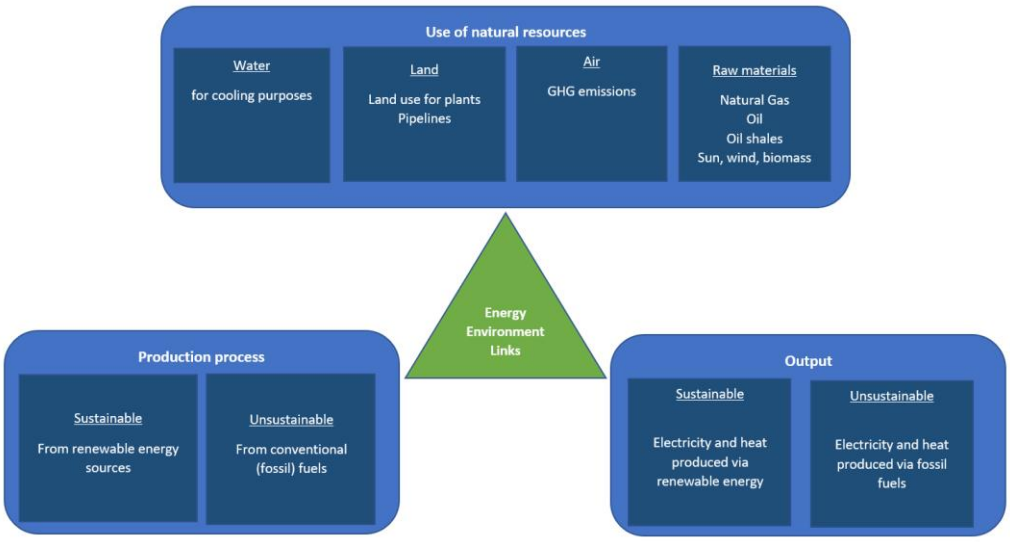
Efforts are being put into improving energy efficiency: In April 2018, the government has approved The National Energy Efficiency Action Plan (NEEAP)-(2018-2020). The document aimed at increasing energy efficiency to enable a 20% reduction of energy consumption by 2020 compared to the average energy consumption during 2006-2010. To be signalled is also the high loss associated with water transport networks and circulation, using about 15% of the total electricity demand (MEMR, 2020a).The aim is to completely eliminate such losses and accordingly, the National Energy Efficiency Action Plan (NEEAP) sets the target of "reducing final energy demand improving energy efficiency in the water sector by 15% up to 2025 counting the year 2018 as the base year" (MEMR, 2020a).

Summary of linkages

Figure 9.12 shows an overview of the linkages between energy activities and the environment in Jordan.

[84] http://extwprlegs1.fao.org/docs/pdf/jor205905E.pdf

Figure 9.12: Energy activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems

The issue of securing energy is particularly challenging for Jordan, which suffers from a scarcity of natural resources combined with regional instability and conflicts. Jordan's energy security is based on a conventional mix, mostly relying on imported fossil fuels and natural gas. This makes the country vulnerable to external shocks and energy market volatility.

Despite reform efforts to reduce dependency from imports and some progress in diversifying the energy mix, energy security remains critical: the country imports around 94% of its energy (MEMR, 2019). Such dependency on conventional imported energy sources is having profound implications on the Jordanian economy, further compounded by the consequences of the Arab Spring and the interruption of natural gas imports from Egypt, the outbreak of the war in Syria, and the inflow of massive waves of refugees. This has made securing sufficient and cheap energy a priority for Jordan.

In comparison, while the cost of consuming energy represented 12% of GDP in 2009, the disruption of Egyptian gas import and their replacement via oil caused the cost of energy to reach 21% of GDP in 2012 and to remain on average 18.9% between 2011 and 2014. As a result, between 2011 and 2015, NEPCO accumulated a debt of JOD 5 billion.

Reducing dependency on imports and vulnerability to international energy markets could have positive implications for all sectors of economic activities, which are all relying on energy, whose prices are passed through to the end consumers. In addition, there is evidence from other countries that energy production from renewable sources requires more employment than conventional energy sources (NASEO, 2019), thus offering a potential for employment creation. According to estimations by UNDP (2011), solar energy generation employs an average of 6.96 to 11 workers per Kilowatt, and wind 0.70 to 2.78 workers.

The progressive increase in the share of renewables to the total energy mix will of course also be crucial in granting the sustainability of energy supply and in mitigating climate change.

Subset of core green activities or selected environmental-related and socially sustainable activities

Based on the analysis of sectoral activities in the Jordanian electricity sector and their links with the environment, Table 9.5 presents a set of activities which can be described as 'green.' These activities are sustainable in their production processes as they rely on renewable resources and produce green outputs, that is, without greenhouse gases.

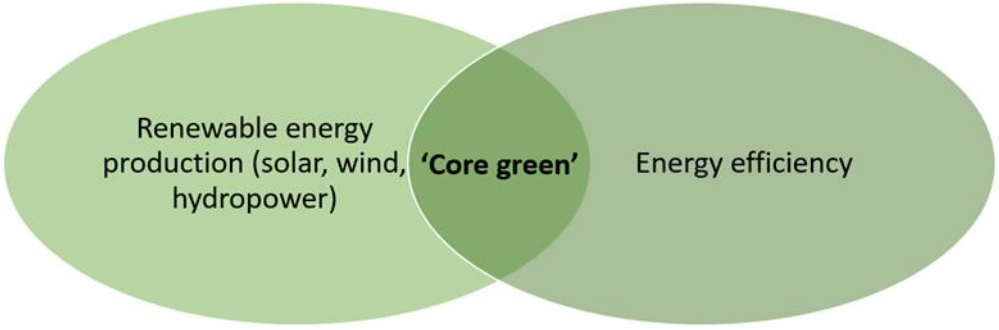
Table 9.5: 'Green' activities in the Jordanian electricity sector

Activity	Description	Environmental impact	Extent	Jobs	Corresponding ISIC Rev 4 sector
Solar electricity production	Photovoltaic electricity generation	No Greenhouse Emission, large use of land		To be estimated based on the list of renewable energy projects in Annex	3510 Electric power generation, transmission and distribution, which includes however the operation of generation, transmission, and distribution of facilities producing electric energy, from all sources, including thermal, nuclear, hydroelectric, gas turbine, diesel and renewable
Wind electricity production	Electricity generation via wind	No Greenhouse Emission, large use of land, acoustic pollution		To be estimated based on the list of renewable energy projects in Annex	
Hydropower electricity generation	Electricity generation via circulation of water	No Greenhouse Emission, water resources and physical characteristics necessary (e.g. slope of terrain)	As due to the scarcity of water, mostly connected to waste water treatment plants	Small impact, due to the limited size of the hydropower plants	
Biomass electricity generation	Electricity generation via combustion of solid waste	Greenhouse Emission (reduced in comparison to conventional sources), use of resources that would be otherwise wasted		To be included in the analysis of the waste sector	3821 Treatment and disposal of non-hazardous waste (not included in the electricity sector)

Source(s): Cambridge Econometrics.

The classification of 'core green' activities goes beyond the adoption of a 'green' activity in a production process (i.e. use of clean technology), but also looks at other practices. Figure 9.13 provides an illustration of how we could look at 'core green' electricity and energy activities. Renewable energy generation is considered to be a 'green' activity. Combined with energy-efficient production technology, e.g. clean tech, this would result in what can be described as a 'core green' activity.

Figure 9.13: Illustration of 'core green' activity classification as a combination of 'green' activities in production process



Source(s): Cambridge Econometrics.

Biomass is also a form of renewable energy that makes use of resources that would otherwise be wasted and releases less GHG than conventional sources. Based on the ISIC-4 classification, it belongs to the waste section E, Water supply; sewerage, waste management and remediation activities. Therefore, it is not listed in the diagram above.

Reforms and investment: policies, R&D technology

Energy is at the core of the government's Jordan Vision 2025 strategy, which targets several elements related to the green transition. In particular, it aims to encourage the use of solar energy for water heating, and introduces several measures to improve energy efficiency, such as requiring the implementation of green building codes and encouraging the use of green standards devices (Government of Jordan, 2014).

Energy is also one of the priority economic sectors of the Economic Modernization Vision, which posits the need to improve energy efficiency, expand on renewable energy, and also explore the option of hydrogen among the targets to realize sustainability.

Table 9.6 presents an overview of Green Growth Priorities as found in existing national documents and as reported by the Energy Sector Green Growth National Action Plan for 2021–2025 (Jordan Government, 2020b).

Table 9.6: Green Growth Priorities as found in existing national documents (Source(s): Energy Sector Green Growth National Action Plan for 2021–2025)

Relevant plans and strategies for Energy Sector
Jordan Economic Growth Plan 2018 - 2022
National Renewable Energy Action Plan (NREAP) 2018-2023 (tbc)
National Strategy and Action Plan for Sustainable Consumption and Production in Jordan (2016-2025)
Nationally Determined Contribution (NDC, Paris COP21)

In addition, the Energy Sector Green Growth National Action Plan for 2021–2025 presents an overview of the most significant investment into greening the energy sector (Table 9.7).

Table 9.7: Green initiatives in the Energy Sector and estimated investment for 2025 (Based on the Energy Sector Green Growth National Action Plan for 2021–2025)

Action	Period	Investment	Goal/target
Improve Energy Demand Management through Development of a Smart Electricity Grid	2021-23	USD 3.5 mn	31% contribution of renewable energy to electricity generation by 2030 14% contribution of renewable energy to total primary energy mix by 2030
Develop Industrial Renewable Roadmap and Investment Plan	2021-22	USD 1 mn	
Improve the market for green building and construction services	2021-22	USD 1 mn	Reduce energy consumption by the residential sector through the adoption of green building codes, and through the mitigation of the sector's contribution to climate change.
Develop and Implement a National Green Building Strategy and Action Plan	2022-22	USD 3 mn	
Conduct Energy Efficiency Retrofits for Public Buildings	2021-23	USD 1.5 mn	EE upgrades of the selected priority public buildings completed and handed over to the respective owners. This can include, but is not limited to, thermal retrofitting, installation of energy efficient lighting and appliances, smart energy metering, and others.
Implement Electric Vehicle Charging Stations and Services Provision in Greater Amman Municipality through a Public-Private Partnership	2021-23	USD 16.3 mn	Establish a network of slow and fast EV charging stations in the City of Amman to respond to growing demand for services.
Develop a Behaviour Change Campaign and Financial Mechanism to Increase Use of Energy Efficient Appliances in Jordan	2021-24	USD 9 mn	Achieve 25% rate of replacement of old, high energy consuming appliances, with energy efficient appliances by the end of the year 2024, and accordingly reduce

			energy consumption at residential and commercial establishments by 15% or more
Increase Public Investment in Energy Sector Research and Development	2021-25	USD 15 mn	
Achieve GCF Accreditation for the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF)	2021-22	USD 1 mn	
Implement the Energy Sector Monitoring, Reporting and Verification (MRV) System	2021-22	USD 3 mn	MRV operationalized and maintained

Source(s): https://www.greengrowthknowledge.org/national-documents/jordan-green-growth-national-action-plans-2021-2025-energy-sector

With regard to electricity, Jordan and Egypt have agreed to increase the capacity of the existing power interconnection, with the intention to supply Iraq with electricity from Egypt, via Jordan. Furthermore, Jordan and Iraq signed an agreement in September 2020 to connect their electrical grids, and Jordanian authorities expect operations to begin by 2022. Developments in the field of electricity are crucial for the economic and environmental sustainability of the energy sectors of the three countries. In perspective, the interconnection of the power grids can be expanded to other neighbouring countries, such as Syria, Lebanon, and beyond.

Table 9.8 provides information on renewable energy projects in Jordan.

Table 9.8: Renewable energy projects

Project Name	Project size MW(AC)	The name of the owner/executing company	Location
Jordan wind Farm	117	JWPC	Tafileh
Wind energy project -Mass	100	Mass Energy	Tafileh
Wind energy project - Abour	51.75	Abour Energy Company PSC (Xenel)	Tafileh
Wind energy project - Daihan	51.75	Daehan (KOSPO)	Tafileh
Al-Badiya Philadelphia	13	Solar Philadelphia	Northern Badiya
Jordan Solar One	20	Jordan Solar One	Mafraq
Zaatri Refugee Camp PV Plant	11.1	Belectric Gulf	Zaatri Refugee Camp
Air Force PV Project	10	Royal Jordanian Air Force	Mafraq
PV Project	51	Fotowatio Renewable Ventures (FRV)	Mafraq
PV Project	51	FRV + Hareon Swiss Holding	Mafraq
Scatec Solar	10	Scatec Solar	Ma’an

SunEdison Project	20	Adwa'a Ma'an	Ma'an
Ardh Al Amal Project	10	Ardh Al Amal	Ma'an
Arabia one Project	10	Arabia One	Ma'an
PV EJRE	20	EJRE	Ma'an
Shams Ma'an	52.5	Shams Ma'an	Ma'an
Zahrat Alsalam	10	Zahrat Alsalam	Ma'an
Alzanbaq	10	Alzanbaq	Ma'an
Alward Aljoury	10	Alward Aljoury	Ma'an
PV/ Falcon Ma'an	20	Falcon Ma'an	Ma'an
Ma'an Wind Project	80	Elecnor	Ma'an
PV/ Shamsuna	10	Shamsuna	Aqaba
Al-Qweira PV Plant	92	TSK + Enviromena	Al-Quairah
Azraq Camp Solar PV Power Plant	2	ATERSA	Azraq
Azraq Solar PV Power Plant	2.5	Ennera	Azraq
Expansion of Azraq PV plant project	5	Mustakbal	Azraq
Expansion of Azraq PV plant project	1	JV of Al Edwan Contracting Company	Azraq
East Amman PV project	40	AES/Mitsui	Al-Madouna
South Amman PV Plant	40	Belectric Gulf	South Amman
Baynona PV project	200	Masdar	Mwaqar/ Amman

Source(s): MEMR, stand of September 2021.

