An Overview of The Jordanian Food System: Outcomes, Drivers & Activities

Foresight4Food

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Key messages

Catering to the needs of more than 11 million inhabitants across an area of 90 thousand km^2, the Jordanian food system is facing socio-economic, climatic and environmental challenges. Jordan's ecology is marked by arid conditions and limited water resources, resulting in most agriculture situated in the Jordan Valley, Ghor and the Highlands. The Jordanian food system is embedded within a stable political environment, with a well-educated and relatively highly urbanised population, and a significant influx of refugees (from Palestine, Syria, Iraq). High-intensity export agriculture co-exists with extensive farming systems—both rain-fed and irrigated—that are dominated by smallholders, as well as with extensive Bedouin livestock-keeping.

The Jordanian food system delivers a variety of outcomes to society, including the capacity to feed its population, contribution to the GDP, gradual poverty reduction and a reduction in severe undernourishment. Malnourishment exists amongst key population groupings (e.g. refugees), however, anaemia is prevalent and obesity is becoming more prevalent. Income inequality is persistent, the food system is at least partially sensitive to global and regional political-economic volatility, and it is affected by climate change. The National Food Security Strategy 2021–2030 signals Jordan's commitment to food security and systems development. This overview is intended to build a collective understanding of key dynamics in outcomes, drivers and activities. It will help to identify trends and uncertainties that will shape the future of the food system, in addition to providing the foundation for a comprehensive and participatory process drawing upon foresight and scenario analyses.

Highlights of the Jordanian food system:

1. Progress towards global nutrition targets: Although only 3% of all Jordanians are experiencing severe undernourishment, the rate of undernourishment amongst the country's large refugee population is 21%, and two thirds are at risk.
2. Changing consumption patterns and obesity: The national average intake of food groups associated with health and environmental impact (e.g. red meat, fish and dairy) by adults 20 years of age and older significantly exceeds the recommended daily intake. The expansion of supermarket and fast-food retail sales, in which profits are derived primarily from processed foods, has contributed to shifts in dietary choices, leading to a rise in obesity in more than half of the adult population. In 2019, more than 46% of women older than 18 years were obese, 37.7% of women of reproductive age (15–49 years) were affected by anaemia, and 18.9% of all women (18 years or older) had diabetes.
3. Rising food prices: Since 2015, the consumer price index for food has increased by more than 5%, thus having an impact on the affordability of a healthy diet, particularly in terms of meat, poultry, legumes and fruit. Jordan is also highly dependent on global markets, as it imports around 70% of its staple food needs.
4. The food processing industry is growing and drives an increased demand for ingredient inputs, which is expected to double in the next five years.
5. Water stress and climate change: Levels of water stress have doubled since the 1970s, reaching a peak of 103% in 2014. The agricultural sector uses more than 50% of the country's available water resources. Climate change could further reduce water supply and crop productivity, thereby potentially decreasing Jordan's GDP by as much as 6.8%.
6. Declining agricultural employment: In 2021, the agricultural sector employed only 2.5% of Jordan's labour force, with a higher proportion of informal labour (including Asian, Egyptian and refugee workers), relative to other economic sectors.
7. Food waste: Reinforced by cultural norms, altered dietary habits have caused food waste to double over the past two decades, reaching an estimated 93 kg of food waste per person each year.

1 Introduction

Food-system transformations are urgently needed

The transformation of food systems is regarded as an urgent issue around the world. Together with hikes in the price of food, world events like climate change, COVID-19 and Russia's war in Ukraine have awakened the international community to the necessity of reconsidering the ways in which food is produced, handled, consumed and managed. This is critical to ensuring food security for the present generation, as well as for the future. The challenge is to determine how to bring about the transformations that will enable better nutrition, sustainability, inclusiveness and resilience.

The urgency of this transformation calls for a systemic approach to policymaking that can be integrated with 'futures thinking' to assess the longer-term requirements and consequences of alternative scenarios. Creating the political will and societal understanding for change will demand an effective process of scientifically informed stakeholder engagement. Such processes should integrate systems approaches with foresight and scenario analysis, supported by the effective use of data, computer modelling, data analysis and visualisation.

Prioritising food-system change in Jordan

The Food Systems Summit of 2021 underscored the need to transform food systems and chart broad directions for change. These directions must be implemented at the national and local levels, and it will not be possible without greatly enhancing forward-looking processes of engagement between policymakers, researchers and society as a whole.

In Jordan, food security and food systems have had high priority on the development agenda since 2021. With cooperation between the government, the private sector and civil society organisations, and with support from the World Food Programme (WFP) and the Food and Agriculture Organization (FAO), Jordan has developed its first National Strategy for Food Security 2021–2030. One part of this strategy consisted of establishing the Council for Food Security, which is chaired by the Head of Entity (H.E.) the Minister of Agriculture of Jordan. The Jordanian government is working to establish a Food Security Management Information System and a Food Security Dashboard. In addition, it has recently launched the 'No Food Waste Initiative', which aims to reduce food waste to a minimum during the upcoming decade. This initiative seeks to develop a clear framework and to conduct research to address the issue of food waste in the country.

The aforementioned efforts have created a strong foundation for considering the future of the food system in Jordan from a variety of perspectives. This will entail asking the following and other questions about food systems. What is the food system expected to deliver in terms of outcomes, not only to enhance national food and nutrition security, but also to contribute to socioeconomic development in Jordan? How should Jordan's precious resource base be preserved and managed sustainably? Which uncertainties could potentially have an impact on the envisaged pathway, and how will they affect the country's aspirations? These issues will be the focus of the planned foresight and scenario analyses, which will involve engaging a variety of stakeholders in a process aimed at clarifying their aspirations while assessing the plausible impacts of risks and uncertainties. Foresight analysis will allow policymakers, practitioners, entrepreneurs, producers and civil society representatives in Jordan to take preliminary and anticipatory action in order to prepare the food system for future demands and plausible events.

Initiating the Foresight4Food process

Foresight approaches have been used for quite some time as a structured method for examining important uncertainties that shape the ways in which decisions taken today might play out in the future. The forward-looking perspective helps to ensure that decision-making is prepared for the future, as well as to test some of the assumptions on which these decisions are based. Merging an understanding of the complex structures and key outcomes of current food systems with foresight approaches, the Foresight4Food initiative developed an approach to

facilitate planning for processes of food-system transition. The first step consists of a comprehensive description of the food system that can be used by a variety of stakeholders. A detailed analysis aimed at generating a collective understanding of the food system could enable stakeholders to make well-considered, evidence-based compromises and informed strategic decisions leading towards a sustainable and resilient future.

The approach consists of the following stages: i) building common ground for the transformation process, which will include building consensus around definitions, methodologies and approaches; ii) identifying and surveying the prevailing food system at the national and sub-national levels; iii) analysing the prevailing food system in terms of nutritional value, financial cost, environmental impact, challenges and inefficiencies and other factors (foresight and scenario analyses); iv) developing new/alternative food systems, including the identification of advantages and disadvantages (foresight and scenario analyses); v) identifying the conditions and requirements for the successful implementation of these systems (i.e. providing the enabling environment); and vi) developing the Road Map and Action Plan for transformation.

The objective of the present report is to describe the Jordanian food system in order to provide evidence-based input for a participatory scenario process and for the development of an Action Plan in Jordan, led by Jordanian stakeholders, to support the development of food-system transformation in that country. Systems and foresight analyses are crucial to helping stakeholders understand the likely consequences of 'business as usual' and to engage in the exploration of the trade-offs, opportunities, synergies and risks of alternative scenarios and pathways. This effort is conducted under the support facility known as 'Foresight for Food System Transformation (FoSTr)', a three-year programme funded by the Kingdom of the Netherlands, overseen by the International Fund for Agricultural Development (IFAD) and implemented by University of Oxford and Wageningen University & Research in five countries: Bangladesh, Jordan, Kenya, Niger and Uganda.

This report is structured as follows:

- Section 2 outlines the approach and methodology used to describe and analyse the food system. It also indicates how this report builds on the concept of food-system analysis and its application to the context of Jordan.
- Section 3 provides key insights into the regional context and geography of the Jordanian food system, describing a variety of farming systems in the three agricultural zones of Jordan.
- Section 4 describes the key outcomes of the Jordanian food system in terms of food and nutrition security, economic and social well-being and environmental sustainability.
- Section 5 provides an overview of the key drivers of the Jordanian food system: demographics, development, consumption, technology, markets, climate and environment, and policy and geopolitics. This section also describes the impact of recent shocks, including the COVID-19 pandemic and the war in Ukraine.
- Section 6 presents an overview of key actors in the Jordanian food system and their activities. It also analyses the producers, processors, traders, retailers and consumers who shape the system on a daily basis.
- Section 7 describes the dynamics between the various elements in the Jordanian food system, focusing on example trade-offs and synergies
- Section 8 provides key conclusions emerging from this food-system mapping analysis, along with initial policy recommendations and suggestions for subsequent research steps within the FoSTr programme.

The report is intended for use in discussions amongst food-system stakeholders in Jordan aimed at building on the ideas presented herein. This published version offers a snapshot of the current status as of 2023.

Foresight4Food recognises the active landscape of initiatives working towards a common goal: to promote sustainable food-system transformation in Jordan. The programme therefore aims to complement such actions and accumulate recent work on Jordan's food system and, ultimately, to compile a comprehensive and up-to-date account of that system.

Disclaimer

This report uses data from both national and global sources. It is important to acknowledge that we have given priority to national statistics whenever they are accessible, contingent upon data availability. We understand that national and global datasets may not always coincide with each other, thus requiring continuous iterations in order to obtain accurate and up-to-date data. This report has been created as the initial iteration of a living document, with the intention of regular updates as additional data become available.

2 Using a food-systems approach

To map the key components of the Jordanian food system, we adopted the Foresight4Food food system framework (Figure 1, below). This framework builds on previous work and incorporates elements of the food-systems framework developed by Ingram (2011), HLPE (2016) and van Berkum et al. (2018). We use this framework as a basis for describing the food system, while customising specific elements to the Jordanian context. We also use it to scan for trends relating to the food system and to detect major drivers behind it. This framework describes the main components of a food system: activities, support systems, drivers and outcomes.

A set of activities forms the core of the food system. These activities are undertaken by a variety of actors, and they include primary production, processing, retail and consumption, along with storage and disposal. Given that, in reality, food systems involve multiple interacting value chains, their proper functioning requires a broad set of support services, including physical and market infrastructure, transport, financial services, information and technology.

The incentives and operating conditions for the actors are influenced by the institutional environment of policies, rules and regulations (e.g. concerning food safety, food quality, financial matters, taxation and environmental considerations), consumer preferences and social norms. These institutions create the formal and informal rules that are applied by key actors to govern the food system.

The food system operates within the wider context of society, which also includes human and natural systems, with multiple interactions and feedback loops between the systems. These wider systems create a set of external drivers and trends that shape the behaviour and evolution of the food system as a whole. At the same time, however, although each system actor influences, is influenced and thus reacts accordingly. The drivers of a food system include population dynamics, consumption preferences, technological developments, global markets, environmental factors and politics. Food-system outcomes can be categorised into three main areas: economic and social well-being, food and nutrition security; and outcomes relating to nature and the environment.

A food-systems model provides the basis for understanding and exploring the critical relations, trends and trade-offs that support any desired system transformation aimed at generating higher levels of desired outcomes. For example, indicators of the three outcomes enable the assessment of whether food systems are functioning in desirable or undesirable ways, in light of wider societal and environmental objectives. Analysis of the drivers behind the current state of food-system performance enable an understanding of the pressures exerted on food systems and influencing the ways in which these pressures are changing (with these drivers subsequently being influenced by the outcomes).