Barriers to green adoption

Despite the authorities' commitment to increasing the share of renewable energy in the total energy mix, there are some technical challenges that may delay the transition. In general, one can refer to the need to upscale the infrastructure to enable the integration of non-conventional energy sources into the national electricity grid (green corridor) and the economic challenges, regarding the scale of investments needed. This would call for a stronger involvement of private companies, but the small size of the domestic market together with regional instability may discourage investment.

Current developments regarding the interconnection of the electricity grids of Jordan and neighbouring countries may be a way to counterbalance the limited size of the market. A more short-term challenge may be represented by already signed contracts for electricity, leading to a systematic overproduction in Jordan.

As a further constraint, renewable energy use for heating and cooling purposes has been limited – and based mostly on solar water heaters (IRENA, 2021).

A.4 Sectoral profile – Water and waste

Economic structure

Employment and GDP

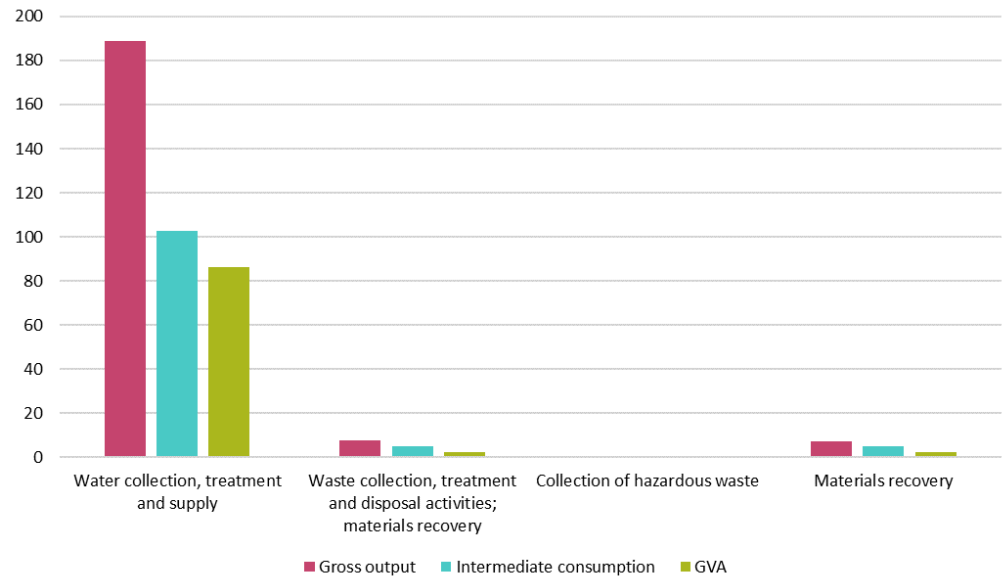
The Water and waste sector (ISIC Rev 4 codes 36 – 39)[85] in Jordan employs merely 0.3% of workers in 2021[86], equivalent to around 7,000 people. Together with the electricity sector, the sector contributes around 2% to national GDP. Gross output in 2019 was just under 200 million JOD[87]. The sector grew by 5% per year in 2010-21.

The water sector alone generates 0.5% of Jordan's GDP in 2021 and formally employs 6,800 workers (Jordan Government, 2022), 92% of which are native Jordanians. This makes up nearly all of the formal employment within the waste and water sector, implying that most jobs in the waste sector are of informal nature. Informal employment is particularly to be found at the bottom of the value chain in the waste sector and is estimated to include more than 6,000 (Friedrich Ebert Stiftung, 2016) workers active as waste pickers (Jordan Government, 2020e).

Despite its small share in the country's GDP, Jordan's economy is dependent on the water sector. This is due to the dependence of agriculture on the water sector, as well as its high energy consumption from the pumping of water from wells.

As shown in Figure 9.14, the major share of output and value added generated by the sector originates in water collection, treatment, and supply.

Figure 9.14: Gross output, intermediate consumption and GVA of water and waste activities, 2019 (million JOD)



Note(s): Gross value added (GVA) of a sector is the gross output from the sector less the intermediate consumption by the sector.
Source(s): Department of Statistics, Table 1: Main Result by Economic Activity 2011 – 2020.

[85] Water supply, sewerage, waste management and remediation activities
[86] http://www.dos.gov.jo/owa-user/owa/emp_unemp_y.show_tables1_y?lang=E&year1=2021&t_no=78
[87] http://dosweb.dos.gov.jo/databank/yearbook/YearBook_2020.pdf

Of the 1,093 million m^3 of water supplied by the sector in 2021, 49% goes to the agriculture sector, 48% is for municipal use and 3% for manufacturing (Table 9.9).

Table 9.9: Quantity of water by usage and type, 2021, million m^3

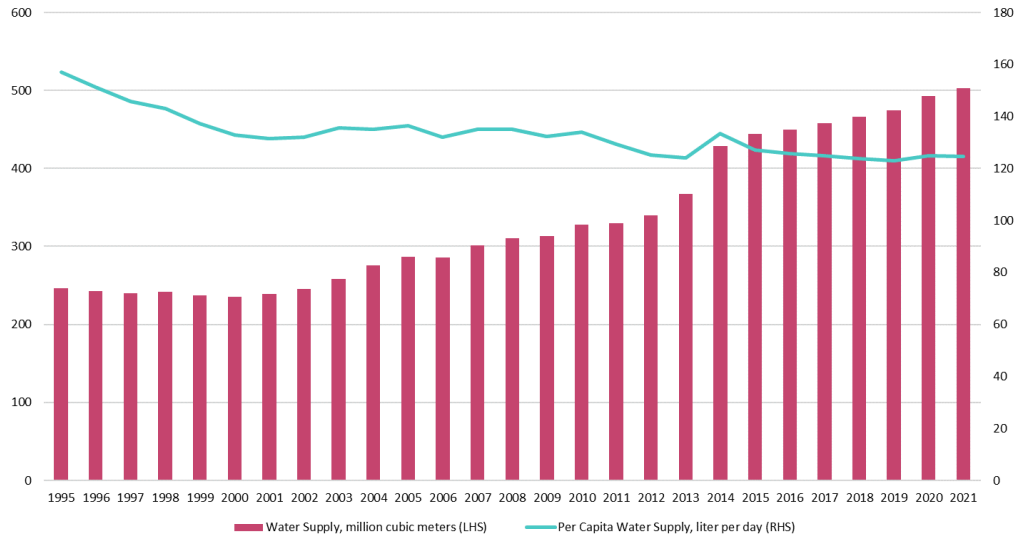
	Groundwater	Surface water	Treated wastewater	Total
Municipal	378.0	141.25	0	519.3
Industrial	28.5	4.19	3.17	35.9
Irrigation	209.8	157.34	164.02	531.2
Livestock	2.4	4.2	0	6.6
Total	618.7	306.98	167.190	1,092.9

Source(s): Department of Statistics, Environment - 2.Environmental resources and their uses.

Water supply growth is not keeping up with population growth

Per capita domestic water supply in Jordan has declined over the past decades, down from 157 to 125 litres/day between 1995 and 2021 (Figure 9.15)[88]. In some governorates, the figure drops even below 100 litres/day, highlighting the severity of the country's water scarcity. Even though the water supply in the same period has more than doubled, water supply is not keeping up with the rapid growth in Jordan´s population.

Figure 9.15: Water supply, total and per capita, 1995-2021



Source(s): Department of Statistics, Table 6:Per Capita Water Supply by Kingdom (1995-2021)[89]

Main sources of water in Jordan are surface water, ground water and (increasingly also) treated wastewater. Of total surface water, 51% is used in irrigation, 46% is for municipal use, with the remaining 3% equally shared between industrial use and livestock[90]. Groundwater usage is primarily for

88 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Water%20Resources/

89 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Water%20Resources/W_tab6.px/

90 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

municipal (61%) and irrigation (34%) purposes, with 5% used in industrial processes[91]. Treated wastewater is primarily used for irrigation purposes.

Wastewater treatment

The quantity of treated wastewater from domestic and industrial use in Jordan increased by 65% between 2008 and 2021, representing 15% of total water usage, with nearly all treated wastewater (98%) used for irrigation in the agriculture sector[92]. As such, the water and waste sector is critical for the sustainability of the agriculture sector in Jordan, and "failure to sustain and protect water resources […] threatens food security, livelihoods, and life" (Jordan Government, 2020f).

Recovery of materials

Around 30% of the volume of waste is comprised of plastics, metals and paper. Recycling of plastics is fairly well-developed in Jordan. Amman's plastic waste recycling sector treats between 4,000 and 6,000 tons of plastic waste per month (Hamdan, 2021). The recovered materials, except for PET for which no domestic recycling industry exists in Jordan, are re-used in domestic end-market industries. Other solid waste which is being recycled in Jordan includes metals, though lower in volume than plastics. Iron and steel metals are recycled and re-used domestically, providing inputs for the construction sector. Other metals, such as aluminium and copper tend to be exported. Paper and cardboard are also being recycled in Jordan, with around 20 paper recycling mills in Amman and Zarqa, producing outputs such as egg tray cartons.

Despite around 50% of commercial waste being of organic nature, currently recycling of organic waste is near inexistant in Jordan (Hamdan, 2021). Moreover, treatment of special waste, such as cooking oil, electric and electronic waste, old tires, and textiles, is less developed in Jordan. Consequently, these waste types, including hazardous waste, end up, together with organic waste, in the 21 landfills in the country (Jordan Government, 2020e).

Environment-economy linkages: primary, secondary

Water scarcity

Jordan is the second water-poorest country in the world. Climate change adds to the challenges, with increased drought frequency and reduced precipitation depleting natural water sources in the country. Moreover, poor environmental practices in industry and agriculture cause declining quality of existing water sources. The challenges for the sector's contribution to economic growth and environmental sustainability are therefore plentiful, with improvements in water-efficient practices being a top priority for action. The Jordanian government in 2020 acknowledged that "[at] the current rate of extraction and consumption, the available water supply is insufficient to sustainably support economic activities we at the same time providing critical environmental services" (Jordan Government, 2020f). Due to the dire situation in terms of water scarcity in Jordan, treatment of wastewater is crucial.

Resource use

Due to few natural water resources in the country, as well as the topography of the land, and low efficiency of pumping, distribution of water to consumers requires a large amount of energy for pumping. Electricity costs for water consumption in 2019 were as high as 17% of total energy costs[93].

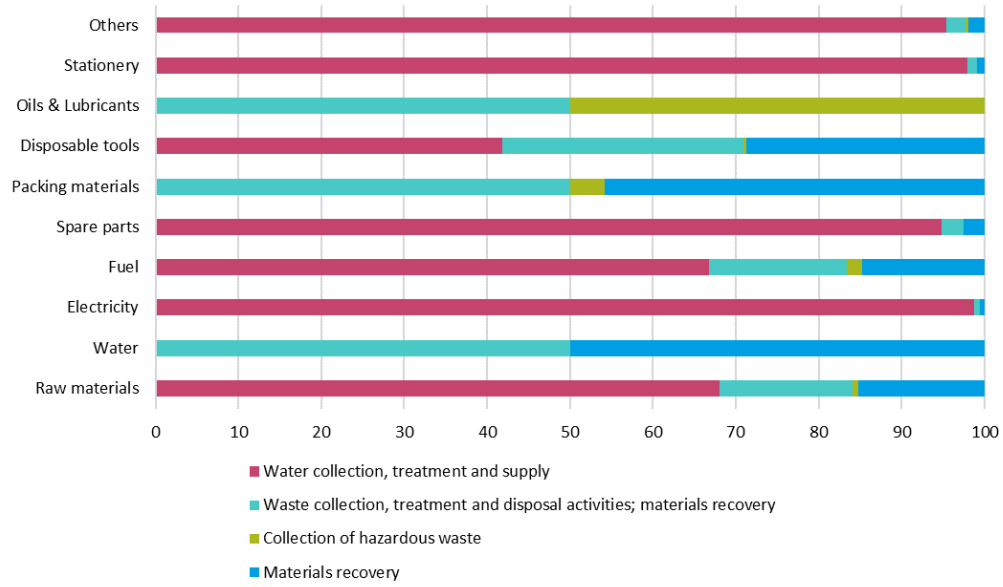
[91] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

[92] https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

[93] https://www.jordantimes.com/news/local/water-ministry-reform-path-introduces-green-energy-sources-sector

The majority of fuel and electricity used in intermediate consumption in the water and waste sector is in water collection, treatment and supply activities (Figure 9.16).

Figure 9.16: Intermediate consumption of goods by sector activity, 2019 (% of consumption value)

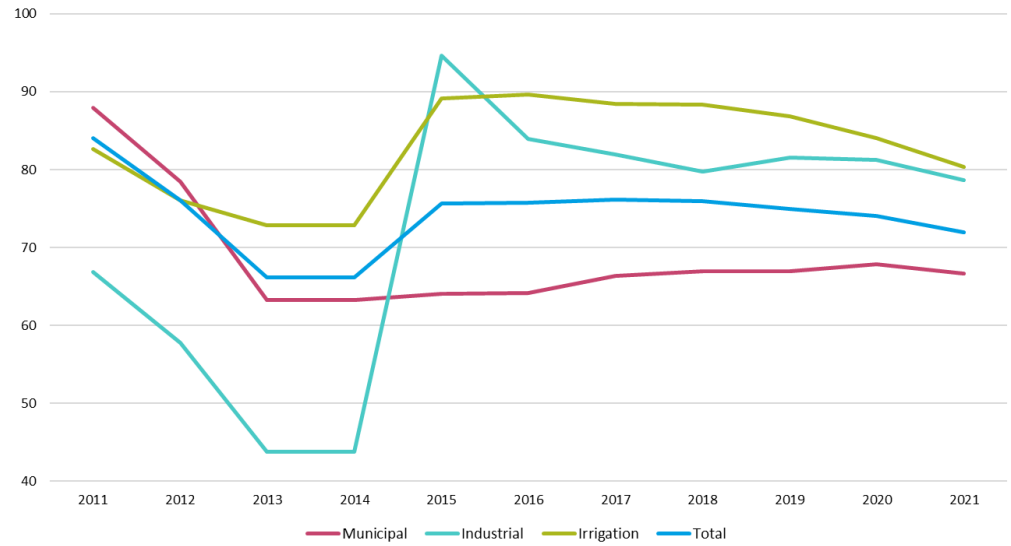


Source(s): Department of Statistics, Table 10: Intermediate Consumption of Goods Used in Production by Economic Activity, Items and Time[94]

Inefficient and unsustainable water practices in Jordan are estimated to cost 71 million JOD in 2017 (Jordan Ministry of Water and Irrigation, 2020). Due to low quality of surface water from rivers, such as the Jordan, the Yarmouk and Zarqa rivers, as a result of industrial pollution, farmers primarily use groundwater for irrigation. Groundwater resources are estimated to be overexploited to a level far beyond safe yield of extraction and the rate of replenishment (Jordan Government, 2020e). The share of renewable groundwater in total groundwater used in the country increased in recent years, albeit remaining below its level in 2011, at 72% (Figure 9.17). Irrigation activities exhibit the highest proportion of renewable water in total groundwater used, while this share is lowest in the municipal sector.

94 https://jorinfo.dos.gov.jo/Databank/pxweb/en/DOS_Database/START__10__1001__1101/ECO_T10/

Figure 9.17: Renewable groundwater usage by sector (% of total groundwater usage), 2011-21



Source(s): Department of Statistics, Table 2: Quantity of Groundwater Used by Usage (1995-2021)[95]

Recycling

More than 1,000 tons of hazardous recyclable waste is generated in Jordan each year (Jordan Government, 2020f). Most of this originates from liquid battery production or battery recycling centres (Jordan Government, 2020f). Around 2 million tonnes of waste were produced annually (UNDP, 2015) and municipal waste disposed of in landfills is expected to grow in volume by 3-5% annually[96]. Municipal waste in Jordan is, on average, composed of organic waste (51%), plastics (15%) and paper (14%)[97]. Just approximately seven percent of waste is being recycled in Jordan however, with 45% dumped openly and 48% ending up in landfills.

Poor management in the waste sector, particularly in the handling of plastic waste, results in the clogging of drainage systems, aggravating flash flooding in urban areas in Jordan. In 2020, the volume of waste generated by plastic bags in the country is estimated to have reached 17.2 tons (Saidan and Ansour, 2017).

The waste sector accounts for 11% of Jordan's total GHG emissions, 99% of which result from methane gas from managed landfills (Jordan Government, 2020e). When accounting for related activities, such as waste collection and transport, the sector's carbon footprint is higher still.

Hazardous materials are not typically separated and sorted, ending up in municipal waste streams together with organic waste, which accounts for over 50% of waste content. As a result, organic waste cannot be processed for re-use and becomes hazardous waste instead, releasing harmful compounds, such as methane gas, upon decomposition. Moreover, groundwater contamination risk is exacerbated by high levels of heavy metals at landfills, where leachate seeps into the ground. Such landfills and dumpsites are often unsanitary and the hazardous materials pose health risks for humans and biodiversity[98].

The government of Jordan, in its National Municipal Solid Waste Management Strategy 2012-34, set targets of diverting 75% of organic waste from landfills

95 https://jorinfo.dos.gov.jo/Databank/pxweb/en/Environment/Environment__Environmental_Resources__Water%20Resources__Abstraction%20Use%20and%20Returns%20of%20wter/

96 Government of Jordan. National Municipal Solid Waste Management Strategy 2015-2034

97 MoEnv. "Country Report on the Solid Waste Management in Jordan," 2014.

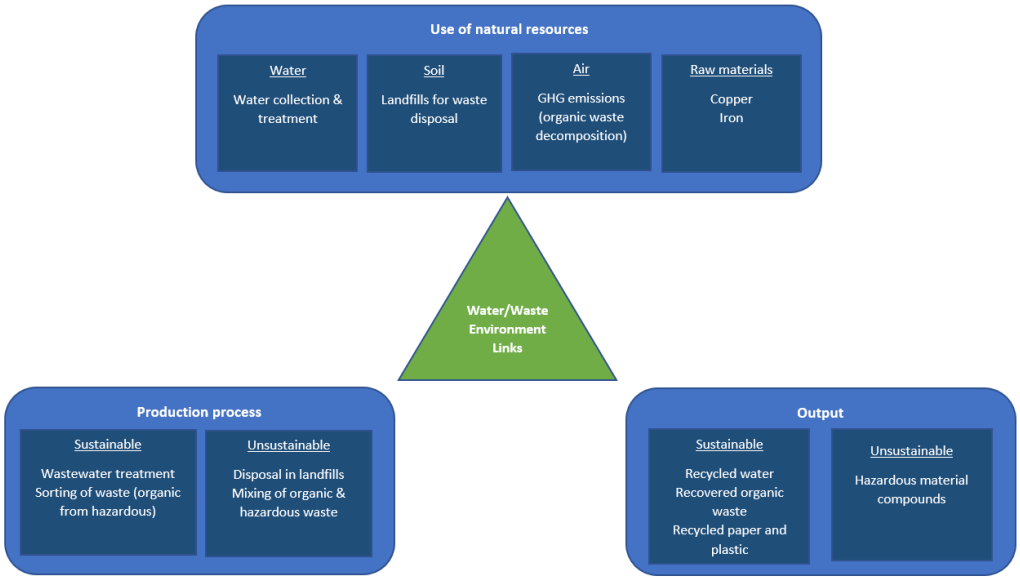
98 https://www.ecomena.org/swm-jordan/

and increasing the recovery of waste from packaging by 25% and improving the management of sorting of recyclable materials (metals, paper, plastic, glass).

Summary of linkages

Figure 9.18 shows an overview of the linkages between waste and water activities and the environment in Jordan.

Figure 9.18: Waste and water activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems: environment, climate, social

Environment, climate

Limited water resources and water scarcity poses a significant challenge, as surface and groundwater resources are depleting due to higher frequency of climate change-induced droughts and reduced precipitation. Natural water sources are deteriorating, due to pollution, such as fertiliser use, upstream diversion, and infiltration.

Subsidisation of water to ensure access for poor farmers results in overconsumption. Up to 30% of farmers prefer using water-intensive surface irrigation or other traditional practices (Molle and Venot, 2008). Inhibiting factors include access to finance for modern irrigation technologies and farmer knowledge[99]. Surveys among Jordanian farmers suggest there is scope for improving information and understanding of water-efficient irrigation practices, a challenge, given that many farmers do not wish to be given advice (Jordan Government, 2020f).

There is a substantial degree of water loss due to leakage, non-metering, and illegal use. Non-revenue water (NRW), i.e. water going through the distribution network but not being charged, poses another problem for the sector. The share of NRW in total domestic water supply remained in the range of 40-50% since 2013[100]. Utilities struggle to be cost-effective and require fiscal resources to function, placing a burden on the state budget.

Lack of incentives to involve the private sector in waste management activities and investment, therefore lack of innovation. Half of the country's municipalities take care of waste collection without the involvement of private actors.

Social

[99] https://gggi.org/report/jordan-green-growth-national-action-plans-2021-2025-water-sector/
[100] MWI. "Jordan Water Sector Facts and Figures 2017

Lack of waste separation at the source, i.e. at the waste generators, raises costs of recycling (Hamdan, 2021). This explains the relatively low recycling rate in the country and the general practice of mixed waste types ending up in landfills. Waste pickers take up the job of sorting and collecting waste from landfills, and are mostly informal workers, often dealing with materials which pose health risks.

The country's growing population, due to migration, leads to increased pressure on the water sector's ability to supply a growing number of people with water.

Usage of treated wastewater in agriculture is lagging behind, as farmers struggle to be convinced by the government to use this type of water (Jordan Government, 2020f).

Subset of core green activities or selected environmental-related and socially sustainable activity

Based on the analysis of activities in the Jordanian waste and water sectors and their links with the environment, Table 9.10 presents a set of activities which can be described as 'green' activities. These activities are either sustainable in their production processes (e.g. more efficient in their use of natural resources), produce green outputs, or result in outcomes which support social sustainability.

Table 9.10: 'Green' activities in the Jordanian waste and water sector

Activity	Description	Environmental impact	Extent	Jobs	Detailed ISIC Rev 4
Wastewater recycling	Collection and treatment of wastewater from households and industry for re-use	Water-efficiency, circular economy			Treatment of wastewater (370002)
Waste sorting and recycling	Separating organic from hazardous waste to enable recycling	Resource efficiency, circular economy			Collection of recyclable materials (381103) Transfer of non-hazardous industrial waste (381104) Production of compost from organic waste (382104) Recycling and reuse of municipal waste (383005) Recycling and reuse of hazardous wastes (383006) Recycling and reuse of non-hazardous industrial waste (383007) Recycling and reuse of oil and petroleum waste (383008)

Source(s): Cambridge Econometrics.

Wastewater recycling is critical for Jordan's water supply, given the country's severe scarcity of water resources, and its growing population. In light of

climate change impacts such as more frequent droughts and reduced precipitation, wastewater collection and treatment activities can be considered a 'green' activity, as their output enhances the country's resilience to climate change.

Waste sorting and recycling in Jordan involves separating waste, for example in landfills, where waste types are mixed. Typically, waste pickers, who most often work informally, collect waste types to sell on to facilities specialised in processing and (sometimes) recycling waste materials for re-use in further production processes. Some types of waste, in particular PET plastic waste, is primarily exported. Organic waste often is mixed with hazardous waste types, which can result in potentially reusable waste becoming unrecyclable, e.g. animal waste for organic fertiliser production.

Activities in wastewater and solid waste recycling could be considered 'core green'.

Reforms and investment: policies, R&D technology

In 2020, the Jordanian government, in their Waste and Water Sector Green Growth Action Plan 2021-2025, identifies 35 priority actions to achieve green growth in the waste and water sectors with an estimated cost of 193.9 million USD. These activities, which vary in length of implementation and costs, include, amongst others, the actions mentioned in Table 9.11.

Table 9.11: Some actions mentioned in the Waste and Water Sector Green Growth Action Plan 2021-2025

Action	Period	Investment	Goal/target
Construct an industrial **wastewater treatment plant** in Zarqa	2021-25	USD 27 mn	Reduce energy costs for WWTP by producing energy from biogas
Reduce water losses and increase **water savings** in King Abdullah Canal	2021-25	USD 50-65 mn	Two scenarios: (a) rehabilitate King Abdullah Canal (110 km); (b) convert northern part of Canal (65km) into a closed pipeline
Develop municipal **solid waste infrastructure** to promote **recycling** and the use of **sanitary landfills**	2021-25	USD 78 mn	Construction of new sanitary landfill sites
Implement Key **Wastewater Treatment** Projects to improve Water Supply Augmentation	2021-25	USD 68 mn	Construction of the Burkish WWTP Rehabilitation of the Madaba WWTP Expansion of the Aqaba WWTP
Improve **irrigation efficiency** in the Jordan Valley (Mid-Ghors)	2021-25	USD 28 mn	Raise irrigation efficiency at network level to 85% Serve area of 930 million m2 by rehabilitating irrigation network

Develop municipal solid waste infrastructure to promote **recycling and the use of sanitary landfills**	2021-25	USD 78 mn	New sanitary landfill sites New transfer station projects

Source (s): Jordan Green Growth National Action Plans 2021-2025: Waste sector[101] and Jordan Green Growth National Action Plans 2021-2025: Water sector[102]

Barriers to green adoption

Specifically relating to the water and waste sector in Jordan, the government identifies different barriers to the adoption of green practices. These include, for example, inadequate public financing and cost recovery mechanisms for waste management systems, insufficient engagement with the private sector and weary water infrastructure. Informal work, in particular in the waste sector (waste pickers), hinders the transition to green growth.