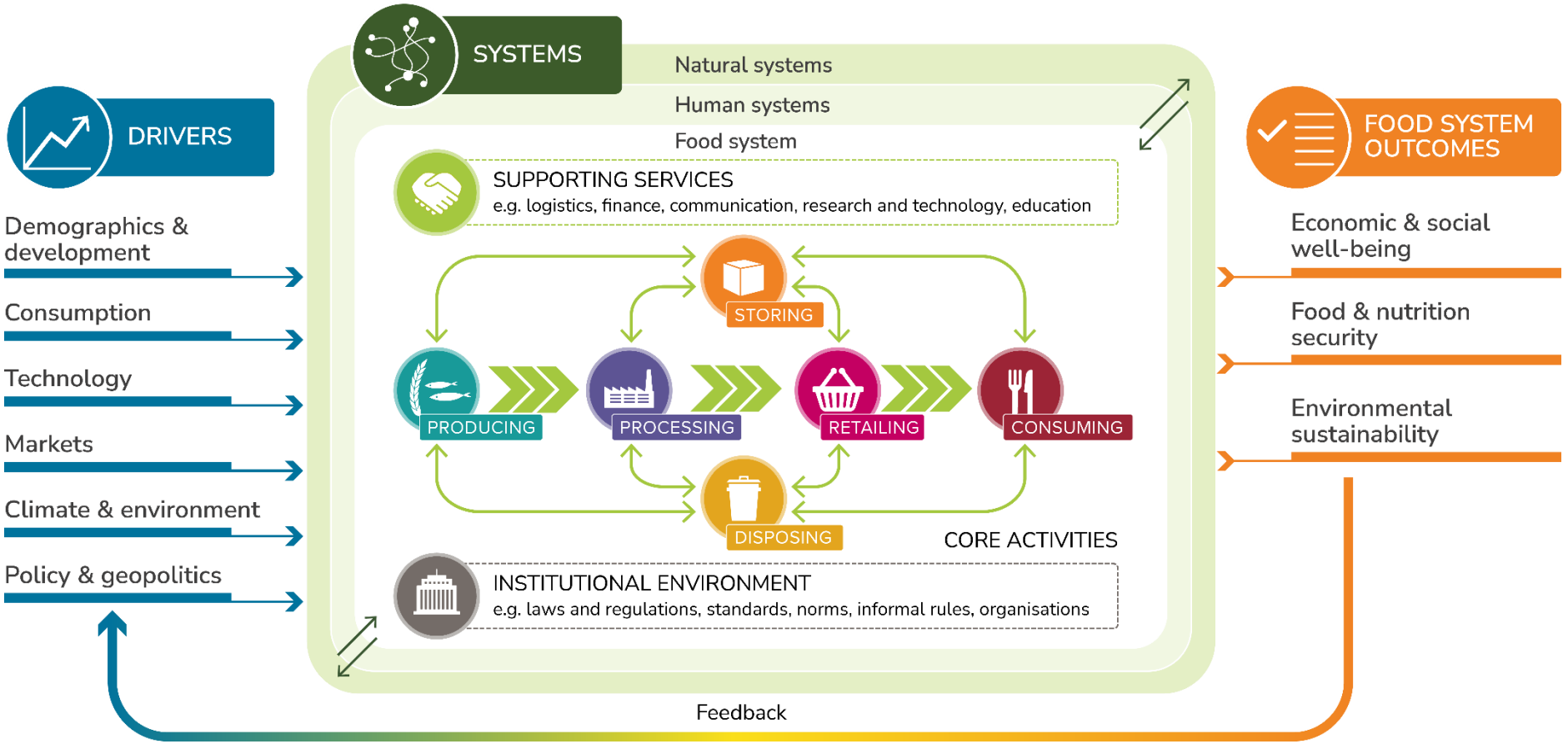

Figure 1 *The Foresight4Food food systems framework*

3 Context & geography

This section provides a description of the regional context, history, geography and water resources of Jordan in relation to its food system.

3.1 Brief context and history of the Hashemite Kingdom of Jordan

The Hashemite Kingdom of Jordan is a country with an area of 90 thousand km^2 in the Middle East Region, bounded by Syria to the north, Iraq and Saudi Arabia to the east and south, and the Palestine West Bank in the west. The country has access to the Red Sea only through the southwestern region, and it is bounded by the Dead Sea in the west. Almost 75% of its area is desert, and the weather is classified as arid and semi-arid. More specifically, 80% of the country receives only 100 mm of precipitation per year. Jordan also has very limited water resources (Nortcliff et al, 2008; UNFPA, 2016).

Jordan emerged from the Emirate of Transjordan in 1921, which was under British administration. At the time of the Emirate of Transjordan, several key factors shaped the country, particularly British settlement efforts through the Land Programme and 1933 Land Settlement Law, as well as the successful efforts of the Hashemite monarchy to establish alliances and cohesion amongst the various segments of society.

Since its establishment in 1946, The Hashemite Kingdom of Jordan has been regarded as a beacon of stability. It has nevertheless suffered from the impact of regional politics, hostilities, wars and conflicts in the region, including the Arab-Israeli conflict of 1948, the Treaty of Hadda in 1925 (which established the border with Saudi Arabia and enabled access to the Red Sea) and the decision to split from the West Bank in 1988. Another issue that has been at play in recent decades has been the pressure of integrating several waves of refugees, including from Palestine, Iraq and, more recently, Syria (Méouchy, Neveu & Ababsa, 2013, pp. 212-221). These dynamics have impacted on societal structures.

Historically, the food system has been shaped by movements and interactions between nomadic, semi-nomadic, rural and urban peoples. Many inhabitants of this region originally migrated from one area to another with the seasons, seeking water and grass/shrubs for their flocks. The Hashemite rulers incorporated the services of Bedouins into military and government functions. In the early 1920s, Jordan had a relatively community-oriented land-ownership structure, which was managed by *masha'a* (communal) ownership, which included rotating land use amongst community/tribe/village members (Ababsa, 2013, pp. 222-225; Fischbach, 2000, in Ababsa, 2013, pp. 222-225).

3.2 Physiographic zones

Despite having a small area that is dominated by the desert, Jordan has five different physiographical zones (see Figure 2 below), characterised by different temperatures and rainfall patterns, as well as agricultural and livestock-related activities: Jordan Valley, Highlands, Central Desert, The Badiya, the Azraq and the Wadi Sirhan Depression (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46).

3.2.1 Jordan Valley and Ghor

This area is a depression bounded by the Dead Sea (the lowest point is below sea level) and the Wadi Araba. It has a semi-tropical climate, meaning that it usually its winters are relatively warmer than in the rest of the country, and its summers are hotter. Because of its topography and high temperatures, the area is considered 'the food basket of Jordan'. Its importance as a food-producing area is related to both its high temperatures and the presence of a constant water

supply from Yarmouk and the Jordan Rivers. Around 84 hectares of irrigated fertile land are located in this region, which supplies the country with vital crops, including vegetables and citrus fruits (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46).

3.2.2 Highlands

Located in the middle and western part of the country, this zone is characterised by a Mediterranean climate. The Highlands region encompasses the natural forests of Jordan (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46). Due to its topography, this area suffers from surface runoff and erosion.

3.2.3 Arid plains (central desert areas)

This area is bounded by the highlands to the west, the southern mountains to the south and the Wadi Sirhan Depression to the east. It has an arid climate, with annual rainfall varying from 200 to 350 millimetres. Half of Jordan's arable land is located in this area. The cultivated lands are rain-fed, and the main crops are fruit trees, wheat and barley (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46).

3.2.4 The Badiya

The vast majority (90%) of the land in Jordan is located in the Badiya, which is bounded by the Arabian desert to the north, east and south. This region has a desert climate (hot summers and cold winters), with annual rainfall of 200 mm or less. The area has historically been famous for grazing activities. In the past 20 years, underground water has been used to irrigate around 5,000 acres for the purpose of growing fruit trees, cereals, potatoes, watermelons and tomatoes (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46).

3.2.5 The Azraq and Wadi Sirhan depression

This area is located between the central desert and the Badiya. It has historically been used as a trade route connecting the Arabian Peninsula and the Highlands. Because it is a low-lying area, it is supplied by water from the nearby valleys (Ababsa, 2013, pp. 64-67; AL-Bilbisi, 2013, pp. 42-46).

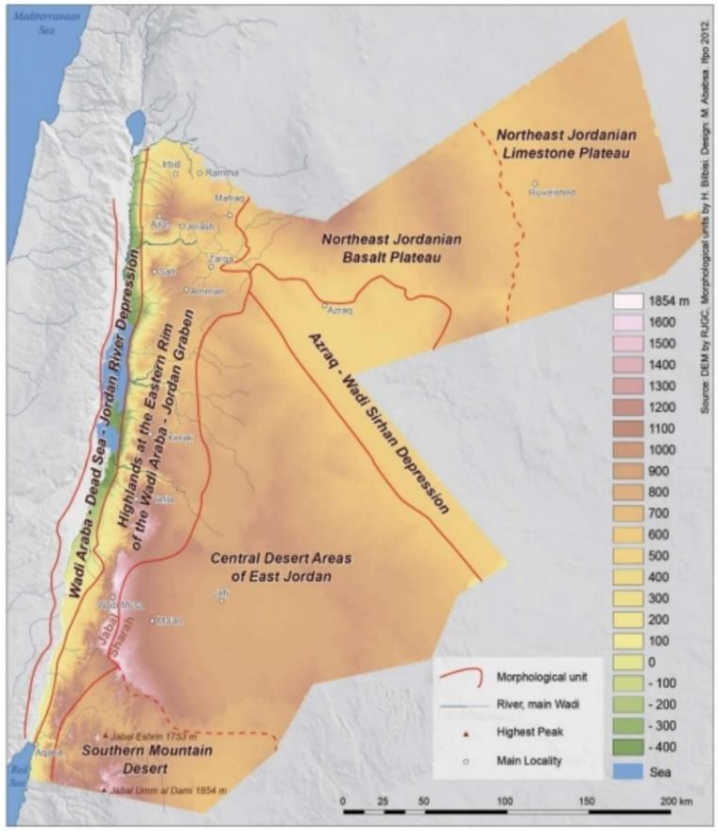

Figure 2 *A Map of Jordan and its three agricultural zones*
Source: Talozi et al., 2015.

3.3 Water

Jordan faces unique challenges in terms of water resources. As a water-scarce country, its annual supply of renewable resources amounts to 100 m^3 or less per capita. Due to its location downstream of the Jordan and Yarmouk rivers, Jordan is at a disadvantage when it comes to accessing water. The country relies on the Sea of Galilee and the basins of the Jordan and Yarmouk Rivers for 40% of its

water supply. Because these sources are under the control of Israel and Syria, however, Jordan is heavily dependent on groundwater for its water supply. Given that the aquifers are recharged by rainfall, they are vulnerable to depletion and drought, especially in light of the effects of climate change (UNICEF Jordan and Economist Impact, 2022). Jordan possesses a total of 12 groundwater basins, 10 of which exhibit a negative balance. The depletion rate of the aquifers has been observed to be alarmingly high: 2–20 m per year. This rapid depletion rate has far-reaching effects that extend beyond the quality of groundwater to include increased energy consumption and risks to the long-term sustainability of these vital water sources (Ministry of Water and Irrigation, 2020). Given the challenging situation at hand, Jordan is taking steps to minimise stress on its resources by seeking to narrow the gap. Treated wastewater is being used as a non-conventional water resource, with 15% of the country's water supply derived from this source and directed towards agricultural purposes. The water stress level in Jordan currently exceeds 100% (UNICEF Jordan and Economist Impact, 2022).

4 Food-system outcomes

To obtain an overview of the current state of the food system, it is important to understand what the food system is currently delivering. Food systems produce a variety of results, to which we refer as 'outcomes'. Food-system outcomes have become well-articulated in terms of three main areas: ensuring food security and optimal nutrition for all; meeting socio-economic goals, particularly with regard to reducing poverty and inequalities; and making it possible to meet food needs within the boundaries of the planetary environment and climate. In general, food systems are recognised as needing to be resilient to shocks, sustainable over the long-term and equitable in terms of the costs and benefits to different societal groups. Trade-offs and synergies obviously occur across the outcomes and properties of food systems, accompanied by the potential for both conflict and collaboration between interest groups. This section provides an overview of the status of the outcomes of the Jordanian food system.

4.1 Food and nutrition security

According to the World Health Organization, Jordan is not on course with regard to recommended dietary intakes. The country is also not progressing in terms of global nutrition targets, and its nutritional outcomes are deteriorating. In 2019, more than 46% of all women older than 18 years of age were obese, 37.7% of women of reproductive age (15–49 years) were affected by anaemia and 18.9% of all women (18 years or older) had diabetes (Global Nutrition Report, 2022).

The national average intake of food groups associated with health and environmental problems (e.g. red meat, fish and dairy) for adults 20 years of age and older significantly exceeds the recommended daily intake, as shown in Figure 4. The average intake of red meat is around 400% of the recommended value. For fish, the average intake is almost 200% of the recommended value, and dairy intake is around 130% of the recommended amount. At the same time, the intake figures for healthy food groups are well below the recommended amounts. The intake of whole grains is the lowest, with average levels as low as 14% of the recommended value, and the intake of legumes, nuts and vegetables does not reach half the recommended values. The daily intake of fruit is more favourable than the rest, reaching 86% of recommended value (Global Nutrition Report, 2022).

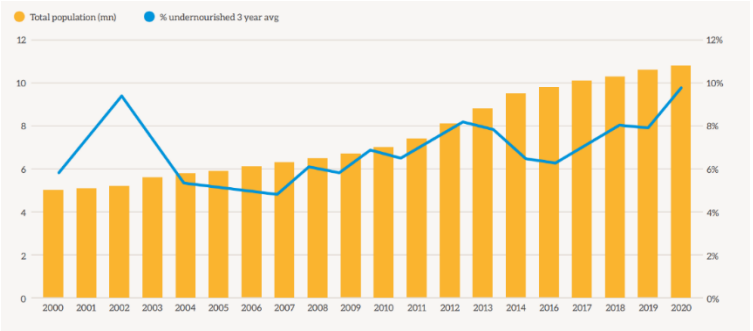

Figure 3 *Undernourished population in Jordan, compared to the total population*
Source: UNICEF Jordan and Economist Impact, 2022.