A.5 Sectoral profile – Transport

Economic structure

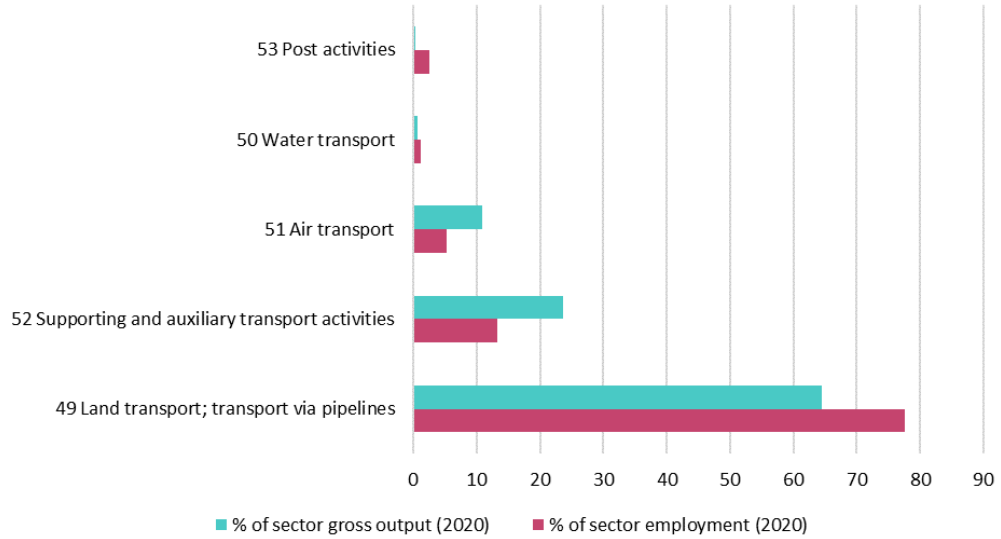
Transportation and storage (hereafter: transport) is an important sector for the Jordanian economy, with a gross output in 2020 of 2.2 bl JOD and 1.4 bl JOD value added, which corresponds to 6.3% of GDP. While the sector has been registering an annual average growth of 3% between 2009 and 2019, it has been negatively affected by the COVID-19 pandemic and suffered a contraction of 5% in 2020 (Department of Statistics, 2022, National Accounts).

In 2020, transport employed a total of 90,120 individuals, making herewith for a share of 6% of total employment[103]. According to estimations by the UNDP and as reported by the Transport Sector Green Growth National Action Plan for 2021–2025 (Jordan Government, 2020d), in 2017 the transport and logistics sector accounted for 11.7% of all informal employment. This implies that total employment in the sector – formal and informal – is significantly higher.

Figure 9.19 shows employment and gross output of sub-sectors in the transport sector. Within the sector, land transport makes for the largest contribution to gross output creation (64.5%) and for 77.6% of employment. It is followed by supporting transport activities, contributing to 23.7% of gross output and 13.3% of employment.

[101] https://gggi.org/report/jordan-green-growth-national-action-plans-2021-2025-waste-sector/
[102] https://gggi.org/report/jordan-green-growth-national-action-plans-2021-2025-water-sector/
[103] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.

Figure 9.19: Employment and output within transport by ISIC 2-digit sectors (2020, % of sector)



Source(s): Department of Statistics LSF microdata. Department of Statistics Jordan Statistical Yearbook 2020.

Table 9.12 provides employment and output figures for transport sub-sectors in levels and percentages.

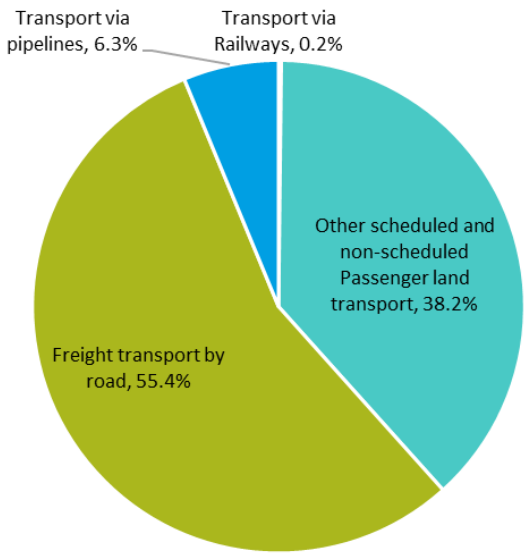
Table 9.12: Employment and gross output in transport by ISIC 2-digit level

Isic 2 digit	Employment (2020)	% of sector employment (2020)	Gross output, 000 JD (2020)	% of sector gross output (2020)
49. Land transport; transport via pipelines	69,931	77.6	1,402,205	64.5
50. Water transport	1,058	1.2	12,145	0.6
51. Air transport	4,807	5.3	237,375	10.9
52. Supporting and auxiliary transport activities	11,988	13.3	514,841	23.7
53. Post activities	2,336	2.6	6,850	0.3

Source(s): Department of Statistics LSF microdata. DoS Jordan Statistical Yearbook 2020.

With a road network of 9,152 kilometres (Government of Jordan, 2021)roads are the main transport infrastructure in Jordan. Freight transport via roads represents 56% of gross output while passenger land transport and transport via pipelines contributes 38% and 6% of gross output respectively (Figure 9.20).

Figure 9.20: 3-digit sub categories of Land Transport as share of total sector output



Source(s): DOS, Table 1: Main Result by Economic Activity 2011 - 2020[104]

As Figure 9.20 shows, transport via railway is de facto non-existent. There is no railway, with the exception of the Aqaba Railway Network, which is used for phosphate transport, and the 509 km Hejaz Railway Network. It was built by the Ottoman Empire starting in 1900 to connect Damascus (Syria) to Medinah (Saudi Arabia), passing through Amman, Qatrana, Ma'an and Mudawwara in Jordan (Nicholson, 2006). The network is currently operated only for small sub routes and for sporadic (mostly touristic) transportation of passengers. A feasibility study was conducted in 2017 (COMCEC, 2017) to explore the possibility of modernizing the railway, but the route proved to be an obstacle for faster transportation. The railway currently reaches a maximum speed of 35 km/h. It employed a total of 84 employees in 2017.

With regard to air transport, Jordan has three main airports: Queen Alia International Airport, which is the largest airport in Jordan, Amman-Marka Civil Airport, and King Hussein International Airport.

Water transport is marginal in Jordan, as the country has no navigable rivers and has access to the sea only through the port in Aqaba.

Support activities refer to the operation and maintenance of facilities and infrastructure immediately before or after transport.

Environment-economy linkages: primary, secondary

Policy makers worldwide have been increasingly dedicating attention to develop tools, policies, and action plans to foster sustainability in transport, whose three main dimensions are social, environmental, and economic sustainability (Shah *et al.*, 2021).

Green transport

A key concept that has emerged is that of green transport and national efforts have risen to adopt policies to switch to it, based on its role in preserving the environment.

Green transport can be defined as encompassing all modes of transport that do not depend on diminishing natural resources like fossil fuels. These transport modes rely on renewable energy sources and have very low impact

[104] https://jorinfo.dos.gov.jo/Databank/pxweb/en/DOS_Database/START__10__1001__1101/FIN_T1/

on the environment, producing minimal or no greenhouse gas emissions (IGI Global Dictionary).[105]

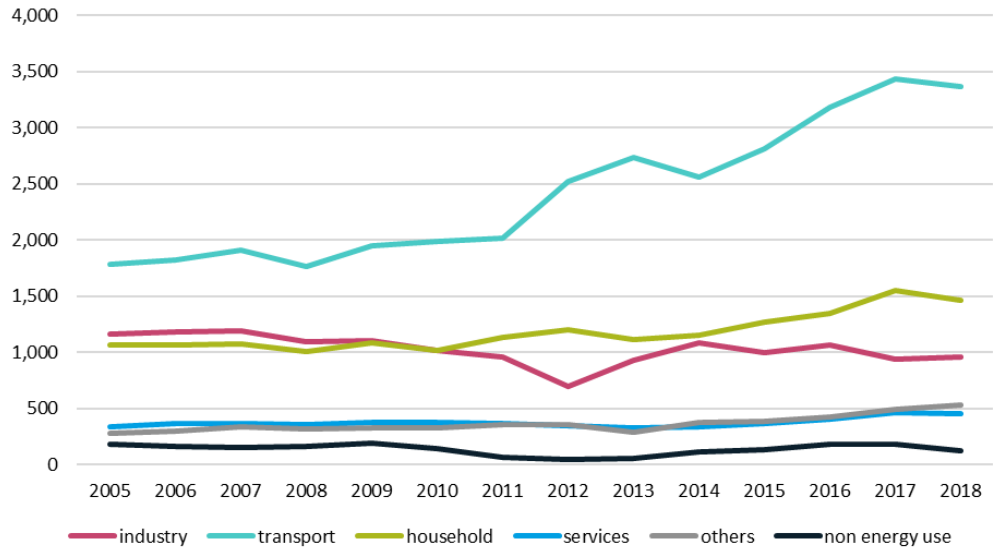
As a result of the understanding and awareness by the Jordanian authorities of the importance of green transport in achieving sustainable development, transport is among the pillars of the Green Growth National Action Plan 2021-2025. The transport sector is also addressed by the Economic Modernization Vision 2022 as part of its Green Driver. The Economic Modernization Vision sets Economic Growth Priorities, based on five growth drivers: transportation and logistics are mentioned both among the High Value Industries' and among the Future Services' Drivers. In particular, the vision states that "Jordan has a modern road network, yet there is a strong potential for enhancing transport networks, especially railway networks and linkages with other countries in the region." Among the proposed initiatives, there is the enhancement of environmental policies and regulations for transportation and logistics, as well as to "move towards the use of clean energy in transportation" (Jordan Government, 2022).

Direct link to environment via energy usage

The transport sector in Jordan accounts for 49% of total primary energy consumption (Figure 9.21).[106] Private cars make for 57% of this. Total energy consumption by the transport sector grew by around 90% between 2005 and 2018, which is a faster pace than growth of total energy consumed in the economy (+43%). Over the same period, transport's share in energy use rose by 12 percentage points. Strong population growth in the last decade explain this trend in energy consumption patterns, as household consumption also saw growth. The high share of energy used for transport is a steady feature in the Jordanian economy. It can be explained by the absence of an efficient public transport system and by the necessity to rely on private vehicles, for passengers and freight transport. As of 2018, the total energy used by transport was represented by oil derivatives only. A further trend that emerges from Figure 3 is the decrease in industry's share of energy consumption. This reveals the non-expansion of the industrial sector, as the value added of industry to GDP decreased from 32% in 2008 to reach 27.5% in 2018 (WDI, 2020).

[105] https://www.igi-global.com/dictionary/green-transportation/52775
[106] MEMR, Annual Report, https://www.memr.gov.jo/ebv4.0/root_storage/en/eb_list_page/bruchure_2019.pdf
Ministry of Environment, 2020) the Hashemite Kingdom of Jordan. 2020. Jordan's Second Biennial Update Report (SBUR) Under the United Nations Framework Convention on Climate Change. UNDP.

Figure 9.21: Final energy consumption by use between 2005 and 2018 (units: 1,000s TOE)



Source(s): MEMR, 2020.

GHG emissions

With regard to pollution, transport is the second largest contributor to total greenhouse gases emissions in Jordan, after energy industries (Jordan Government, 2014). Energy sector produce 72.9% of the total GHG emissions and Table 9.13 shows the breakdown this percentage by energy subsectors.