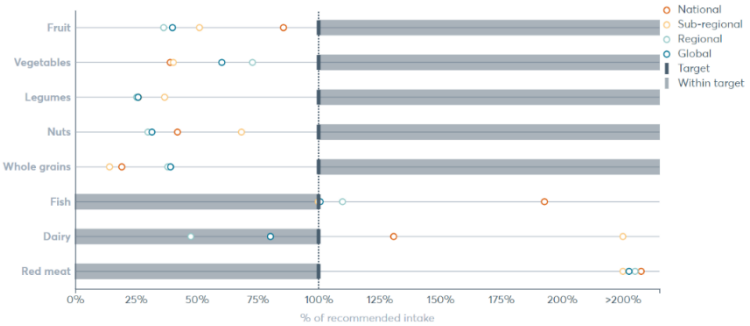

Figure 4 *Dietary intake of key foods and nutrients by adults 20 years of age and older, compared to minimum and maximum targets*
Source: Global Nutrition Report, 2019.

4.1.1 Food utilisation

Although there has been either a slight improvement or a stable trend in some indicators of infant malnutrition and non-communicable diseases (NCDs; e.g. stunting, wasting), other indicators are deteriorating. Adolescents and adults exhibit similar trends, thus causing an increase in the burden of NCDs. Anaemia and diabetes are prevalent, and these trends are increasing.

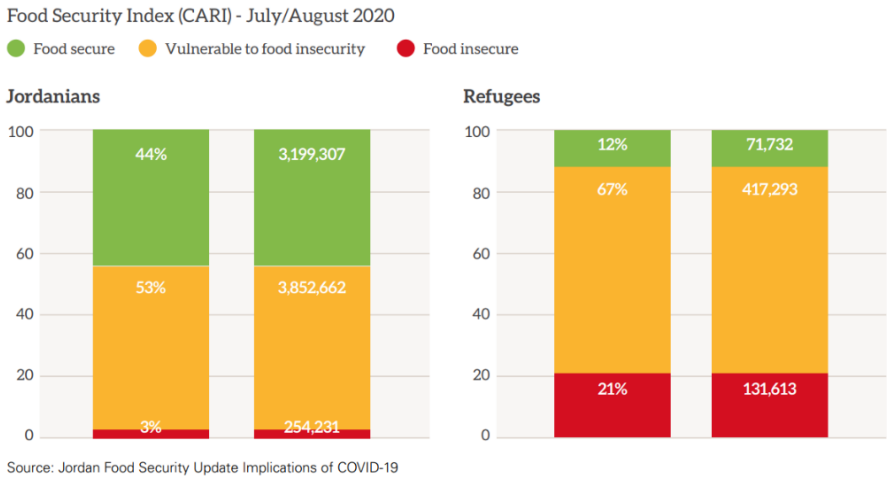

Figure 5 *Food-security levels amongst Jordanians and refugee. Source: WB, FAO, WFP & IFAD, 2020.*

Overweight and obesity are prevalent amongst both adults and adolescents. More than half of the adult population is overweight, and the prevalence of obesity among women is reaching 50% (Global Nutrition Report, 2022). The prevalence of diet-related problems in Jordan is well known and, with almost two-thirds of all calories being imported, national food security requires undivided attention and action (FAO, 2022).

4.1.2 Food affordability

The affordability of food is a critical issue. Since 2015, the consumer price index for food has increased by more than 5% each year (FAO, 2022). This trend has mainly affected the price of meat, poultry, legumes and fruit, with staple foods being less affected. More than half of the refugee population has experienced price increases in the market for fresh food (Jordan Food Security Update, 2020).

4.1.3 Food availability

Jordan depends heavily on imports to meet its food needs, making it vulnerable to the vicissitudes of the fast-changing world. Due to the COVID-19 crisis and Russia's war in Ukraine, Jordan's main wheat suppliers have stopped their exports. Given the country's high reserve supplies of wheat and barley, however, food availability has not posed a serious problem. It has also achieved high self-sufficiency ratios in vegetables, fruits, eggs, milk, poultry meat, olive oil and fruit.

4.2 Economic and social well-being

The Jordanian food system makes a significant contribution to the country's economy, as well as to the well-being of its citizens. The contribution of agriculture to the national GDP has declined by half over the past 50 years, however, and the number of people working in the sector has decreased drastically since the start of the 21st century (Our World in Data, 2019). In response, the agriculture orientation index decreased from 0.55 in 1995 to 0.28 in 2015 (Our World in Data, 2015). The number of people working in the agricultural sector decreased from 115,000 workers in 2000 to 100,000 in 2015, and agricultural workers currently comprise 2.5% of the labour force (World Bank, 2018). It is worth noting that there around 497,000 foreign agricultural workers, around 34,000 of whom are Egyptian (DOS Yearbook 2020). The unemployment rate in Jordan has doubled in the past decade, and it was further exacerbated by the COVID-19 pandemic, which resulted in many more people losing their jobs. The effects on female employment have been particularly strong, and the share of the population living in poverty has correspondingly increased slightly in the past two decades (Turi Fileccia et al., 2015; World Bank, 2018; Ministry of Environment, 2020; WFP, 2020; National Food Security Strategy, 2021; World Bank, 2021).

Another important issue to track is the Gender Inequality Index, in terms of which Jordan has made progress in recent years, albeit less than regional and global averages. As reported by UN WOMEN, 'gender inequality is still one of the major issues hindering Jordan's advancement as a country', noting that, as of 2018, only 14.6% of women were economically active, with labour-force participation rates lower than those of men across all age groups, and only a very limited number of women in leadership positions (UN WOMEN, 2019).

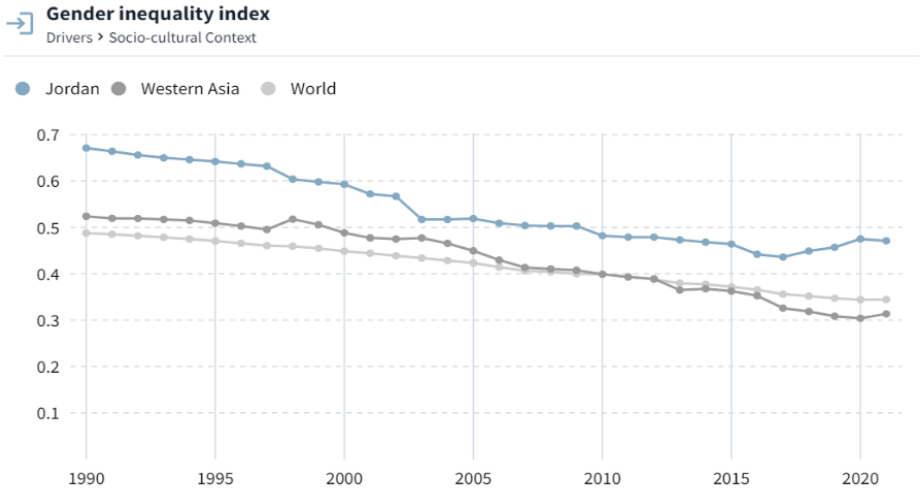

Figure 6 *Gender Inequality Index scores for Jordan*
Source: Food Systems Dashboard, 2021.

4.3 Environmental sustainability

Climate change is taking a toll on the food system in Jordan. The water-stress level has doubled since the 1970s, reaching a peak of 103% in 2014 (UNICEF Jordan and Economist Impact, 2022). The agricultural sector uses more than 50% of the country's available water resources. Municipal withdrawals constitute the second largest consumer of water, having more than tripled since the 1970s, mirroring the exponential population growth. The renewable water supply in the country currently fulfils less than 70% of the population's water needs. Groundwater is being depleted twice as fast as it can be replenished, and water-stress levels have risen from 80% to 100% over the past two decades (UNICEF Jordan and Economist Impact, 2022). Climate change could lead to a further decrease in the water supply, as well as to alterations in crop productivity, resulting in a potential decline of as much as 6.8% in Jordan's GDP. The impact of water stress on the future of the food system is so significant that even a small increase could affect the country's crop prices, agricultural labour and nutrition status (Taheripour et al., 2020).

The food system in Jordan is responsible for nearly 30% of the country's overall greenhouse gas (GHG) emissions (Crippa et al., 2021), making it a heavy contributor to climate change. This is similar to global trends, in which food systems account for roughly a third of the world's total GHG emissions (Crippa et al., 2021). The largest share of GHG emissions from the Jordanian food system is from 'end of life' (food waste and disposal), followed by retail and production (each accounting for about 20% of GHG emissions from the food system) (Crippa et al., 2021). Total GHG emissions from the food system in Jordan have been rising steadily in recent years (Figure 9), and total GHG emissions increased from 20.9 $mtCO_2eq$ in 2000 to 36.6 $mtCO_2eq$ in 2019 (Food Systems Dashboard, 2019).

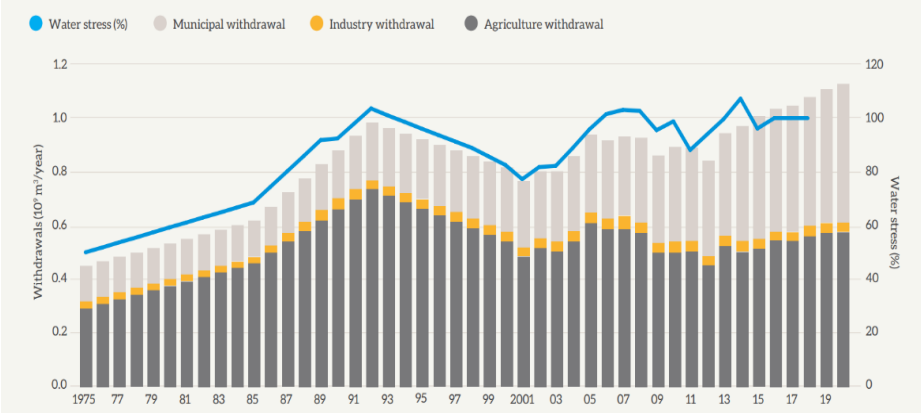

Figure 7 *Jordan's water withdrawals, by sector, and water stress (% of water withdrawals as a share of available renewable sources)*
Source: UNICEF Jordan and Economist Impact, 2022.

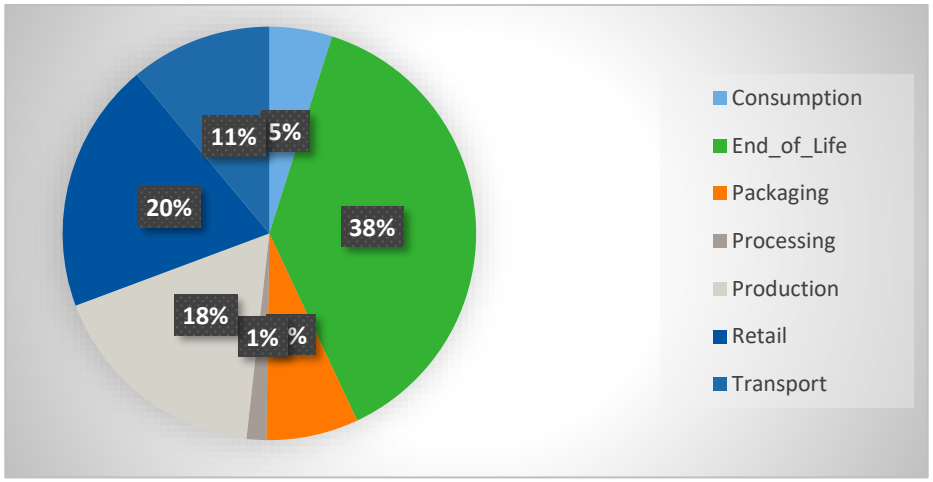

Figure 8 *CO2 eq. emissions by food-system stage in 2018*
Source: Crippa et al., 2021.

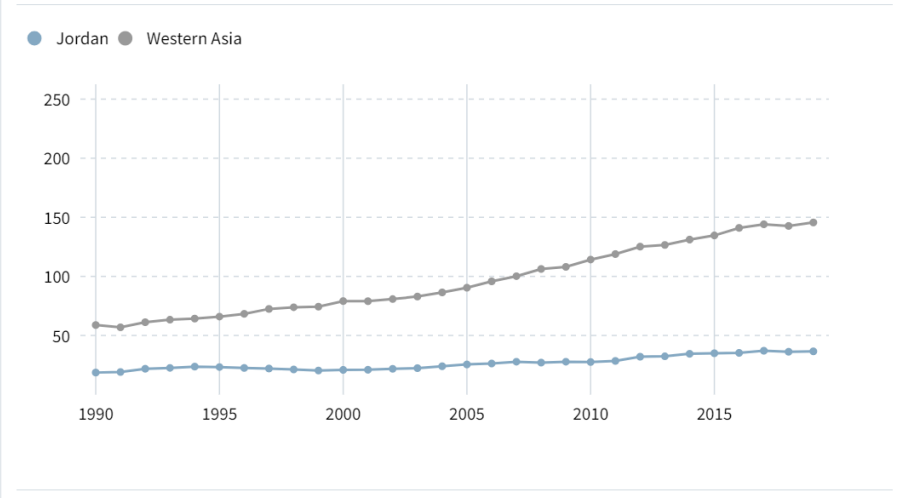

Figure 9 *Total greenhouse gas emissions, excluding land-use change and forestry (mtCO₂eq)*
Source: Food Systems Dashboard, 2019.

5 Food-system drivers

Proceeding from the snapshot of what the Jordanian food system is delivering to society, as provided in the previous section, we can begin to explore the factors that shape such outcomes. In this section, we describe key drivers as forces and influences that shape and structure food-system activities and their associated outcomes. Drivers of the food systems are detailed below under the following categories: demographics and development; consumption; technology; markets; climate and environment; and policy and geopolitics. It is important to note that drivers are not the same as trends, which are emerging patterns of change that are likely to impact the context of the food system. Although trends may be moving in a certain direction, they are often uncertain.

5.1 Demographics and development

5.1.1 Demographics

The population of Jordan exceeds 11 million inhabitants. An increasing trend can be observed from slightly more than half a million in 1950 to 5 million in 2000 and to more than 11 million in 2022. It is worth noting that the refugee population has also doubled from 1.6 million in 2000 to more than 3 million now. The increase in the population of both Jordanians and refugees is placing additional burdens on many aspects of the food system in terms of food availability and access (World Bank 2021; Department of Statistics, 2022). Future scenarios are displayed in Figure 10. Even under optimistic scenarios, the population is projected to double by the end of this century. Given the influx of refugees, the population is likely to triple in the same period (Yoon et. al., 2021).

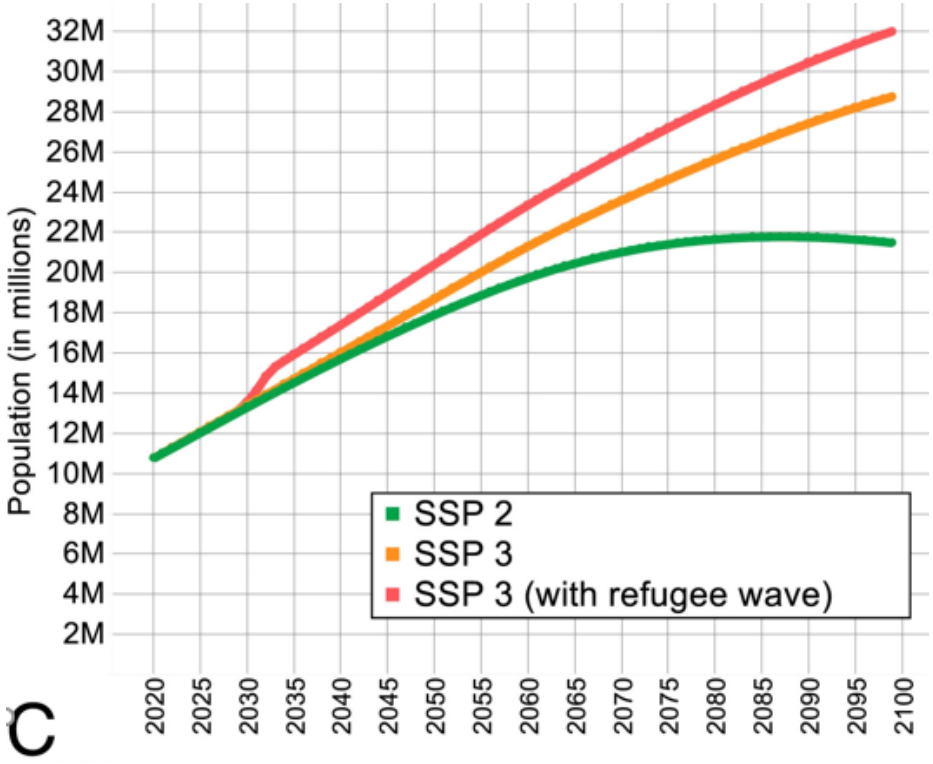

Figure 10 *Projected population growth in Jordan under different scenarios*
Source: Yoon et al., 2021.

5.1.2 Economic development

Jordan's GDP has undergone a mean expansion of 6.5%, although the expansion has decelerated to an average of 2.5% per annum from 2010 to the current period (World Bank, 2021), with the real GDP increasing from 4% in 2000 to 8% in 2007

(Turi Fileccia et al., 2015). Throughout 2018 and 2019, the real GDP grew at a steady rate of just under 2% (Ministry of Environment, 2020). According to the World Bank, the value added to the GDP by agriculture, forestry and fishing decreased from 14% in 1965 to only 5.2% in 2021. In addition, until the recent renewed interest in the Jordan food system, government spending in the agricultural sector was decreasing relative to its economic value. According to the Global Nutrition Report (2022), the share of the population in extreme poverty (below US$ 1.9/d) has remained the same (0.03%) since 2005. The share of the population living in poverty (below US$ 3.2/d) has decreased from 8.3% in 2002 to 1.8% in 2021, as shown in Figure 11.

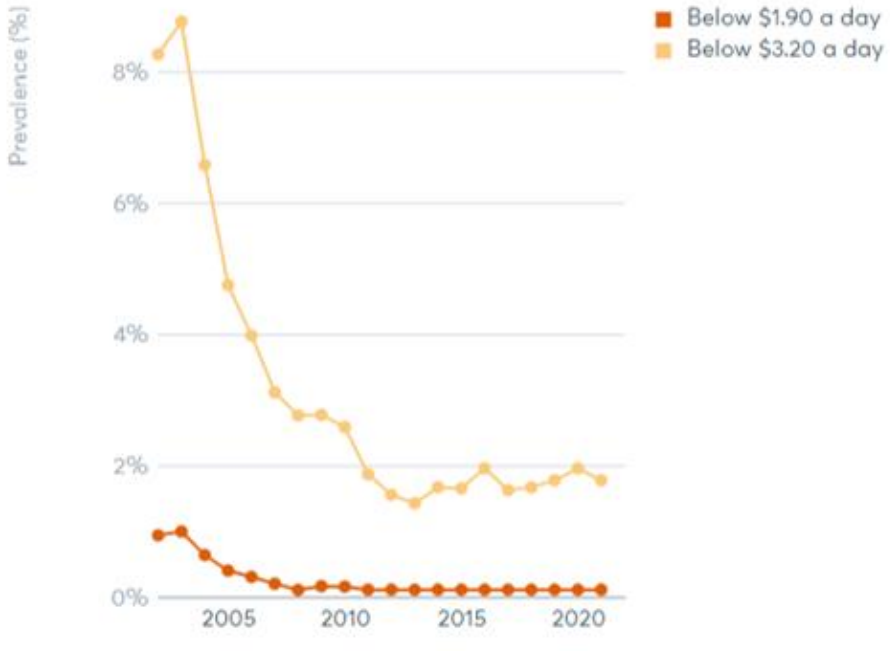

Figure 11 *Population living below the poverty line in Jordan*
Source: Global Nutrition Report, 2022.

5.2 Consumption

According to the Jordanian Department of Statistics (2018), a sizeable proportion of households (around 30%) spend 30–40% of their income on food, with the greatest share of income spent on meat and poultry. According to the Department of Statistics, an average household spends JOD 1,200 per year on meat and poultry, which is more than they spend on staple food. Cereals, cereal products, bread, vegetables and legumes come next, followed by dairy, cheese and eggs (as illustrated in Figure 12). In addition, poultry-meat production increased from 123,700 tonnes in 2003 to 200,000 tonnes in 2012. This increase was in line with the population growth from 5.2 million in 2003 to 6.5 million in 2012. Meat consumption was slightly higher than production, having increased from 124.5 in 2003 to 225.8 in 2012 (Turi Fileccia et al., 2015). As shown in Figure 12, household spending on meat is trending upward and, in a few years, it is likely to be almost twice the spending on all food groups combined. Spending on other food groups (e.g. dairy products, eggs, sugar and cereals) is following a similar trend. Spending on sugar surpasses spending on essential food groups, such as fruits and legumes (CEIC Data, 2021).

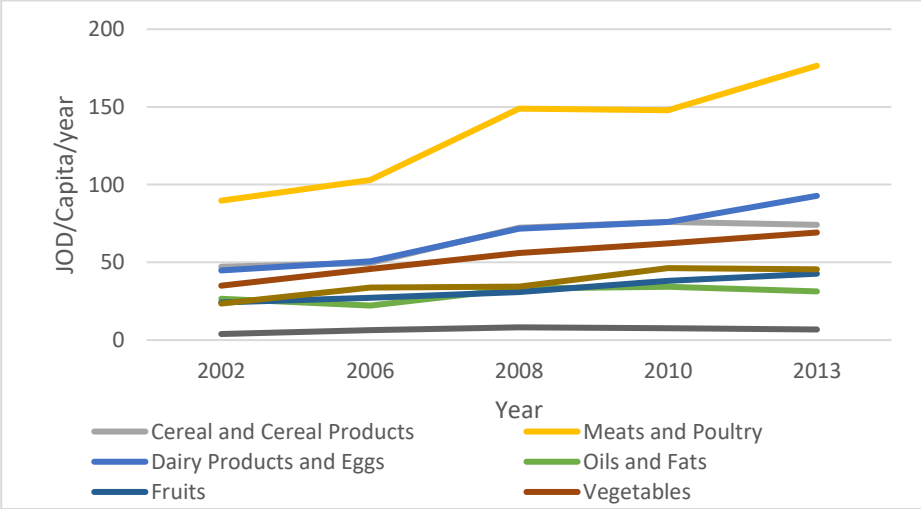

Figure 12 *Jordan average household expenditures (per capita) on food groups*
Source: CEIC Data, 2021.

5.3 Technology

The use of technology in Jordan is increasing across various economic areas, including eCommerce, energy, services, agriculture and fertiliser use. According to Note (2018), total factor productivity has increased, thereby providing an indication of agricultural technology use. Over the course of a decade, the amount of fertiliser used in agriculture per unit of arable land has undergone a significant transformation. Fertiliser consumption has fluctuated substantially over the last decade, in line with price fluctuations, although it has generally followed an upward trend from the 1970s to 2015, peaking at 176.9 kg/ha/arable land. More recently, fertiliser consumption has declined, reaching 138.9 kg/ha/arable land in 2021 (World Bank, 2018; Trading Economics, 2023).

Based on the Statista market forecast for 2023, the eCommerce industry in Jordan is experiencing an impressive surge, with the food sector emerging as the second-fastest growing sector, after fashion. Jordan has an internet penetration rate of 68%, with widely available high-speed broadband (International Trade Administration, n.d.). This has resulted in an increasing demand for convenient and contactless shopping options, which is fuelling the country's grocery-delivery market. The trend of purchasing food online is on the rise, with revenues from food in the eCommerce sector reaching a substantial US$ 273 million as of 2022. The outlook for the future seems equally promising, with the e-market expected to more than double in size by 2027.

5.4 Markets

Given its dependence on imports, Jordan is vulnerable to price volatility on the international markets, and this may have significant consequences for food and nutrition security in the country (FAO 2020; National Food Security Strategy, 2021). In 2021, Jordan's main partners for food imports were Saudi Arabia, Argentina, the United Arab Emirates, the Arab Republic of Egypt and the Netherlands. In the last few years (during the COVID-19 pandemic, as well as since the start of the Ukrainian-Russian war in 2022), international food prices (most notably, grains) have reached historically high levels. Given that wheat is an important component of the Jordanian diet, the government has applied a fixed and subsidised pricing system that has protected consumers from international price hikes. Households were nevertheless confronted with a doubling, or even more, of retail prices for other commodities. Similar dependencies and effects of international price volatility have also been observed in various economic sectors, including poultry (which relies on imported feed from soy and maize-producing countries) and export crops (which rely on imported industrial fertilisers).

5.5 Climate and the environment

Given its status as one of the most water-poor countries in the region and the world, Jordan is greatly affected by climate change. Precipitation is progressively decreasing, and temperatures are rising. Even under optimistic and moderate scenarios, the increase will be around 2° Celsius (Rajsekhar & Gorelick, 2017). Over the past 50 years, annual precipitation has dropped by almost 20 mm (World Bank, 2020), and this is having an impact on all sectors. Figure 13 presents an optimistic scenario, in which the climate is changing moderately. Even under this scenario, however, the annual water supply will be reduced by more than half across all sectors (Yoon et. al., 2021). Temperatures are also expected to increase in coming years, due to climate change (Rajsekhar & Gorelick, 2017; see Figure 14).

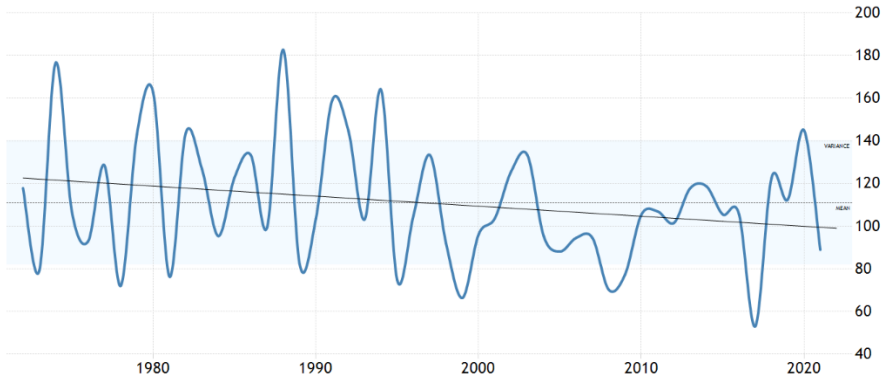

Figure 13 *Decrease in precipitation from around 120 mm in 1980 to 100 mm in 2020*
Source: Trading Economics, 2022.