Table 9.13: Breakdown of Green House Gases (GHG) emission from various energy subsectors (2014, %)

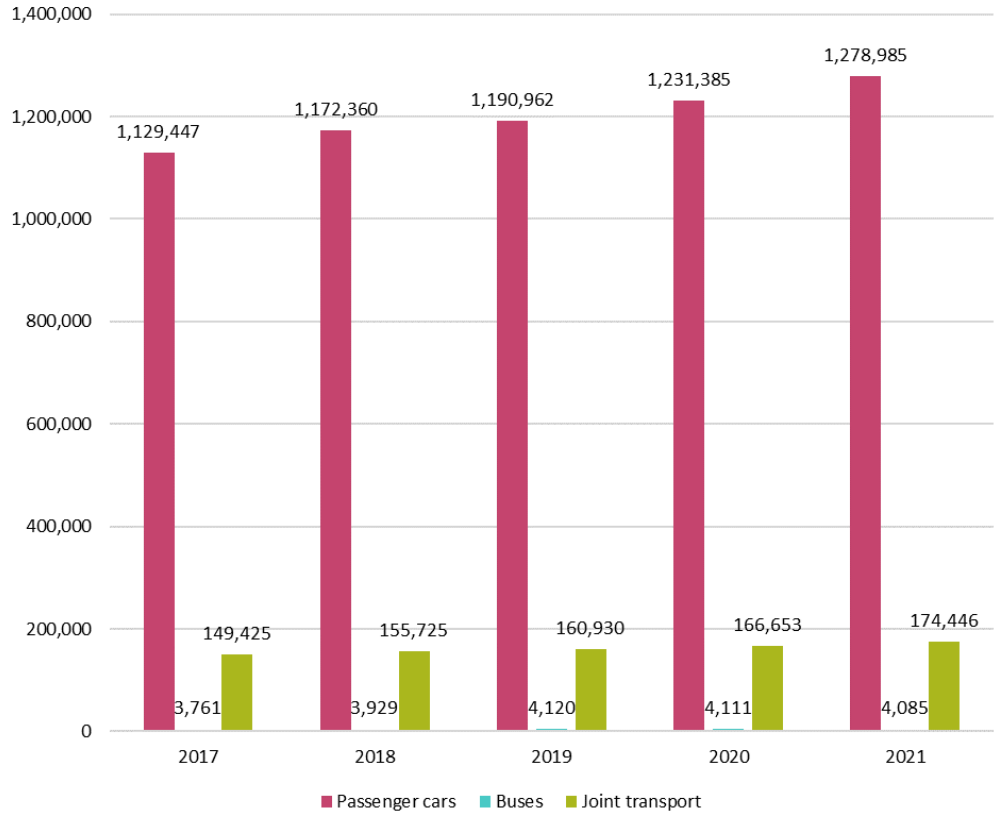
Sub-sector	Share of GHG emissions
Energy industries	27.6%
Transport	16.4%
Other sectors (commercial, residential, and agricultural)	10%
Manufacturing industries	9.3%
Others	9.5%

Source(s): Jordan's Third National Communication on Climate Change, 2014

Passenger vehicles

In 2021, the License Department reports of 1,728,144 vehicles registered in the country. The number of private cars grew by 93.5% between 2008 and 2018 (World Bank, 2022d). Meanwhile, the number of buses and other joint transport vehicles in the country remains low and is only growing slowly – by 9% and 17% respectively between 2017 and 2021 (Figure 9.22).

Figure 9.22: Number of passenger vehicles between 2017 and 2021



Source(s): Annual Report of the Jordan Ministry of Transport, 2021

Electric vehicles

Electric vehicles (EVs) still make for a marginal share of private vehicles. Nevertheless, Jordan can be considered as "one of the pioneers in transport electrification in the Middle East" (Shalalfeh *et al.*, 2021), also due to favourable legislation, with the exemption and/or reduction of customs on EVs imported. As a result, the share of EVs has been increasing significantly, in particular since 2015 (Table 3) and a report by (Friedrich Ebert Stiftung, 2019) estimated that more than 18,000 EVs were circulating in Jordan in 2018. Estimations for 2021 report over 21,500 EVs.[107]

Table 9.14: The number of registered electric vehicles (EVs) in Jordan from 2010–2017

Year	2010	2011	2012	2013	2014	2015	2016	2017
Number of Electric vehicles	24	23	37	57	72	253	797	6,423

Source(s): Shalalfeh et al., 2021, and FES, 2019

To reduce the barriers to the ownership of EVs, legislation now requires all new gas stations to install electric charging stations.[108] In 2018, the government signed an agreement with the company E-Charge, to install 10,000 electric charging stations across the country. As of October 2022, Electromaps reported a total of 96 connectors in more than 53 locations.[109]

[107] https://www.netherlandsandyou.nl/latest-news/news/2021/06/09/nl-jor-dialogue-sessions-electric-vehicles

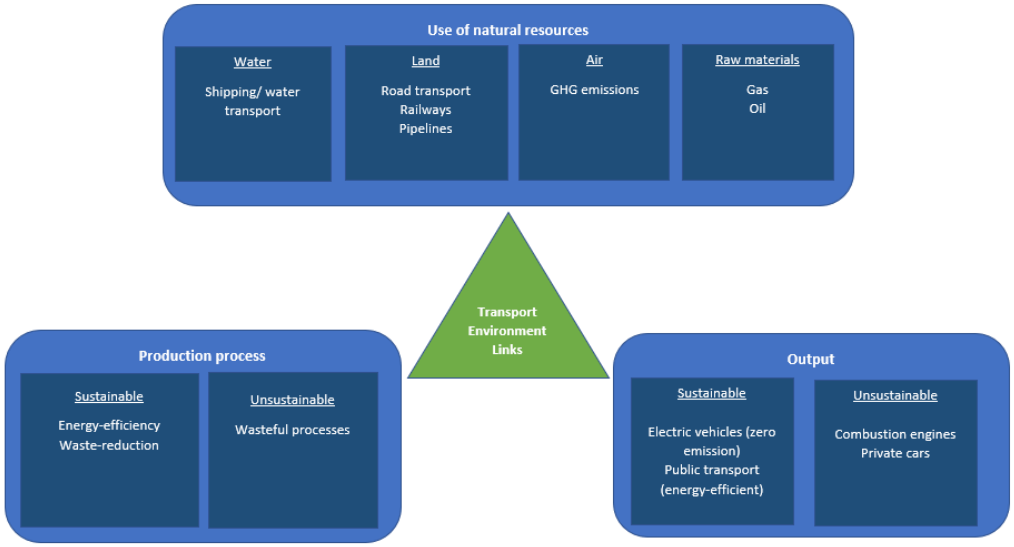
[108] https://www.ammancity.gov.jo/site_doc/climate.pdf?fbclid=IwAR063ZYGb7ESWZZFaBjaNxhYn1VKcU0OqU055JhTLGVXQcuw6v4FF2yl86I

[109] https://www.electromaps.com/en/charging-stations/jordan

Summary of linkages

Figure 9.2 shows an overview of the linkages between transport sector activities and the environment in Jordan.

Figure 9.23: Transport activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems: environment, climate, social

Environment and Climate

The transport sector in Jordan is the second-largest contributor to GHG emissions and the most important user of energy, primarily composed of fossil fuels. The sector, and in particular land transport, is characterized by the absence of a comprehensive and efficient public transport network, both for densely populated and rural areas. Jordan is also not connected via railway to link cities and villages, either for passenger and goods transport. The majority of people therefore use their own vehicles to move and rely on trucks and vans for the movement of goods. Jordan has only one sea port, Aqaba, which is relatively far from the capital city, Amman, and other populated cities. Therefore, also imports and exports of goods via Aqaba port need to be transported via roads. All of this contributes to the high level of GHG emissions and environmental degradation due to the transport sector, congests roads and further increases the negative environmental impact.

Improving public transport systems in Jordan would result into significant environmental benefits (World Bank, 2022d). Further investment into e-mobility would further reduce the carbon footprint of transport. Custom reductions and other measures undertaken to boost e-mobility are however not backed up by a sufficient infrastructure to charge the EVs.

Social

Inefficient transport networks increase the cost of mobility, in terms of expenses and time. This negatively impacts mobility of people and their employability. Mobility constraints often represent an additional difficulty in finding jobs for people in rural areas and in particular for women. Traffic congestion leads to pressure on public infrastructure and to frustration among people[110].

[110] https://ps.boell.org/en/2020/01/27/how-transportation-can-help-jordan-achieve-its-climate-commitments

Subset of core green activities or selected environmental-related and socially sustainable activity

Based on the analysis of sectoral activities in Jordanian transport and their links with the environment, Table 9.15 presents a set of activities which can be described as 'green' activities. These activities are either sustainable in their production processes (e.g. more efficient in their use of natural resources), produce green outputs, or result in outcomes which support social sustainability.

Table 9.15: 'Green' activities in the Jordanian transport sector

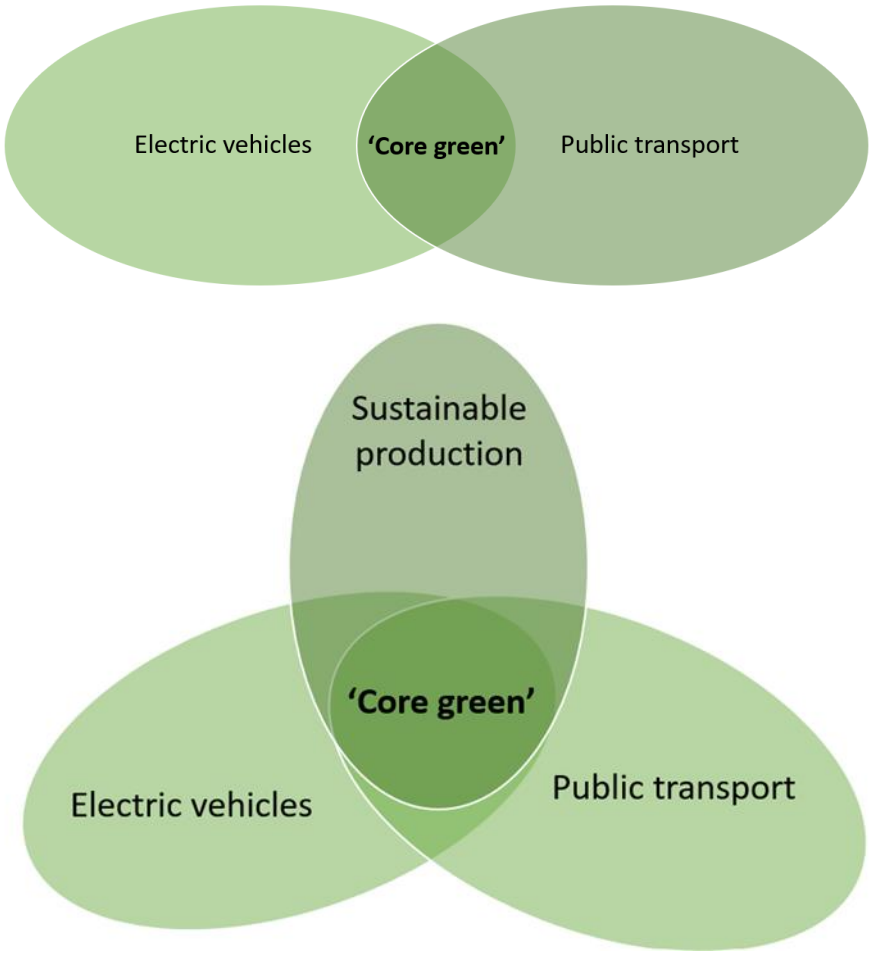
Activity	Description	Environmental impact	Extent	Jobs	Potential mapping to detailed ISIC Rev 4
Electric vehicles	Vehicles with electric motor, as an alternative to combustion engines	No Greenhouse Gases emissions Pollution linked to the disposal of e-cars batteries	~ 20,000 EVs		351019 Other activities of Electric power generation, transmission and distribution 432190 Other types of electrical installation 452013 Cars electrical repair 453031 Wholesale and retail sale of motor vehicle batteries, lighting equipment and electrical parts 475250 Retail sale of electrical equipment and installations 272040 Manufacture of electric batteries and their parts 293099 Other activities of manufacturing motor vehicle parts
Public transport	Mass transit	Reduced emissions per passenger (compared to private transportation)	Insufficient		4921 Urban and suburban passenger land transport 4922 Other passenger land transport
Transport via railways	Rail transportation of passengers and/or freight using railroad	Decreased GHG emissions, use of land, impact on landscape and ecosystems	Nearly non-existent		4911 Passenger rail transport, interurban 4912 Freight rail transport

Source(s): Cambridge Econometrics

A broader definition of green transport encompasses “the transportation service with a lower negative impact on human health and the environment compared to existing transportation services” (Björklund, 2011) but can also include the efficient use of traditional fuels, the increased deployment of electric vehicles, and strengthening of public transport (Lee and Hashim, 2017). According to such a broader understanding of green transport, pipeline transportation (4930 category of ISIC-4) would be also considered as a green alternative towards road transport of liquid gas and fuels (Shaton, Hervik and Hjelle, 2020).

The classification of ‘core green’ activities goes beyond the adoption of a ‘green’ activity in a sector, but looks at a combination of related possible activities, as well as the output. Figure 9.3 provides an example of this, looking at ‘green’ transport practices. While electric vehicles can be considered green transport, their production, maintenance and disposal might involve unsustainable processes and generation of emissions. Public transport has the benefit of reducing congestion by servicing a larger number of people compared to private vehicles. In combination, various activities can result in ‘core green’ output.

Figure 9.24: Illustration of ‘core green’ activity classification as a combination of ‘green’ activities



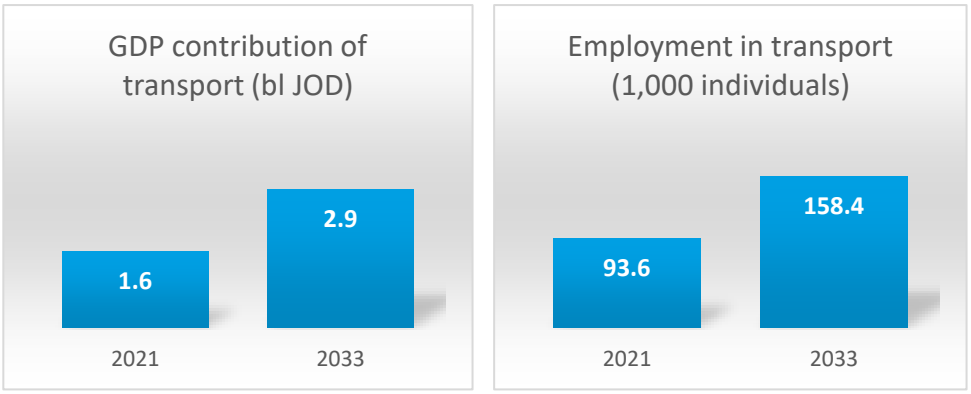
Source(s): Cambridge Econometrics.