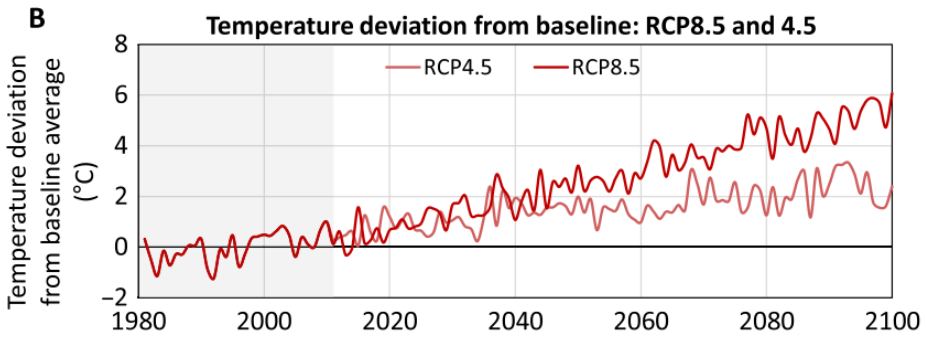

Figure 14 *Temperature forecast based on RCP 8.5 and 4.5*
Source: Rajsekhar & Gorelick, 2017.

5.6 Policy and geopolitics

5.6.1 Regional powers

Despite its relatively small economy and population compared to neighbouring countries, the political role and influence of Jordan is quite evident, and the country has always been characterised as a moderator and stabilising power. It is situated within a troubled region that experiences frequent political turbulence and military conflict, which in turn result in negative economic, social and environmental impacts and outcomes at all levels. The necessity of coping with such pressures, in addition to the emerging international crises (i.e. the COVID-19 pandemic and Russia's war in Ukraine), has taken its toll on every aspect of life in Jordan.

In light of recent political developments and initiatives aimed at cementing relations between countries in the region, Jordan has acted as an honest broker. In December 2022, it hosted the second session of the Baghdad Conference, with the participation of all Gulf States, along with Egypt, France, Iraq, Iran and Turkey. Food security was one of the major sectors selected to enhance regional cooperation amongst the 11 member countries, with support from France and the EU. Shortly before that, Jordan hosted the ministers of agriculture of Iraq, Lebanon and Syria to focus on advancing regional cooperation in food security.

Jordan has integrated the establishment of the Regional Food Hub as a major initiative within its food security strategy and the new vision on modernisation for 2033. The country is prepared to maximise the benefit of its comparative advantages in the region to promote stability, economic growth and peace within the region (USAID and the Jordan Investment Commission, 2022). According to Our World in Data and the national food system strategy (2021–2030), the agriculture orientation index has decreased tenfold since 2000. In addition, there is significant potential for increasing public investment in research and development (1.8% of the agricultural GDP) (World Bank, 2018).

5.6.2 The COVID-19 pandemic

The COVID-19 pandemic was yet another shock that affected the development of Jordan. According to the national food-security strategy for 2021–2030, 17% of all Jordanians lost their jobs as a result of the pandemic. The pandemic also exacerbated the existing gap between female and male employment. During the fourth quarter of 2020, female unemployment was higher than male unemployment (32.8% vs. 22.6%). At the same time, however, the share of the population living below the poverty line (below US$ 1.9/d) decreased from 0.9% in 2002 to 0.1% in 2021 (Global Nutrition Report, 2022). Although Jordan is largely dependent on the import of inputs and basic food, it was one of the least affected countries in the region during the pandemic. This was primarily due to its high wheat and barley reserves (which were sufficient for more than 18 months), amongst other factors, including additional support to the poor and the postponement of loan payments. Some inequalities were noted by Mercy Corps: 'many formal and informal small and medium enterprises (SMEs) in the agricultural sectors of Irbid and Mafraq suffered significant loss due to insufficient access and/or delays to permits'. Other larger companies were nevertheless found to have better access to these work permits (Mercy Corps, 2020). In order to become more resilient, Jordan is embarking on a major crisis-mitigation programme that seeks to diversify its import sources, in addition to increasing its storage capacity for major food commodities and improving regional cooperation.

5.6.3 The war in Ukraine

Ukraine and Russia are significant global producers of cereals and sunflower oil, with Russia also a being major exporter of fertilisers. Since the outbreak of the war in Ukraine in February 2022, global food prices have increased, particularly for cereals and vegetable oils, which were already at high levels in 2021, due to the COVID-19 pandemic. Since March 2022, record high prices have been experienced worldwide. Jordan is vulnerable to global price hikes, due to its dependence on internationally traded food commodities. Furthermore (as noted above), Russia and Ukraine are important direct suppliers of wheat, cereals and sunflower oil. In 2021, the two countries together accounted for more than 30% of Jordan's total wheat imports. As shown in Figure 15, Jordan is not reliant on Russia for sunflower oil and cereals (excluding wheat), as most of these products come from Ukraine. A potential shock from Russia would thus not have a significant impact on those commodities. In the past two years, however, most wheat and barley imports have not originated from either Russia or Ukraine. The war has thus had only a limited impact on food prices in Jordan.

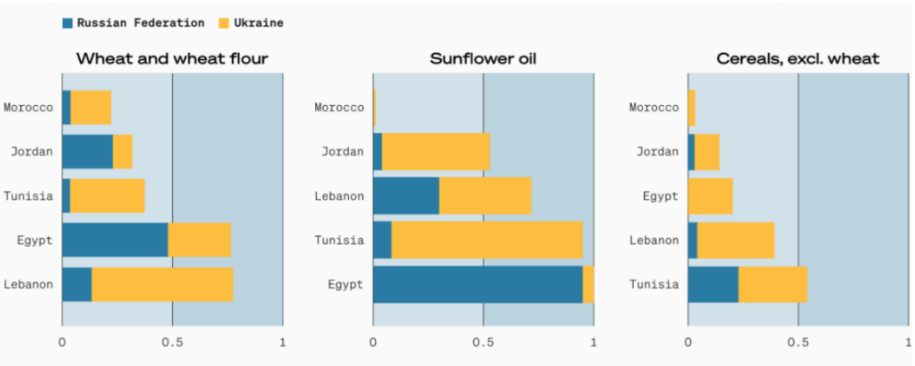

Figure 15 *Key commodities: Share of imports sourced directly from Ukraine and Russia*
Source: Rauschendorfer & Krivonos, 2022.

6 Food-system structure, actors and activities

This section presents the key actors in the Jordan food system, along with their activities along the value chains and the environments within which they operate. With 92% of Jordanians living in urban areas, the agricultural sector employs only 2% of the Jordanian workforce. Local agriculture produces a sizable share of the national food supply, with tomatoes being the most produced crop. For staple foods, however, the country relies heavily on imports. Food consumption is dominated by red meat, fish and dairy, despite the negative health and environmental impacts of these food groups. A summary of key actors and their activities is provided in Table 1. The food system activities are then placed into context by describing the enabling environment and food environment in which they take place.

Table 1 *Overview of key food-system actors along the value chains, and their main activities*

Production	Processing	Trade	Retail	Consumption
Agriculture • Local agriculture produces a sizable share of the local food supply, but not staple foods. • Sheep and goats account for 90% of all livestock. • Of the total cropland area (196,000 ha.), approx. 40% is dedicated to tree and field crops, and the rest is planted with vegetables (FAO, 2022). **Labour** • The agricultural sector employs 2.5% of the labour force in Jordan (ILO, 2021). • The sector employs a high proportion of informal workers (an estimated 16% of whom are women). • Foreign labour—particularly Asian, Egyptian and refugees—constitute a considerable portion of the workforce (ILO, 2018).	**Packing & manufacturing** • Jordan's food-processing sector comprises several large processors and many small, informal businesses (Hundaileh & Fayad, 2019). • An estimated 4,000 food processors are active in Jordan (USDA, 2023). • Most processing occurs in the bakery, food-preparation and dairy-product sectors. • Most businesses are distributed around Amman and in the businesses of that governorate (Hundaileh & Fayad, 2019). • The food-processing sector employed 49,935 workers in 2017. **Storage and disposal** • Jordan has stockpiled strategic food reserves—mainly wheat and barley (Fathallah & Robertson, 2021). • Almost no actors involve recycling and disposal activities specifically focusing on food waste.	**Marketing** • Some smallholder farms sell to individual buyers who distribute to domestic markets. • Large farmers/processors distribute their supply directly to domestic markets or use distributors. **Import & export** • Jordan is a food-deficit country (WTO, 2022). • It imports around 70% of its staple-food needs (Carnegie, 2021). • In 2019, Jordan imported consumer-oriented products amounting to US$ 2.7 billion (USDA, 2022). • Potash and phosphates are a major export. In 2021, Jordan was the world's fifth-largest exporter of fertilisers (OEC Trading).	**Open-air markets** • Traditional outlets are still dominant, representing 85% of total outlets and 90% of total sales (United States Department of Agriculture, 2023). **Supermarkets** • Jordan's retail food sector is valued around US$ 4.5 billion (USDA, 2023) • Modern retailing is growing in both number and volume of sales (USDA, 2022). • Online retail platforms are also becoming increasingly popular. • The retail sector is expected to grow by 3–5% over the next five years (USDA, 2022). **Small shops** • On average, small grocery shops employ 1–4 people (Ababsa and Demilecamps, 2013). • Small vegetable, meat and poultry shops are widely distributed throughout both rural and urban areas of Jordan.	**Low-income consumers** • Jordan is a growing market of around 11 million consumers, including high ratio of refugees. • Undernourishment is high in Jordan (17%) (FAOStat, 2022), particularly amongst refugees. • The majority (80%) of Syrian refugee households in camps and communities are food insecure or vulnerable to food insecurity (WFP, 2021). • Residents in rural governorates are most susceptible to food insecurity. • The Al-Tafilah governorate accounts for the highest share of food-insecure households (20%) (Fathallah & Robertson, 2021). **Middle-class & high-end consumers** • High-income consumers drive demand for imported processed and higher-value/quality products. • Middle and low-income consumers focus on domestic goods (USDA, 2023).

6.1 Food system activities

6.1.1 Agricultural production & livestock rearing

Of Jordan's total land area (nearly 9 million ha), only a small portion (1 million ha) is suitable for producing crops (FAO, 2019). Agriculture accounted for 4.7% of the country's GDP in 2018 (World Bank, 2021). The total agricultural area is around 195,600 ha. In 2020, 80,600 ha of this area was planted with field crops, with 80,500 ha planted with fruit and 34,400 ha planted with vegetables. The total irrigated area was 86,300 ha, and the rain-fed area amounted to 159,200 ha (Annual Statistical Yearbook DOS, 2020).

Jordan encompasses three major agro-ecological zones (which cut across the physiographic zones mentioned in Section 3.2). The first is the Jordan valley, with three sub-zones: the northern valley, the middle valley and the eastern valley. This zone produces irrigated vegetables and fruits benefitting from the favourable warm climate in winter. The second agro-ecological zone—the highlands—is also the most populated. It produces mainly rain-fed crops (e.g. olives and grapes), in addition to wheat, barley and other field crops, as well as irrigated fruit and vegetables. The third zone is the Badiya, which receives rainfall of less than 200 mm/year and is used mostly for grazing and for raising sheep and goats, with some pockets of irrigated areas planted with vegetables and fruit (Taimeh, & Katkhuda, 1997). Tomatoes are one of the most produced crops, with total production reaching about 700 thousand tonnes in 2017 (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2019).

Modern commercial farms are owned by large investors and operated by farm managers, engaging large numbers of sharecroppers and lease farmers. Smaller, less capital-intensive farms are run by families. Livestock is reared by dedicated herdsmen throughout the country, and it is of economic and cultural importance. More intensive cattle and chicken-rearing businesses have been developed particularly around cities, with more extensive goat and sheep-rearing taking place on permanent pastures (Ababsa and Demilecamps, 2013). About 118,000 families in rural districts and the Badiya depend on agriculture as a source of income (Hashemite Kingdom of Jordan, 2021). At the national level, Jordan has achieved high self-sufficiency in terms of vegetables, fruit, eggs, fresh milk, olive oil and poultry meat. Moreover, subsistence and small farmers depend on the consumption of their own production to satisfy part of their food needs.

A workshop with Jordanian food-system stakeholders organised by Foresight4Food in May 2023 yielded a diverse picture of the farming systems in Jordan (see Figure 16). These systems can be placed on a matrix of typologies based on technology and intensity of input (low or high; horizontal axis) and scale (small or large; vertical axis). The quadrant of low-tech/low-intensity input and small-scale farming encompasses farming systems based on small-scale, rain-fed crop production. In contrast, the quadrant of high-tech/high-intensity input comprises commercial irrigated fruit farms, intensive horticulture (partly in greenhouses) and large-scale crop-production farms. On the dimension of high-tech/high-intensity input and smaller scale, we find examples of ruminant production, fish farming and innovative pilot projects involving hydroponics. Finally, livestock production is important and often occurs in extensive grazing systems (Foresight4Food, 2023).