Reforms and investment: policies, R&D technology

With regard to a green transition of the transport sector, the Jordanian government’s Modernisation Strategy endorses the development of a national

sustainable transport system via the establishment of a network of electric charging stations, “strengthening regional transport links, building the north-south railway network, connecting the Kingdom’s northern part with its southern part through the national rail network, upgrading port facilities and road networks, renewing/modernising the trucking fleet” as well as “enhancing environmental policies and regulations for people’s mobility (EVs, lower GHG emissions, etc.)” (Jordan Government, 2022). To help materialize its vision for the transport sector, the strategy sets targets of sectoral growth of 5% by 2033 and an increase in employment by 4.5% per year (Figure 9.25). These targets are intended for all initiatives in the sector, not just for the components related to green transformation.

Figure 9.25: Sectoral targets for transport for 2033



Source(s): Jordan Modernisation Strategy, 2022.

The Transport Sector Green Growth National Action Plan for 2021–2025 is one of the most important documents setting the strategy for a green transition of the transport sector. It was formulated to implement the Green Growth National Action Plan 2021-2025. A further document including elements related to a green transition in the transport sector is the Long-Term National Transport Strategy and Action Plan by the Ministry of Transport. Further strategies with a specific reference to the highly populated and congested capital city are: Amman Climate Plan - a Vision for 2050 (Amman City, 2019), and Amman Green City Action Plan 2021.

Table 9.16 presents an overview of Green Growth Priorities as found in existing national documents.

With regard to investment activities, aimed at promoting the deployment of green activities in the transport sector, the Transport Sector Green Growth National Action Plan for 2021–2025 (Jordan Government, 2020d) presents an overview of the most significant investment into green transportation (Table 9.16).

Table 9.16: Set of initiatives from the Transport Sector Green Growth National Action Plan for 2021–2025

Activities	Estimated Investment (USD)
Develop and/or update Transport and Mobility Action Plans and Capital Investment Plans for the secondary metropolitan areas of Mafraq, Zarqa, and Irbid	5,000,000
Approve and Activate the National Public Transport Fund and identify mechanisms to raise capital for public transport infrastructure	51,000,000
Scale up the provision of public-school bus services in all municipalities (Scale-up Smart Move Project)	15,000,000
Implement a pedestrian green infrastructure enhancement program in local commercial areas and near public transport	25,000,000

Support the deployment of Intelligent Transportation Systems (ITS) to allow a modal and fare integration of the public and private transport systems in the city of Amman	9,870,000
Establish a national center of excellence and capacity building program for sustainable transport	1,000,000
Develop a joint public-private strategy and roadmap to improve the environmental sustainability of the logistics sector	1,000,000
Design and implement a public transport electric mobility pilot and capacity building program in Amman	5,000,000
Establish low-carbon municipal bus fleets for Irbid, Zarqa and Madaba municipalities	22,000,000
Develop a national electric mobility strategy and action plan	1,000,000

Authorities are planning to reinvest in public transportation, making it more efficient and environmentally friendly. Amman's municipal government has purchased 100 electric cars for government use and 30 electric taxis. Further to reform mobility in Amman municipality, the Bus Rapid Transit (BRT) aims at establishing a 25 km net of electrified buses running over preferential lanes to grant fast mobility. The target for 2020 would have been to have 150 rapid buses in the Amman municipality serving 315,000 passengers per day.[111]

Barriers to green adoption

The high contributions of GHG emissions by the transport sector and the share of energy used by transport can be linked to the lack of an efficient transportation network, for both passengers and freights. Concerning the mobility of people, public transport is insufficiently developed. Road transport is also the only modality of transportation for goods. The reliance on imports of the Jordanian economy and the predominance of small and medium enterprises, which are served by a large fleet of smaller trucks, represent some of the barriers to green adoption in the sector.

Quoting the Green Growth Strategy among the key challenges of the sector are the "Absence of a sustainable transport system providing mobility and accessibility in a safe and environmentally friendly manner," the "Exclusive operation by private sector (transport sector) hindering transition towards green growth", as well as the "inefficient public transport system in Jordan and fragmented ownership of transport fleets including freight" (Jordan Government, 2020d). The adoption of low carbon vehicles is still in its nascent stages (World Bank, 2022d).

A.6 Sectoral profile – Accommodation and tourism

Economic structure

Accommodation, and Food and beverage service activities (hereafter: tourism sector) are important sectors for the Jordanian economy, which created in 2020 a Gross Output of 789.7 million JOD and 408 million JOD value added, which corresponds to around 1.3% of GDP. This represented a decline of 8.7% in comparison to the year 2019 where the value added was 447 million, that is 1.4% of GDP (Department of Statistics, 2022, National Accounts). Accommodation represents 21.5% of the sector and food and beverage contributes to the remaining share (Figure 1).

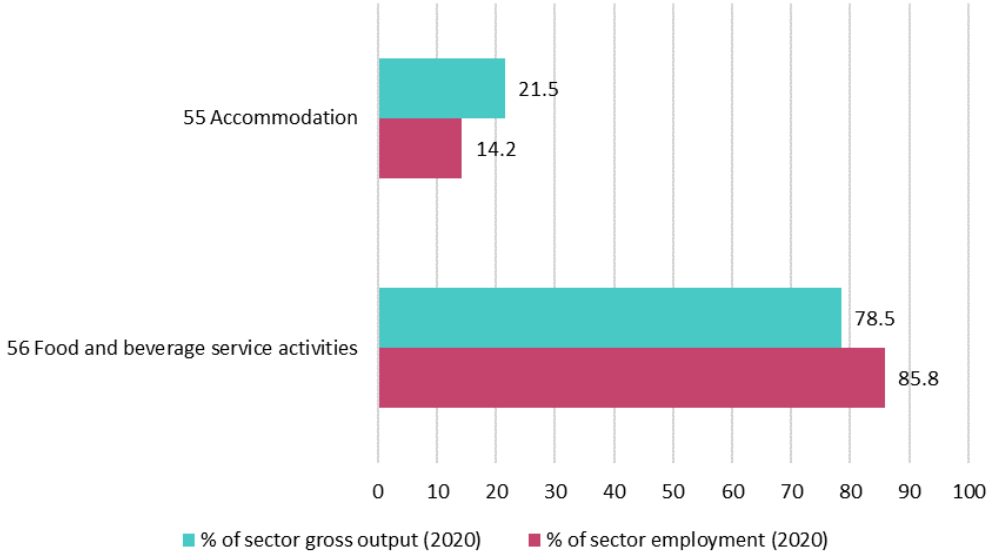
In 2020, tourism employed a total of 92,460 individuals (Jordanians and Non-Jordanians), making herewith for a share of 3.9% of employment. The majority of the employment in this sector is concentrated in food and beverage service activities[112]. The accommodation and food services sector was heavily

[111] https://www.ammancity.gov.jo/site_doc/climate.pdf?fbclid=IwAR063ZYGb7ESWZZFaBjaNxhYn1VKcU0OqU055JhTLGVXQcuw6v4FF2yl86I

[112] Analysis of DoS LFS microdata for 2020, which includes Jordanian and non-Jordanian employed.

affected by the COVID-19 pandemic: in 2020, 8,107 new jobs were created, whereas 19,244 persons lost their job in the sector, which means a net loss of 11,137 jobs (Department of Statistics, Job Creation Survey, 2021).

Figure 9.26: Employment and output within Accommodation by ISIC 2-digit sectors (2020, % of sector)



Source(s): Department of Statistics LSF microdata. Department of Statistics Jordan Statistical Yearbook 2020.

Table 9.17 provides employment and output figures for tourism sub-sectors in levels and percentages.

Table 9.17: Employment and gross output in tourism, accommodation, and food services by ISIC 2-digit level

Isic 2 digit	Employment (2020)	% of sector employment (2020)	Gross output, 000 JD (2020)	% of sector gross output (2020)
55. Accommodation	13,148	14.2	169,617	21.5
56. Food and beverage service activities	79,312	85.8	620,109	78.5
Total	92,460	100	789,726	100

Source(s): Department of Statistics LSF microdata. Department of Statistics Jordan Statistical Yearbook 2020.

Informality in Jordan is high: according to Islam et al. (2022) it can be estimated to reach 59% of formal employment and according to the Jordan Strategy Forum (2020), 41.4%. Notably, informal economy practices and informal employment in the accommodation and food services sector are widespread worldwide (Uguz and Kaya, 2016) and are present also in Jordan (GIZ, 2019b). Seasonality of activity and the large number of micro, small, and medium enterprises can facilitate informal economy and employment practices.

Conceptually, tourism, accommodation, and food activities can be examined together, as they are part of the tourism value supply chain (Baloch *et al.*, 2022). According to the Green Growth Tourism Sector Action Plan (Jordan Government, 2020c), “tourism is the second-largest private sector employer in Jordan with about 8% of employed population in the year 2017 and with the estimation to reach 16% by the year 2025. […] 39% of those employed in the tourism sector work for tourism accommodation (hotels) subsector, 39% at

restaurants, 9% at travel agencies, 4% at tourist's transport companies, 2% as tourist guides, 2% in tourist shops, and the remaining are in other tourism sub-sectors. In addition, these also employ thousands of indirect employees in the sector."

Environment-economy linkages: primary, secondary

Use of resources

In general, tourism can be associated with the depletion of resources, such as energy, water, land, and fuels, but is also responsible for emissions, increases in solid waste, and loss of biodiversity. Worldwide, the UNDP estimates that "In a 'business-as-usual' scenario, tourism would generate through 2050 an increase of 154% in energy consumption, 131% in greenhouse gas emissions, 152% in water consumption and 251% in solid waste disposal." (UNEP, 2022).[113]

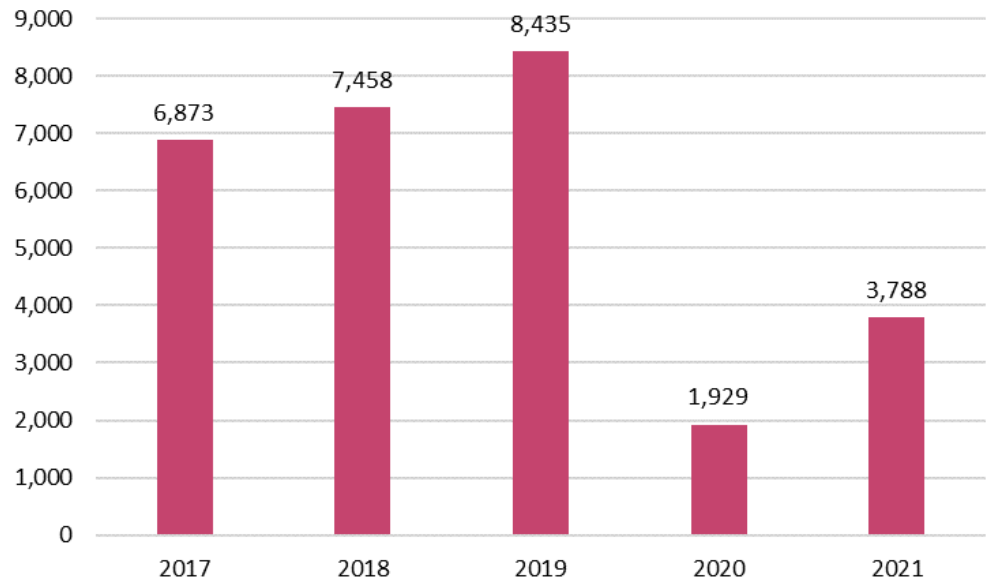
Therefore, sustainable tourism, responsible tourism, and ecotourism are becoming increasingly important concepts. With the aim of promoting environmental and social development aspects of tourism, the Ministry of Tourism and Antiquities (MoTA) commissioned a Strategic Social and Environmental Assessment (SEA) as part of the 2021-2025 National Tourism Strategy's action plan.

GHG emissions

In Jordan, tourism contributes to energy use and GHG emissions from the three main categories in order of importance: transport, accommodation, and tourism support activities. In addition, the inflow of tourists is also associated with an increase in solid waste by 0.13% of total solid waste generated in Jordan (Ecoconsult, 2022).

All of these effects are directly related to the number of tourists. As shown in Figure 9.27, mobility restrictions due to the COVID-19 pandemic caused a decrease in the number of individuals entering Jordan. According to the SEA conducted by Ecoconsult (2022), touristic movements are expected to reach an inflow of 5.5 ml individuals by 2025.

Figure 9.27: Number of arrivals between 2017 and 2021



Source(s): Department of Statistics Jordan Statistical Yearbook 2020.

[113] https://www.unep.org/explore-topics/resource-efficiency/what-we-do/responsible-industry/tourism

Notably, natural resources are very relevant to touristic activities: natural resources are among the factors attracting tourists and conservation of nature is an essential input to many touristic activities.

Therefore, the linkages between the environment and tourism are related, on the one hand, to the fact that tourism increases the stress to which ecosystems are exposed and, on the other hand, to the fact that environmental quality promotes tourism. As such, “tourism is an important driver for the protection of Jordan’s natural environment” (Jordan Government, 2020c).