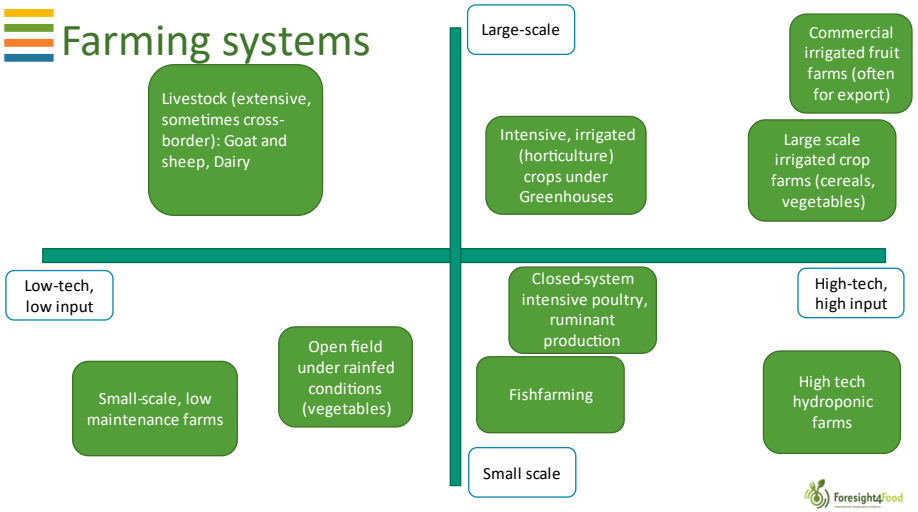

Figure 16 *Typology of farming systems in Jordan*
Developed during a workshop with key stakeholders in the Jordanian food system.

The share of the national labour force working in agriculture has been steadily declining (see Figure 17). At the same time, the agricultural sector in Jordan has the highest proportion of informal workers, relative to other economic sectors. Of those working in the agricultural sector, 16% of women and 5% of men are informally employed. Most agricultural workers are either seasonal, occasional or family workers (HKJ, 2021). Despite the proportionally high unemployment rates recorded in Jordan, which reached 22.9% in the last quarter of 2022 (DOS Website 24 April 2023), foreign labour makes up a considerable portion of the workforce, and work permits are crucial to accessing formal work opportunities. Wage labour in large-scale agriculture is provided primarily through temporal migration by men from Bangladesh, Egypt, India and Syria. Wage labourers of Jordanian origin are more common in the processing and retail industries. Work permits in the agricultural sector are generally perceived as easier to obtain than permits in other sectors are. It is estimated that roughly 37% of all work permits issued to Syrian workers are in the agricultural sector (ILO, 2018).

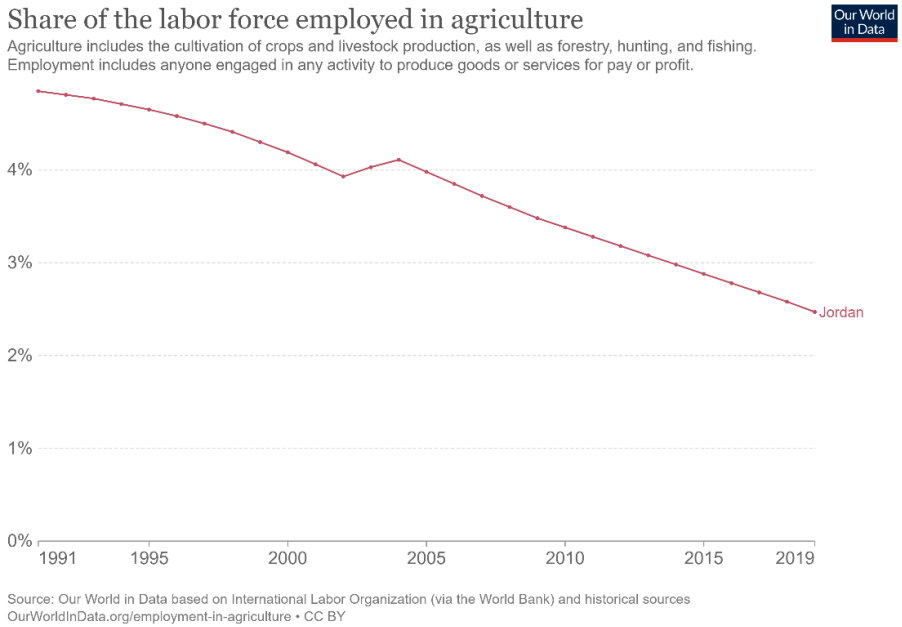

Figure 17 *Share of the labour force employed in agriculture in Jordan Source: Our World in Data, 2019.*

6.1.2 Processing

Jordan's food-processing sector comprises a number of larger companies and processors, as along with many informal small businesses—home businesses, farm businesses or small shops. Most businesses are situated around Amman and in the governorates (Hundaileh & Fayad, 2019). About 4,000 food processors are active in Jordan. Most processors are active in the sectors of bakery and sweets, food preparation and dairy products, focusing on processed and packaged foods and beverages (United States Department of Agriculture, 2023). Revenues in 2016 were JOD 4,112 billion, representing 4.13% of the country's GDP (Hundaileh & Fayad, 2019). The food-processing industry is growing, and it is driving an increase in the demand for ingredient inputs, which is expected to double in the next five years (U.S. International Trade Administration, 2022). Prior to the COVID-19 pandemic, Jordan had started stockpiling strategic food reserves—mainly wheat and barley, little of which is produced locally due to a lack of water and land resources (Fathallah & Robertson, 2021).

6.1.3 Trade

Jordan imports more food than it exports. In 2020, the value of Jordan's agricultural imports was four times higher than the value of its exports (Figure 18 below), which translated into an agricultural trade deficit of US$ 2,863 million. Imports were dominated by staple crops (e.g. maize, rice and wheat), mainly from Argentina, the US and Brazil. Exports of agricultural products from Jordan largely remained in the region (main destination countries: Saudi Arabia, Kuwait and Iraq). Overall, the agricultural sector contributed 14.6% of all exports and 25% of all imports (WTO, 2022).

Goat meat is supplied solely by local producers, while sheep meat is either imported or supplied through domestic producers, often from the Badiya and low-rainfall areas. Dairy and poultry production systems are often highly industrialised, and are commonly owned and managed by professional entrepreneurs. They depend almost entirely on global supply chains for raw materials, which are domestically processed into animal feed. These production systems supply domestic consumers with proportionally inexpensive, animal-based proteins, but they are also exported to consumer markets in the Middle East. The country's high dependence on global markets for raw materials (e.g. barley, maize and soy) makes these supply chains vulnerable to price fluctuations

and supply-chain disruptions. Recent increases in the price of raw materials and their scarcity on global markets have generated substantial increases in retail prices for poultry and dairy products.

6.1.4 Retail

Consumers are demanding a wider variety of foreign food and agricultural products that are packaged and clearly labelled. In 2019, Jordan imported consumer-oriented products amounting to US$ 2.7 billion, with the retail food sector valued at about US$ 4.5 billion and expected to grow by 3–5% over the next five years (USDA, 2021). The country's retail sector is influenced by the rising number of supermarkets and an increase in online shopping and food delivery.

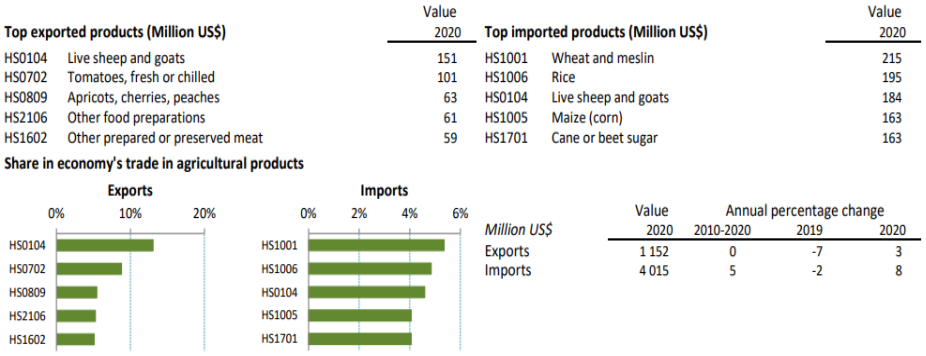

Figure 18 *Value of agricultural exports and imports in Jordan*
Source: World Trade Organisation, 2022.

Supermarkets realise the highest margins on processed foods, and they therefore concentrate their future business development on these types of products. It is unclear whether Jordanian supermarkets focus at least part of their business strategies on 'bottom-of-the-pyramid' consumers (e.g. by supplying cheap food products), even if this would meet the demands of a considerable consumer segment. Supermarkets that supply households of the higher and middle classes are prepared to introduce a variety of alternative procurement and marketing systems, including direct supplies from dedicated farmers, online marketing and home delivery.

New business models are also linking farmers to retailers. For example, the Jordanian start-up Ghoorcom, which was established in 2019, offers a digital marketplace that connects 2,500 farmers and retailers (Palladium, 2019).

6.1.5 Consumption

A large majority of the Jordanian population lives in urban areas (92%) (World Bank, 2022). The purchasing power of many Jordanians has been declining in recent years, due to changes in the government's budget regime. According to FAO estimates, there are 1.7 million severely food-insecure people in Jordan (17% of the population) (FAO, 2022). The high number of undernourished people in Jordan is partly explained by the high number of refugees. The Al-Tafilah governorate accounts for the highest share of food-insecure households (20%) (Fathallah & Robertson, 2021). At the same time, the occurrence of diabetes is relatively high as well, with 37% of the population experiencing obesity (Al-Awwad et al., 2021).

6.1.6 Food disposal

Food waste in Jordan is estimated at 93 kg per person each year, which translates to around one million metric tonnes of food, which could feed 1.5 million people for a whole year. Moreover, it is estimated that 22% of locally produced fruit and vegetables are lost along the various nodes of the supply chain (WFP & FAO, 2022). These figures are quite alarming, especially in light of the country's deficit of water and energy. Despite the struggle with food imports, shortages and insecurity, food waste has almost doubled over the past 20 years. According to the national food-security strategy (2021), there has been an increase in food losses, which occurred during the import, production and export of food.

Reducing food waste has high priority on the government agenda. Food waste is strongly associated with cultural habits of serving ample food during festivities and family gatherings, as well as sharing with visitors. This cultural habit was historically limited to affluent households. In practice, however, it has expanded and intensified, accelerated by the growing middle class. Food loss and waste

nevertheless occur along mainly artisanal supply chains, and it is further exacerbated by the central marketing system. It should also be noted that there no specific actor is clearly taking the lead with regard to recycling, the prevention of food loss and the collection of food waste in Jordan.

6.2 Support services & infrastructure

Jordan has a highly centralised food-trade system, in which all primary food items (whether produced domestically or imported) are registered and traded between suppliers and wholesalers. In Jordan, wholesale vegetable and fruit markets are the only formalized and legal marketing system for fruit and vegetables. The system has important logistical, organisational and distributional implications. The physical centre of activities is very large and, at peak moments, it is crowded with vehicles and people loading, selling and uploading the perishable produce. Although cooling chambers are available, a large amount of produce has also been observed waiting outside for processing. The centralised registration system has advantages in terms of monitoring food volumes and movements in country. One of the roles of the central market is to check food quality (see Amman Wholesale Market, n.d.). All transactions in the central market take place through a commission agreement, in which the commissioner receives and markets the produce on behalf of producers and transfers the buyer's payment to the farmer once a sale has been made. This allows commissioners to offer financing to farmers, but they often also charge high interest rates (Palladium, 2019).

Disadvantages associated with the centralised trading system include long transportation distances and long trading durations, both of which result in high levels of food loss and waste. The law does not allow producers to supply retailers and/or consumers directly, and this might hamper more direct customer-specific production and supply. Centralised marketing may also be accompanied by higher retail and consumer prices, which could be reduced by direct-supply systems. Several current initiatives (e.g. Ghoorcom) bypass the central market (Palladium, 2019).