Ecotourism

In this regard, the Royal Society for the Conservation of Nature (RSCN) is one of the key players in supporting ecotourism, which it defined as “the responsible travel to natural areas that conserve biodiversity and sustain the well-being of local people. Ecotourism aims to generate income to support protection, create nature-inspired jobs that do not exert pressure on the natural resources of the area, change attitudes towards conservation, and to help people understand and value their natural heritage.” (RSCN, homepage).[114]

Ecotourism can be estimated to account for 18% of all touristic activities in Jordan (GIZ, 2019b).

The RSCN established the first biosphere in Dana Natural reserves in 1994 and is currently operating 23 initiatives and projects in the field of ecotourism adopting a sustainable development approach. Projects range from the management of campsites, eco-lodges, and restaurants (mostly operated under the umbrella of Wild Jordan) to promote activities with strong linkages to well preserved ecosystems, such as canyoning, cycling and hiking.

A list of the most important natural reserves and biospheres in Jordan is presented in Table 9.18. The list can help with understanding where are the hubs of ecotourism in the country. According to GIZ (2019b), the reserves receive around 100,000 visitors per year.

Table 9.18: List of most important natural reserves in Jordan

Natural reserves in Jordan
Azraq Wetland Reserve
Dana Biosphere Reserve
Dibeen Forest Reserve
Fifa Nature Reserve
Qatar Nature Reserve
Yarmouk Forest Reserves

Source(s): Compiled by the authors based on several sources.

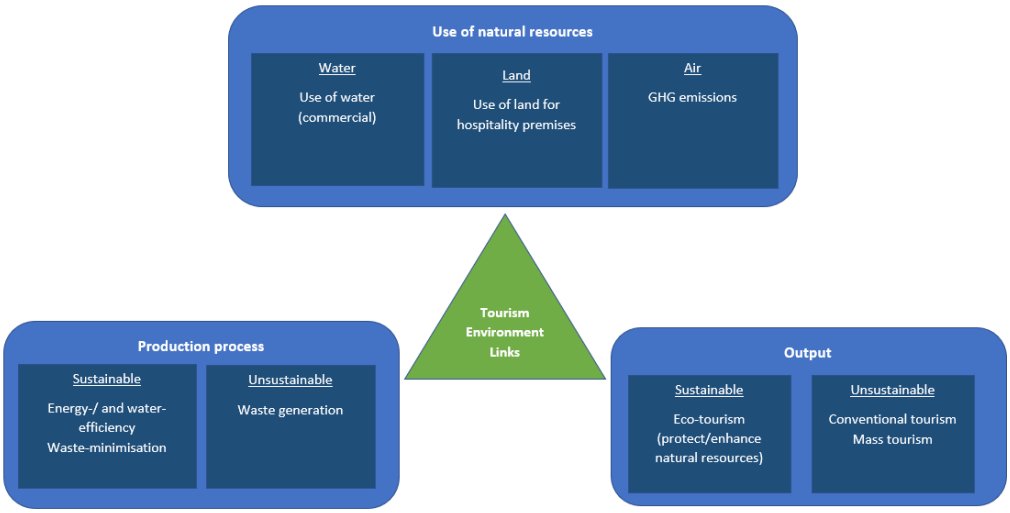
Further attractions linked to ecotourism, which characterizes Jordan as a high potential market, are Wadi Rum (177,569 visitors in 2017, according to Shahateet and Partale, 2019), the Jordan Trail (7,500 visitors in 2017) , the Dead Sea, and Aqaba. According to the study by USAID (2017), ecotourism and adventure tourism are capable of generating up to 500 formal jobs (USAID, 2017).

[114] https://www.rscn.org.jo/ecotourism

Summary of linkages

Figure 9.28 shows an overview of the linkages between agricultural activities and the environment in Jordan.

Figure 9.28: Tourism activities in Jordan and their links with the environment



Source(s): Cambridge Econometrics.

Sector-related problems: environment, climate, social

Business

The accommodation, food services, and tourism sectors were among the sectors which suffered more from the COVID-19 pandemic. In 2020, the Jordan Inbound Tour Operators Association expected up to 40,000 job losses in tourism, hospitality, and related businesses. The sector is slowly recovering, as the number of arrivals (Figure 2) showed, but is still below pre-pandemic levels.

Environment

Climate change is projected to have an impact on the sector, as much of its activities depend on quality of environment, biodiversity, and conservation of nature (Ministry of Environment, 2021). Simultaneously, the sector's activities negatively affect the state of the environment, with significant resource use and waste generation.

Social

Even in the absence of quantifications of informal employment in the tourism sector, precarious and informal jobs can be expected to be widespread: there is a large number of daily and informal workers operating alongside touristic activities, which is however difficult to quantify. The report by USAID (2017) mentions that "in adventure tourism, the majority of firms and operators have an informal, unclear legal status" (USAID, 2017).

Subset of core green activities or selected environmental-related and socially sustainable activity

Based on the analysis of sectoral activities in the sector and their links with the environment, Table 9.19 presents a set of activities which can be described as 'green.' These activities are sustainable in their production processes as they rely on renewable resources and/ or minimize the production of waste and other negative externalities.

Table 9.19: 'Green' activities in the Jordanian accommodation and food service sector

Activity	Description	Environmental impact	Extent	Jobs	Corresponding ISIC Rev 4 sector

Green hotels and other hospitality structures	Hotels and other hospitality premises with a green certification, and/ or relying on renewable energy power supplies, as well as adopting other green economy practices	Reduced GHG emissions, waste generation	Several large and medium sized hotels are powered by solar PVs		5510 Short term accommodation activities
Eco-lodges	Accommodation premises minimizing the impact on the environment		RSCN ecolodges (~ 23 sites)		
Eco-camping	Camping premises minimizing the impact on the environment				5520 Camping grounds, recreational vehicle parks and trailer parks
Ecotourism	Also called adventure tourism, ecotourism can be defined as "the responsible travel to natural areas that conserve biodiversity and sustain the well-being of local people." (RSCN, homepage)	Ecotourism aims to generate income to support protection, create nature-inspired jobs that do not exert pressure on the natural resources of the area, change attitudes towards conservation, and to help people understand and value their natural heritage." (RSCN, homepage)		Up to 500 formal jobs (USAID LENS, 2017)	552001 Environmental tourist camps … 791101 Activities of travel and tourism agencies 551043 Tourist hostel 551044 Resorts 551046 Farm lodges

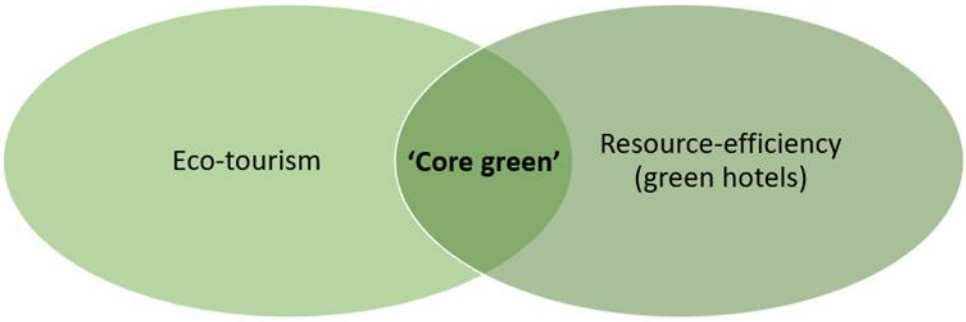
Source(s): Cambridge Econometrics

The classification of 'core green' activities goes beyond the adoption of a 'green' activity in a production process (i.e. use of clean technology), but also looks at other practices, as well as the output. Figure 9.29 provides an illustration of how we could look at 'core green' tourism activities. As per the definition of ecotourism, this activity could be considered being 'core green', as it aims to preserve natural resources, in some instances, even reverse negative effects through conservation/restoration efforts. Ecotourism moreover

raises awareness of for conservation efforts and allows for the collection of funds to be used in furthering environmental protection action. Coupled with resource-efficient and waste-mitigating processes, such as the case for accommodation with green certification, this would be characterised as a 'core green' activity within the tourism sector.

When thinking about classifying activities prevalent in ecotourism, in theory, these could cover any activities within the tourism sector. To determine the extent of 'core green' tourism activities, therefore, requires detailed information about the volume of ecotourism activities in Jordan.

Figure 9.29: Illustration of 'core green' activity classification as a combination of 'green' activities

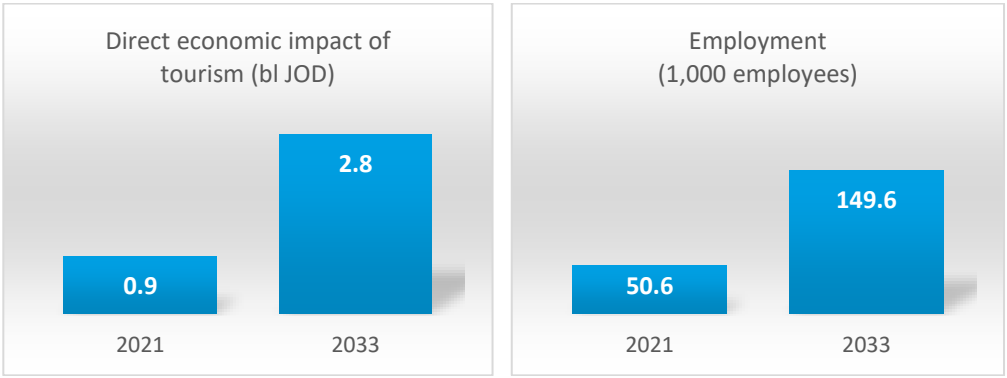


Source(s): Cambridge Econometrics.

Reforms and investment: policies, R&D technology

Nature and culture, as well as adventure tourism are listed by the Economic Modernization Vision 2023 (Jordan Government, 2022) among its economic priority sectors. The targets it envisions for the tourism sector (not just from green initiatives within it) are presented in Figure 9.30.

Figure 9.30: Sectoral targets for the Jordanian tourism sector for 2033

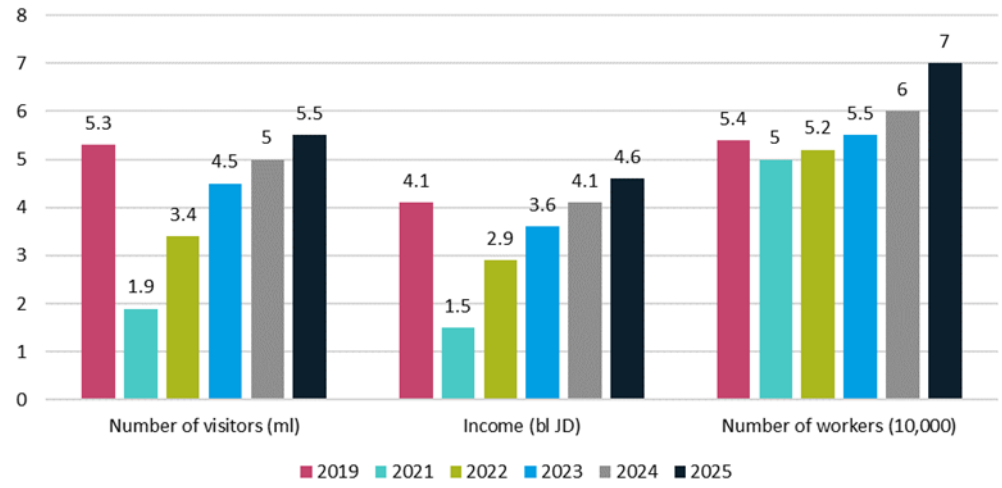


Source(s): GoJ, 2022, Economic Modernization Strategy.

The National Tourism Strategy relies on five main pillars: (1) Development of touristic products, (2) Development of the human resources working in the sector, (3) Marketing, (4) Heritage management and protection, and (5) Sectoral reform, through reviewing all legislation governing the work of the tourism sector. Not all of these pillars contain a specific focus on plans and initiatives for green or ecotourism but are rather centered on reforming the sector and increasing the attractiveness of Jordan as a touristic destination.

The National Tourism Strategy 2021-25 estimates that pre-COVID-19 levels will be reached by 2025, both in term of number of visitors and income. Moreover, an increase in the number of workers is expected (Figure 9.31).

Figure 9.31: Key performance indicators in the Jordanian tourism sector



Note(s): The year 2020 is not included due to the COVID-19 pandemic
Source(s): National Tourism Strategy 2021-2025.

The Tourism Sector Green Growth National Action Plan for 2021–2025 is one of the most important documents setting the strategy for a green transition of the tourism sector. It was formulated to implement the Green Growth National Action Plan 2021-2025.

Table 9.20 presents an overview of Green Growth Priorities as found in existing national documents and as reported by the Tourism Sector Green Growth National Action Plan for 2021–2025. In particular, the tourism sector in Jordan is committed to support the Nationally Determined Contributions to climate change reduction, the national energy strategy, the Jordan national green growth plan, and the biodiversity-friendly tourism charter (Ecoconsult, 2022).

Table 9.20: Green Growth Priorities as found in existing national documents

Relevant plans and strategies for Tourism Sector
Aqaba Ecotourism Development Plan
Jordan's Tourism Sector Analysis and Strategy for Sectoral Improvement
Jordan Vision 2025
NDC and NDC Action Plan

Source(s): Tourism Sector Green Growth National Action Plan for 2021–2025

More specifically, the Tourism Sector Green Growth National Action Plan for 2021–2025 presents an overview of the most significant investment into a green growth of the sector (Table 9.21).