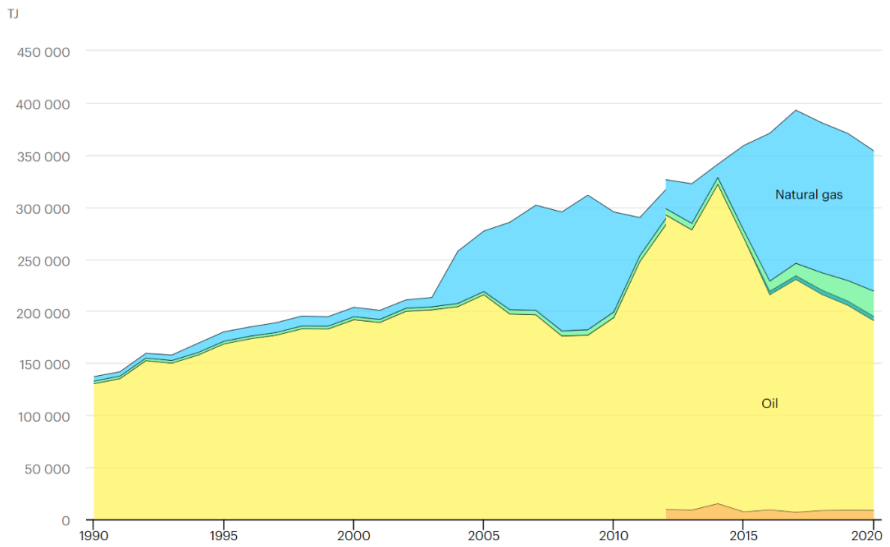

Figure 19 *Total energy supply by Jordan 1990–2020*
Source: International Energy Agency, 2020.

Jordan has limited natural resources for its energy supply, and it is therefore highly dependent on fossil-fuel imports (World Bank Data, 2014). Energy consumption is on the rise. For example, electricity consumption for agriculture and water pumping has doubled in the past decade (CEIC Data, 2021). The country's agricultural sector is energy-intensive and increasingly vulnerable to the rising prices in international markets (Abu-Rumman et al., 2020; FAO, 2021). With regard to financial services, most banks do not have formal loan products specifically for the agri-food sector. Access to financing is a challenge in Jordan, particularly for farmers. In general, the larger commercial banks lend only to well-established businesses in the private sector. Moreover, banks focus on low-risk activities and demand collateral. None of the main commercial banks in Jordan lend to farmers. There are few, if any government subsidies for farming. In most cases, farmers access financing through informal lending practices, micro-finance institutions and Islamic banks. The Agricultural Credit Cooperation (ACC), which was established by the government, is the main lender in the agricultural sector, and it receives more loan requests than it can handle. The ACC has a subsidised interest rate, and loans are often provided under personal guarantees. The non-performance rate of loans is 20%. The majority

(90%) of loan repayments are received by deductions from government salaries earned by the farmer or family members. Finally, farmers receive a form of credit from value-chain or business providers (e.g. input or equipment suppliers) or from central-market commissioners (for a more comprehensive picture of access to financing for agriculture, see Palladium, 2019).

In terms of water and basic sanitation, Jordan is advancing towards full coverage. Safely managed sanitation increased slightly from around 75% in 2000 to 82% in 2020. During the same period, there was a significant increase (from 50% to 95%) in safely managed drinking water (Global Nutrition Report, 2022).

Agriculture and food infrastructure are relatively well-developed and cover most areas in Jordan. Infrastructure includes water, energy and roads, although wholesale markets, slaughterhouses, storage and packing, and packaging facilities need further improvements.

6.3 Enabling environments

6.3.1 Food environment

In the Foresight4Food workshop organised in March 2023, stakeholders identified a number of spaces where consumers source their food. These sources include social initiatives (e.g. food banks), farms, wild plant collections and community spaces. In more urbanised contexts, there are supermarkets, larger open-air (or other) markets and grocery stores, as well as hotels and restaurants. One increasingly popular way to access food is through e-commerce platforms, such as Talabat (Foresight4Food, 2023).

In urban areas, the food landscape is increasingly dominated by fast-food chains and food-delivery services. Within the food system, multiple distinct production and supply chains serve different consumer segments. Higher segments of urban consumers are supplied primarily through the import of foreign products and modern, export-oriented farms that meeting international GAP standards. The food environment of these consumers is composed mainly of high-end supermarkets. Most middle-class urban consumers obtain their food through smaller, emerging supermarkets, shops and open-air markets for fresh produce.

Domestic production is the primary source of fresh food. Urban households with lower purchasing power depend on open-air markets and small shops, as well as on the markets for civil and military consumption, which are owned and managed by the government and serve all segments of the society. These markets are relatively well distributed across the Kingdom, and their prices are generally lower than those in private-sector shops and supermarkets. The extent to which the food environment depends on direct supply (i.e. farmer to consumer) and whether these households complement their food supply with their own production needs to be verified. The food supply to rural households and their modes of food procurement call for further investigation.

6.3.2 Institutional environment and governance

Jordan is a constitutional monarchy, headed by King Abdullah II of Jordan since 1999. The Royal Family is a major stabilising factor in the country's political landscape. The King is advised by a selective committee and identifies, selects and appoints the prime minister and other cabinet members. Democratic elections are held to appoint members to the House of Parliament. In 1999, the King stated the intention to make economic reform a cornerstone of his policies. While this has broadly been taking place, progress has been faster in some areas than in others. In all aspects of policymaking, the pace and success of reforms are influenced by a variety of interests from powerful interest groups. As such, reforms in public administration and decentralisation have been slow (Bino, in Fakoussa & Kabis-Kechrid, 2019). A divide between the private sector and the government can be observed, in which the private sector is likely to perceive the performance of government agencies as poor. The role of government policies is important, especially given that the Jordanian economy has been characterised by a loss of disposable income amongst consumers. To generate more state revenue and reduce public debt by 2021, the government introduced IMF-guided tax hikes and subsidy cuts throughout 2018, thereby making life more expensive for the average Jordanian (Euromonitor, 2019).

The King has recently identified food security and the need for greater resilience in food supply as important national priorities. Inspired by these viewpoints, a committee was installed with support from major international agencies, including the WFP and FAO. The year 2021 was proclaimed as Jordan's Year of Food Security, in which the First Food Security Strategy 2021–2030 was formulated, followed by

the Strategic Action Plan 2022–2024. Within the context of preparing national pathways for transformation for the United Nations Food Systems Summit in 2021, Jordan conducted national and sub-national dialogues. The King is also known to support the ambition to make Jordan a regional food hub, and he has indicated willingness to encourage this initiative. The vision of the National Food Security Strategy is as follows: 'Safeguard Jordan's population against food insecurity while ensuring access to safe, stable, affordable and nutritious supply of food at all times'. The strategy makes a realistic analysis that global crises could jeopardise food supplies, while limited local resources could hamper national production. The key pillars of this strategy include the availability of food, access to food, the utilisation of food and food governance.

In terms of who actually governs the food system, stakeholders identify various actors and institutions as important (Foresight4Food, 2023). Key governing bodies include the Ministry of Agriculture, the Ministry of Health, the Ministry of Industry and Trading and the Ministry of Water. In addition, the Jordan Food and Drug Association, the Jordan Standards Organisation and the Greater Amman Municipality are influential stakeholders. The food system is subject to a number of key regulators. For example, regulations on food production and processing are set by the Ministry of Agriculture and other ministries. The system is also subject to central marketing rules, customs and taxes, subsidies (e.g. for bread), and various regulatory frameworks. Influential players in the food system include champions of trade and industry (e.g. larger importers and processors), wholesale market owners and dealers, the consumer-protection association and various media that have the potential to draw attention to food-related issues.

Multilateral organisations (e.g. FAO, WFP and UNDP) are important actors, especially within contexts in which food and nutrition are of concern for the population of Jordan and the refugees hosted in the country. Key supporting agencies (e.g. the Food and Drug Authority, the Ministry of Industry, the National Agricultural Research Centre and the Jordan Standards Organisation) play a role in the institutional environment. Key research institutes working on food system aspects include the University of Jordan and the Jordan University of Science and Technology. There is a variety of civil society organisations (CSOs), such as the Consumer Protection Association, but their influence and role are modest (Foresight4Food, 2023).

Actors who play a central role in the implementation of the National Food Security Strategy include the Ministry of Agriculture, the Ministry of Industry, Trade and Supply, the Ministry of Health, the private sector and the CSOs. The National Food Security Committee is chaired by the Minister of Agriculture, and it includes high-level representatives from the public and private sectors, as well as from the international community and CSOs.

The food system is influenced by a number of other key aspects. The first is related to cultural norms and values. One example is linked to the generosity and hospitality of Jordanians when inviting guests to dinner, which can also lead to food waste. Finally, major influences that are largely external to Jordan relate to international trade treaties and international diplomatic and economic relations that govern the import and export of food products and prices (Foresight4Food, 2023).

Although there has been an increase in access to financing, the World Bank regards access to financing as the second most problematic development area in Jordan. On an encouraging note, however, the regional rank of the business-enabling environment increased by 2.38% between 2017 and 2018 (Lina Hundaileh & Fadi Fayad, 2019). The Government of Jordan has identified food security as a foremost priority in its national food-security strategy (Hashemite Kingdom of Jordan, 2021).

Access to data is a critical issue. As reported by stakeholders at the Foresight4Food workshop, there is a general lack of available data, the quality of data is mixed and many stakeholders do not trust figures and statistics. As noted in a study on financing in agriculture:

> Although there is data available at the national Department of Statistics (DoS), data on numbers of farmers and their characteristics such as average land size, main crops grown and land ownership, are not considered to be completely accurate. There is also very limited quantitative information available on farmers' financial performance, including cashflow analyses and the characteristics of their savings, payment and lending behaviour. In addition, most financial service providers do not analyse their portfolio to the level of small farmers and their utilization & financial performance (Palladium, 2019, p. 13).

Jordan scored 47 out of 100 on the 2022 Corruption Perceptions Index, which ranks 180 countries and territories according to their perceived levels of public-sector corruption, according to economic experts and the business sector. Whilst the score ranks Jordan fourth amongst neighbouring countries in the Middle East, main points of regression are related to four points: lack of government success in reducing corruption in various government institutions; extent of bribery, nepotism and favouritism; long periods of tenure for public officials; and abuse of public finances for personal gain (Rasheedti & Transparency International, 2022).

7 Food-system dynamics, trade-offs & synergies

7.1 Mapping food-system dynamics

To enhance understanding of the dynamics of the Jordanian food system, it is necessary to draw links between the various elements of the food system: its drivers, activities and outcomes. The interlinkages between some key elements of the food system are illustrated in Figure 20. This simplified casual loop diagram indicates a few general patterns within the system:[1]

1. **Climate change** is a key driver of the food system, affecting not only the availability and use of water, but also the production and efficiency of agricultural production, farmer income and the sector's contribution to the country's GDP.
2. **Agricultural labour** from the influx of refugees and economic migrants plays a critical role in supporting Jordan's food production and keeping prices of Jordanian products affordable.
3. The role of **access to financing (or the lack thereof) for small-scale farmers** is vital to supporting farm investments, the use of technology, agricultural productivity and farmer income.
4. **The COVID-19 pandemic and the Ukraine crisis** have had a major impact on global food prices, and they have thus also affected the affordability of food in Jordan, which is largely dependent on food imports. This has particularly affected vulnerable populations, including the country's large refugee population.
5. **Changes in consumption patterns** have increased purchasing power amongst parts of the population that, in combination with the rise in food advertisements, has led to the proliferation of supermarkets, increased online food purchasing and a changing diet composition, which has contributed to the increasing prevalence of overweight and obesity amongst Jordanians.
6. **Changes in diet composition**, in combination with reinforced cultural habits, have also contributed to an increase in food waste.

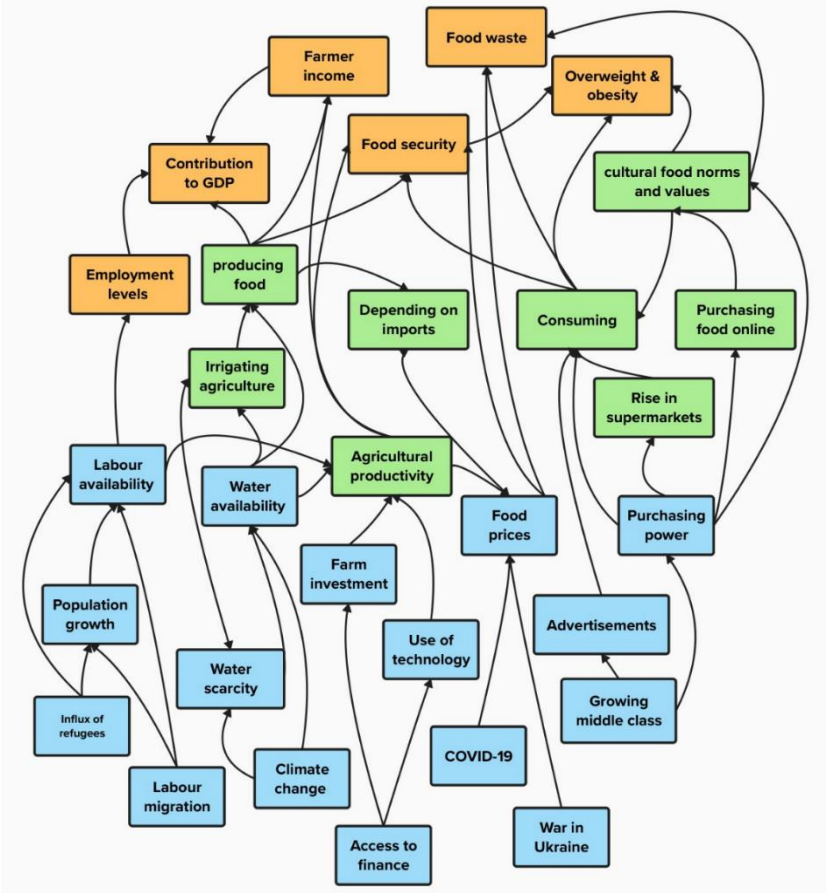

Figure 20 *A simplified causal loop diagram of Jordan's food system. Food-system drivers [blue], food-system activities [green], food-system outcomes [orange]*

[1] This simplified casual loop diagram represents a preliminary analysis of the dynamics in Jordan's food system. It has been published with the intention of further development and validation through participatory processes.

7.2 Trade-offs and synergies

In any food system, stakeholders are likely to have both corresponding and opposing interests. Power and agency are unequally distributed, with certain stakeholders having more influence (e.g. on policymakers) than others do. This interplay between stakeholders, which creates coalitions of mutual interests, exercises power and influence and opposes other stakeholders with conflicting interests, is an important dynamic that shapes the food system. This political economic playground provides a good explanation for why a food system has great beneficial outcomes for one segment of stakeholders, while having significant detrimental effects on other segments in society or outcomes (e.g. the environment).

Examples of opposing interests in the Jordanian food system could include:

- Large-scale traders who rely on the centralised trading system, as opposed to small-scale retailers who could benefit from decentralised, direct trading
- Importers of food products, as opposed to domestic food producers
- Promotion of food exports, as opposed to local prices, especially during certain periods in which production does not meet demand at the national level, which results in a clear conflict between the interests of farmers and dealers and those of consumers

Differences in interests and imbalances in power also explain why food-system transformations towards certain improved outcomes may stagnate due to resistance. If such changes are not perceived as beneficial to powerful stakeholders, they may exercise their influence to hinder or even block their implementation (see also the following section on trade-offs).

7.2.1 Trade-offs between food-system outcomes

Efforts to improve certain outcomes of the Jordanian food system may require trade-offs with other outcomes. An exclusive focus on one desired outcome may have negative impacts on other outcomes. Analysis of the Jordanian food system reveals three **hypothetical examples** of trade-offs that are relevant to the country's ambition to transform its food system in order to improve outcomes for all.

Trade-off 1: Production of low-value crops vs water availability. Jordan's agricultural development policy has favoured export-oriented policy, without due consideration to maximising the returns on each cubic metre of water. This has led to substantial amounts of water usage. In this way, the growth in Jordan's horticultural sector is having a significant impact on the availability of water, not only for agriculture, but also for industry and consumers. The increasing scarcity of water is further exacerbated by the impacts of climate change.

Trade-off 2: Import dependency vs food affordability. Despite its export of fruit and vegetables, Jordan is dependent on imports from abroad for the majority of its food consumption. Two thirds of its calorie consumption is imported. With increasing global food prices due to the impact of climate change, COVID-19 and the Ukraine crisis, the affordability of imported food products is under pressure. This reduces food security, especially amongst the more vulnerable parts of the population in Jordan (e.g. its large refugee population). The current food system is therefore not sufficiently resilient against future volatility in international food prices.

Trade-off 3: Food waste vs food security. The annual amount of food wasted in Jordan could feed 1.5 million people for a whole year. On average, each Jordanian wastes 93 kg of food each year, which amounts to around one million tonnes/year. Moreover, it has been estimated that 22% of all locally produced fruit and vegetables are lost along the various nodes of the supply chain. While economic policies have improved food security amongst the Jordanian population, the growth in food consumption and the change in diet has contributed to more food waste. Reducing the amount of food loss and waste would increase the availability of food for consumption.

7.2.2 Synergies towards food-system transformation

The transformation of the Jordanian food system towards improved economic, health and environmental outcomes will require interventions that provide synergies between the various desired food system outcomes. In this section, we present three **hypothetical examples** of possible synergies between desired outcomes within the Jordanian food system.

Synergy 1: Balancing water-intensive crops with economic success. At present, much of the agricultural production in Jordan, especially in the horticultural sector, is relatively water-intensive, thereby exacerbating water scarcity in the country and posing a threat to the industry's own success. Investments in less water-intensive, nutrient-rich and/or high-value crops could retain the economic success of Jordan's agricultural sector, while reducing the pressure on the country's water reserves. Policies that favour nutrient-rich crops could have a positive impact on the availability and accessibility of healthy diets for less-advantaged households.

Synergy 2: Purchasing power vs fruit and vegetable consumption. As purchasing power increases for most Jordanians, the consumption of meat, dairy and eggs is starting to exceed recommended levels. At the same time, the consumption of pulses, fruit and vegetables remains below recommended levels, thus resulting in nutritional deficiency for large parts of the population. Efforts to promote the health benefits of eating fruit, vegetables and pulses could increase the consumption of these food categories up to the recommended levels.

Synergy 3: Food loss and waste and water conservation. Food loss and waste contribute to unnecessary water use through production and the processing of inputs and food. This is of vital importance in a country like Jordan, which suffers from acute food scarcity.

8 Conclusions

The Jordanian food system has evolved rapidly over time to meet numerous needs existing within the society. The agricultural system is characterised by the co-existence of diverse farming systems within a challenging climatic and ecological environment. As such, highly intensive export agriculture can co-exist with extensive Bedouin livestock keeping. The food system delivers well on several outcomes, and it has managed to secure the food security of the vast majority of consumers despite the COVID-19 pandemic and the effects of Russia's war in Ukraine-Russia on international food prices. At the same time, however, many households in the country are experiencing malnutrition, lack of a healthy diet and obesity. These outcomes are thus accompanied by trade-offs, which are clearly visible in the food system. One key question concerns whether the food system is sufficiently capable of meeting society's needs in the future and whether it is resilient against a variety of future shocks? This report is an attempt to create a solid foundation on which to discuss such matters amongst multiple stakeholders in the Jordanian food system, whilst looking into the future together and discussing what can be done to strengthen the country's resilience and the performance of its food system.

Food-system outcomes

Economic and social well-being

Despite its strategic importance to the country, the agricultural sector's contribution to the GDP has decreased by half since 1970, with a significant decline in agricultural employment. Over the past decade, Jordan's unemployment levels have doubled, and poverty levels have increased. With its rapidly growing population, Jordan is becoming increasingly dependent on food imports. At present, the country imports two thirds of all calories consumed. In contrast, Jordan is a net exporter of fruit and vegetables, and the industry makes a substantial contribution to the creation of value, as well as to the GDP.

Food and nutrition security

Despite the COVID-19 pandemic and the crisis in Ukraine, Jordan has managed to avoid major food shortages. Of all Jordanians, only 3% face severe food insecurity. Amongst the nation's large refugee population, however, 21% are food-insecure and two thirds are vulnerable to food insecurity. While the consumption of meat, fish and dairy exceed the recommended intake, the consumption of whole grains, nuts, legumes, fruit and vegetables is insufficient. As a result of changing diets, more than half of the adult population is overweight, and this fuelling an increase in obesity-related diseases.

Environmental sustainability

Jordan's food system draws on more than half of the country's freshwater resources. With groundwater being depleted twice as fast as it can be replenished, water-stress levels have increased in the past two decades. The impact of climate change is further exacerbating the water crisis in Jordan, which poses a true threat to the country's GDP. In addition, the food system is responsible for 30% of all greenhouse gas emissions in the country, with most emissions relating to production, retail and food waste.

Food system actors and activities

Production

In Jordan, agricultural production is concentrated in the northern and central highlands, where vegetables, fruit, olives, wheat, barley and other field crops are cultivated. In the Jordan River Valley, vegetables and fruit (citrus and bananas) are produced mainly for local consumption and export. At the national level, Jordan has achieved high self-sufficiency ratios for vegetables, fruit, eggs, fresh milk, olive oil and poultry meat. Modern farm owners are largely investors, with farming activities generally performed by sharecroppers. In the agricultural sector, foreign labour (particularly from Egyptian) makes up a considerable portion of the workforce.

Processing

Most of Jordan's 4,000 food-processing businesses are concentrated around the major cities and involved in baking, dairy and the preparation and packaging of food. Food-processing revenues represent 4.13% of the national GDP. The food-processing industry is growing rapidly, with the demand for ingredients expected to double in the next five years.

Retail

Jordan's retail sector is valued at US$ 4.5 billion, and is expected to grow by 3–5% over the next five years. In 2019, Jordan imported consumer-oriented products amounting to US$ 2.7 billion. The country's retail sector is influenced by the rising number of supermarkets and an increase in online shopping and food delivery.

Consumption

The large majority of the Jordanian population lives in urban areas (92%). High-income consumers are driving the demand for imported products, with middle and low-income consumers focusing on domestic goods. While 17% of people in the country face food insecurity, 37% of the population is obese.

Food waste

Food waste in Jordan has doubled over the past two decades, and it has been estimated at 93 kg per person each year. The total amount of food wasted in Jordan could feed 1.5 million people for a whole year. At the level of food loss, it has been estimated that 22% of all locally produced fruit and vegetables are lost along the various nodes of the supply chain, and that one third of the country's wheat supply is either lost or wasted.

Supporting services

Jordan is dependent on energy imports, and it is facing increasing water scarcity. Meanwhile, the energy and water consumption of the food system are growing. Over the past decade alone, electricity consumption and water pumping for agricultural purposes have doubled. The increasing demand for energy and water in the food system, combined with rising energy prices and increasing water scarcity, make the Jordanian food system increasingly vulnerable. Access to financing is limited for farmers and specific agri-food sectors in the country.

Institutional environment

The Jordanian government has identified food security as a top priority in its national food-security strategy. Moreover, Jordan has expressed interest in becoming a food-security hub within the region.

Business environment

While access to financing remains a hurdle for many food businesses, the wider business-enabling environment has improved in recent years.

Food Environment

In urban areas, fast-food chains and food-delivery services have increasingly come to dominate the food landscape. Advertisements are promoting additional demand for the consumption of food away from home, thereby enticing people to move away from eating food prepared at home. In many cases, this can increase the cost of food.

Food-system dynamics

Food systems are dynamic in nature, and they change over time as a function of the interplay between drivers, trends and internal forces that steer the system in certain directions. Synergies can thus emerge between outcomes (e.g. reducing food waste), thereby having a positive impact on food prices and water availability. Trade-offs are likely to emerge as well, however, creating positive impacts on one outcome, while disadvantaging another outcome. In many cases, changes within the system are associated with winners and losers. More specifically, the losers are disadvantaged stakeholders, whose situation may deteriorate in response to particular policies or measures. Such stakeholder segments are likely to resist the anticipated changes in the system. It is therefore important to understand food systems in terms of their political economic constellation. Key questions concern which interest groups are important within the food system, what their interests are and the extent to which they are able to advocate for their own interests. In terms of future scenarios, questions concern whether these groups will be amongst the winners or losers, and which factors might alter the trade-offs for the losers.

Ensuring the future resilience of the Jordanian food system is a highly dynamic process, in which policymakers and all key stakeholders navigate the boundaries of the system, explore internal relations between actors and activities, touch upon

each other's interests with due respect and together enter into the unknown: the uncertainties that lie ahead. Only through collective action is it possible to build a food system in Jordan that will be resilient to the future and that will continue to progress and enhance its performance, despite the uncertainties that come on its pathway, while delivering the best possible outcomes for all citizens.

Food-system drivers

Demographics and development

In the past two decades, Jordan's population has doubled from 5 million in 2000 to more than 11 million now. This increase is largely due to the high influx of refugees. At present, it is unclear whether their presence will become permanent, or whether an outflux can be expected once the regional situation allows. Government spending on agriculture has decreased over the past decades, relative to its economic value.

Consumption

Many households in Jordan spend 30–40% of their income on food. Relative to other food groups, the consumption of meat, dairy, eggs and sugar has increased over the past two decades.

Technology

The Jordanian food system is being increasingly shaped by technological advances, from computer-steered irrigation systems to the growing role of online shopping and app-based food delivery.

Markets

Although Jordan is largely self-sufficient in terms of vegetables, eggs, milk, poultry, olive oil and fruit, its food consumption is largely dependent on imports. As a result, the country is impacted by price volatility on the global market.

Climate and the environment

With rising temperatures and decreasing precipitation, Jordan is already experiencing the effects of climate change, and it will be further affected in the future. This will have a compounding effect on existing water scarcity resulting from competing water demands from consumers, industry and agriculture.

Policy and geopolitics

The Jordanian food system has also been affected by the COVID-19 pandemic and the crisis in Ukraine. Although the pandemic did not cause an major issues with regard to food availability in Jordan, it did lead to an increase in unemployment. The impact of the crisis in Ukraine has been dampened by the large national reserves of cereal commodities, which protected it from the shock.

In Jordan, food security and food-systems transformation have been assigned high priority on the developmental agenda for the past two years. Through cooperation between the government, the private sector and civil society organisations, and with support from the WFP and the FAO, Jordan has now developed its first Food Security Strategy and Action Plan and the National Pathways for Food System Transformation. Moreover, it has established the Council for Food Security, which is chaired by H.E. the Minister of Agriculture, and which is working to establish a Food Security Management Information System.

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