Table 9.21: Summary of initiatives as of the Tourism Sector Green Growth National Action Plan for 2021–2025

Initiatives	Period	Estimated investment (USD)	Target/goals
Develop and implement a green growth capacity	2021-23	1,500,000	Advisory, on-job training and

building program for tourism sector stakeholder			mentorship program designed, implemented, monitored and evaluated for MoTA (3-year program)
Develop a roadmap for crisis, disasters and climate change management in the tourism sector	2021-22	500,000	
Develop a roadmap for increasing resource efficiency in the tourism sector	2021-22	1,200,000	
Scale-up and expand the Jordan Trail	2021-23	11,000,000	Enhance the environmental and social performance of the trail
Scale up eco-tourism experiences in protected areas and stimulate linkages with other tourism products	2021-24	17,000,000	Vocational training services using the modules developed by the above mentioned program delivered for at least 50 trainees
Improve tourism products and services in and around Petra	2021-24	40,000,000	Capacity for enforcement of environmental and tourism laws, and for improved service delivery enhanced among PDTRA staff and other Service Providers Capacity

The Green Growth National Action Plan also signals that the Jordan Renewable Energy and Energy Efficiency Fund (JREEEF) is also supporting 3- and 4-star hotels at important touristic sites to implement energy conservation and efficiency measures.

Barriers to green adoption

The Green Growth National Action Plan 2021-2025 for the Tourism sector focuses on four main domains of action: increasing coordination, increasing the sector's profitability, mainstreaming sustainability, and presenting investment opportunities. However, the plan does not clearly present the available opportunities Jordan has in green tourism and does not envision the tools to upscale touristic attraction and destinations in tune with eco- and sustainable tourism and hospitality. The National Strategy for Tourism 2021-2025 released by MOTA blurs the picture further: it does not present any plan related to a green transition and it is difficult to find linkages to the Green Growth National Action Plan. Therefore, one of the main challenges for the sector is to identify the potential of green tourism and to have a unique institutional umbrella for coordinating the efforts in boosting green activities and initiatives in accommodation, food services, and tourism.

Green transition needs investment and highlights the importance of corporate social responsibility, given the involvement of a large number of private sector stakeholders. The government may play a pivotal role in supporting this transition, creating incentives to the adoption of quality certification related to environmental aspects.

Among the factors discouraging investments are the regional instability which is increasing the volatility of revenues of touristic and hospitality operators, but also the informality of labour and of actors which is affecting the entire accommodation and food services sector, as it increases competition in the lower price segment.

Further barriers to green adoption are related to the main role played by accommodation, food services, and tourism in transportation (Toubes and Araujo, 2022). Moreover, mass tourism is contributing to environmental degradation, pollution of coastal areas and other natural sceneries, while also generating considerable flows of income, which represents a clear trade-off for the regulator to try to strike a balance between these two aspects.

Appendix B Annex B – Other information

B.1 Data Sources

The Department of Statistics (DOS) in Jordan gathers and publishes employment data using three main surveys:

- Labour Force Survey
- Employment in Establishment Survey
- Job Creation Survey

Frequency of implementation, scope of the survey population and collected variables differ between the surveys.

Labour Force Survey (LFS)

The LFS is carried out and reports data every quarter, covering about 16,000 households. In terms of employment data, "employed persons" includes both employees and self-employed/own-account workers.

Most data between 2000 and 2021 are available in terms of percentage distribution, offering breakdowns of employed persons by the following categories (among others):

- Main Current Economic Activity (sectors)
- Current (broad) occupation
- Employment Status
- Age
- Sex
- Educational Level
- Usual hours
- Wage

Since 2017, data for a selection of indicators is also published in absolute numbers, although mostly only covering the Jordanian employed population, while absolute numbers for the non-Jordanian population is not published.

Employment in Establishment Survey

The survey gathers and provides annual data on the number of employees in establishments. The employment data therefore excludes self-employed/own-account workers.

Data is available for most years since 1992 leading up until 2019. The published data is in absolute numbers and includes employee numbers, broken down by the following categories (among others):

- Economic Activity (sectors)
- Size of establishment
- Paid and Unpaid employees
- Sex
- Nationality
- Average Work Hours and Wage

Job Creation Survey

The *Newly Created Job Opportunities Survey* is carried out bi-annually and covers 40,000 households. It provides statistics on the extent (absolute numbers and percentages) of new and lost jobs as well as the net job

creation/loss. The definition of jobs includes employees as well as self-employed persons.

Data on new and lost as well as net jobs is available by various breakdowns, including:

- Economic Activity (sector)
- Broad Occupation
- Education
- Sex
- Age

B.2 Sector Groupings

Broad sector	Specific sectors included
Primary	Mining and quarrying Agriculture, Forestry and Fishing
Secondary	Construction Manufacturing
Tertiary	Arts, entertainment and recreation Water supply, sewerage, waste management and remediation activities Real estate activities Electricity, gas, steam and air conditioning supply Financial and insurance activities Information and communication Activities of extraterritorial organizations and bodies Professional, scientific and technical activities Human health and social work activities Other service activities Accommodation and food service activities Transportation and storage Administrative and support service activities Education Wholesale and retail trade; repair of motor vehicles and motorcycles Public administration and defence; compulsory social security Activities of households as employers; undifferentiated goods and services-producing activities of households for own use

B.3 About Frames model

CE has developed a new E3 modelling tool, the Framework for Modelling Economies and Sustainability (FRAMES). FRAMES is a single-country framework designed to support modelling work for countries where data are limited. The data requirements are substantially less than more complex macroeconomic models, like E3ME. Notably, the framework can be used to

provide a model for emerging economies, where data tends to be less detailed and available for shorter time periods.

FRAMES is an advanced input-output tool designed to examine the socioeconomic and environmental effects of E3 policies. It is based on a post-Keynesian economic framework, and its assumptions are consistent with this branch of economics. The application of this theory to economic modelling are informed by E3ME. FRAMES can be considered a simplified, single-economy version of E3ME.

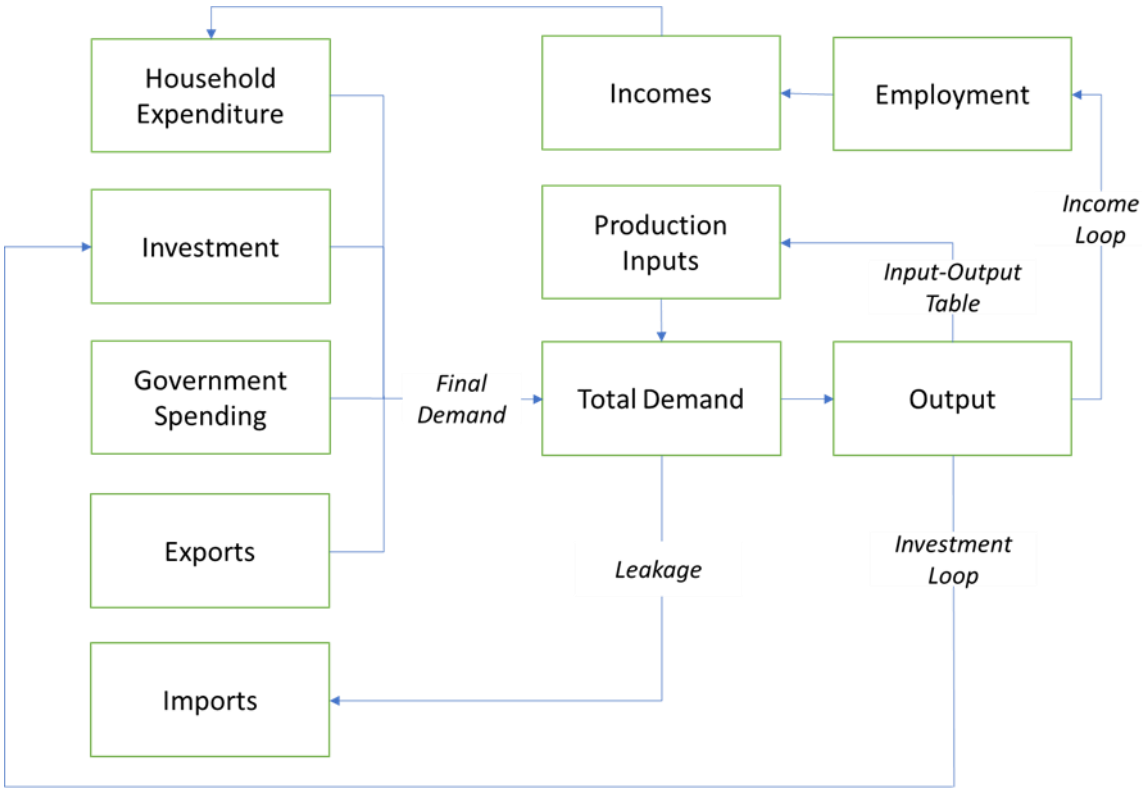
The key features of FRAMES are:

- an economic accounting framework based on the system of national accounts
- integrated treatment of the economy, energy, and the environment, with linkages between each component
- detailed sectoral disaggregation, and a national level input-output table, reflecting the specific structure of the economy
- year-by-year annual projections
- calculations of household income effects by quintile, providing distributional results

Applications of FRAMES are typically as a *simulation* tool: the model is calibrated to provide a 'baseline' projection and then the results for a scenario are compared against that baseline to estimate the impact of changed assumptions in the scenario. Consequently, many of the equations are expressed directly as 'change from baseline', and only consider the impact of a change in certain explanatory variables, rather than representing a complete explanation of the determination of the endogenous variable (of the kind found in E3ME).

Figure 9.32 details the basic economic structure in the model. At the core of the economic modelling in FRAMES is a national input-output table. Relationships for investment, prices, employment, and trade are modelled using elasticities which are drawn from the econometric estimates in E3ME.

Figure 9.32: Economic Structure in FRAMES



The results of modelling in FRAMES include:

- GDP and its final expenditure components: household consumption, investment, government consumption, exports, and imports
- economic variables by sector/product: output, GVA, investment, exports, imports, and employment.
- energy variables by sector: energy consumption by fuel.
- environmental variables by sector: emissions of CO_2 and local air pollutants

In 2019, FRAMES was used to assess the socioeconomic impacts of environmental tax reform in Bangladesh[115]. The work, completed with Ex'tax, provides evidence of co-benefits of environmental policy; namely, positive macroeconomic impacts alongside reduced emissions. In 2020, FRAMES was used in a study for the European Commission (DG Environment), assessing the potential impacts of circular economy policies in Africa.[116] In 2021, FRAMES was used in a study for the World bank to assess the economic impacts of the adoption of government eProcurement in Bangladesh.

FRAMES Jordan

The data use to populate FRAMES Jordan are summarised in Table 9.22.

Table 9.22: Summary of data inputs

Data	Source	Comments
IO tables	DoS https://dosweb.dos.gov.jo/nationalaccount/input-and-output/	• 2018 table is most recent. • We use 2018 as the price base for the modelling • We use the IO tables sectoral classification for the modelling
National accounts	DoS https://dosweb.dos.gov.jo/nationalaccount/quarterly-estimates/tables_quarterly/	• Data up to 2022 in the quarterly national accounts • Data is used from 2018-2021 to grow data from the 2018 IO table (gross output, GVA, compensation of employees)
GDP expenditure components	World Bank https://data.worldbank.org/indicator/NE.CON.PRVT.KN	• Investment, household consumption, government consumptions, imports, exports • Use these totals to grow the sector level demand components of the 2018 IO table
Investment by sector		Estimate by using shares of gross operating surplus / mixed income
Savings rate	EBRD (2020) Jordan Diagnostic, https://www.ebrd.com/country-diagnostic-paper-jordan.pdf	
Taxation policy (direct)	EBRD (2020) PWC (2023) Jordan, https://taxsummaries.pwc.com/jordan/individual/	
Price indices	DoS, https://dosweb.dos.gov.jo/economic/price-indices/	
Population forecast	United Nations Population Division, World Population Prospects	Median variant

[115] https://www.camecon.com/news/low-income-countries-benefit-from-carbon-pricing-study-shows/
[116] See final report for the Ghanaian case study: https://cdn.website-editor.net/1d19b3c8e4ec4cea997a5b973b37c28c/files/uploaded/CE%2520EC%2520Country%2520Report%2520Ghana%2520Published.pdf.

	https://population.un.org/dataportal/home	
GDP forecast	IMF, https://www.imf.org/en/Countries/JOR#countrydata	• IMF growth rates from 2022 to 2028 • Assume 2029 and 2030 equal to 2028 • Grow all components of GDP by this, do not try to replicate differential sector growth rates
Employment	DoS	• LFS for 2021 (A, F onwards) • Establishment survey for 2018 (shares for B, C, D, E)
E3ME parameters		• Use Egypt as proxy country • Geographic proximity, similar GDP per capita, structure of economy (primary/secondary/tertiary), neither has large share of oil/gas sector like surrounding Saudi / other OPEC members
Energy and emissions		• Not populating for now. • Would use IEA data probably (World Energy Balances).