Food and Agriculture Organization of the United Nations

European Bank for Reconstruction and Development

Jordan

Water along the food chain

COUNTRY HIGHLIGHTS

FAO INVESTMENT CENTRE

Jordan

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An analytical brief of selected food chains from a water perspective

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COUNTRY HIGHLIGHTS
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FOREWORD

The Investment Centre Division of the Food and Agriculture Organization of the United Nations (FAO) is assisting the European Bank for Reconstruction and Development (EBRD) in improving the impact of its future agribusiness investments regarding water efficiency. To this end, in 2013, a joint FAO/EBRD project entitled "Water along the food chain" was initiated in four pilot countries — Ukraine, Turkey, Jordan and Kyrgyzstan.

The specific objectives of this project are four-fold:

(i) conduct selected analyses of water efficiency along the food chain to inform EBRD's agribusiness investment decisions;

(ii) identify potential agribusiness clients for the bank and areas for further policy dialogue to improve water efficiency;

(iii) improve agricultural water-use policy-making processes at the country level in the four above-mentioned pilot countries through the involvement of private sector players; and

(iv) coordinate the bank's future interventions regarding water efficiency along the food value chain with those of other international finance institutions (IFIs).

In Jordan, water — an essential factor of economic growth and social development — is scarce. The imbalance between the supply and demand of this precious resource is evidently at the cost of over-abstracted groundwater. The agriculture and food industry is the main water consumer — irrigation alone contributes to about 60 percent of the total water usage in the country. Huge investments have been made to mitigate this imbalance as much as possible and others are in the pipeline or are being planned. Significant improvements are also required from the water demand side in order to move towards a sustainable equilibrium.

The main objective of this report is to both indicate ways for Jordan to move away from all unsustainable agricultural and food activities (high water consumers and water inefficient), and suggest paths toward more water efficient and productive solutions.

The report captures the findings of three missions[1] to Jordan. The first was meant to scope the "water issue" and identify the food value chains that merit analysis to orient EBRD's future investment in the country, while the second and the third missions served as an opportunity for the authors to interact with main sector players and to collect primary data for the analysis.

The scoping report, validated by the EBRD team, identified the following food chains for a more in-depth analysis: processed poultry meat and winter vegetables and fruits (dates) from the Jordan Valley (JV) for high-value markets.

For each specific sector, a value chain and water-use efficiency analysis was carried out. In the case of the fruits and vegetables sectors, the study and the value chain analyses targeted the JV based on the following facts characterising the area:

- irrigation in the JV is conveyed to farmers through an organized collective system managed by the Jordan Valley Authority (JVA);
- the bulk of the irrigation is through surface water, about 60 percent of which is actually treated waste water (TWW);
- the JV has made over time major investments in technology, water efficiency and quality;
- vegetable crops are predominantly harvested off-season;
- water productivity levels are reported as being twice those of the Highlands.

Regarding poultry meat, the industry has made significant investments in recent years to improve its productivity and has the potential to further increase water-use efficiency and productivity.

[1] Turi Fileccia, Senior Agronomist-Mission Leader, and Vasyl Hovhera, Economist of the FAO-Investment Centre (FAO-IC) fielded two missions in May and October 2013. The missions were assisted in Jordan by the consultants: Suhail Wahsheh, Water Sector Specialist and Husam Samman, Industry Technologist. Inna Punda, Agribusiness Specialist of the FAO-IC, contributed to the Agri-Trade and Food Safety aspects; Stefania Manzo, Agriculturist Consultant of the FAO-IC, assisted throughout the entire study process. A third mission in March 2014 was done to organize and conduct a roundtable to present findings and open a public discussion on the next steps. The roundtable brought together all concerned stakeholders from the public and private sector, and from the international organizations operating in Jordan.

All such reasons lead to a better and more efficient utilisation of the national water budget and allow for the production of export produces which yield price premiums and overall value addition to domestic market produces.

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The work was carried out by the staff of the Investment Centre Division of FAO. The main author of the study is Turi Fileccia, Senior Agronomist, assisted by Vasyl Hovhera, Economist, and Inna Punda, Agribusiness Specialist. Stefania Manzo, Agriculturist, provided supported throughout the process.

A scoping report was initially prepared by Turi Fileccia. It was followed by the actual value chain analysis conducted by Turi Fileccia, Vasyl Hovhera, Inna Punda and Stefania Manzo. The value chain analysis of the poultry meat sector was supervised by Dmitry Prikhodko, Economist, while that of dates and selected vegetables from the Jordan Valley was supervised by Andriy Yarmak, Economist.

Suhail Wahsheh and Husam Samman, both Jordanian consultants, carried out background research and assisted the in-country work, which was instrumental for the process.

Iride Ceccacci, Economist at EBRD's Chief Economist Office, provided leadership and coordination on behalf of the EBRD.

This report benefited from comments by Eugenia Serova, Director of the Rural Infrastructure and Agro-Industries Division, FAO, Pasquale Steduto, Deputy Regional Representative and Elhadi Yahia Kazuz, Agro-Industry and Infrastructure Officer, both from the FAO's Regional Office for the Near East.

On 12 March 2014, FAO, together with the EBRD, organized a roundtable discussion on "Investing in efficiency: water along the food chain in Jordan" in Amman. The aim of the roundtable was to present the findings of the FAO report and to open a public dialogue on the way forward.

The authors would finally like to thank: Heike Harmgart, Head of the EBRD's Office in Jordan, Claudio Gregorio, Chief of the Europe, Central Asia, Near East, North Africa, Latin America and Caribbean Service, TCIC, FAO, and Emmanuel Hidier, Senior Economist, for their overall support and guidance. Genevieve Joy, Project Officer, TCIC, provided valuable help in project coordination particularly during the roundtable in Amman and Sarah Mercadante, Project and Communications Officer, TCIC, coordinated the publication process. Thanks are also extended to the entire TCIC General Service team for their assistance during the implementation of the study.

ACRONYMS AND ABBREVIATIONS

BAU	business as usual
BOD	biochemical oxygen demand
BOT	Build–Operate–Transfer
CBJ	Central Bank of Jordan
CIF	cost, insurance and freight
CITS	customs integrated tariff system
DoS	Department of Statistics
EBRD	European Bank for Reconstruction and Development
EC	electrical conductivity
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOStat	FAO Statistics
F&V	fruit and vegetable
FEMISE	Forum Euroméditerranéen des Instituts de Sciences Économiques (Euro-Mediterranean Forum of Economic Institutes of Sciences)
FOB	free on board
FTA	free trade agreement
GAFTA	Greater Arab Free Trade Area
GAPs	good agricultural practices
GDP	gross domestic product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
GMP	good manufacturing practices
GNI	gross national income
GOJ	Government of Jordan
GTA	Global Trade Atlas
GTIS	Global Trade Information Services
HACCP	hazard analysis and critical control points
IAEA	International Atomic Energy Agency
IFI	international financial institution

IMF	International Monetary Fund
IOR	Institute of Refrigeration
IPPC	International Plant Protection Convention
ISIC3	international standard industrial classification of all economic activities (revision 3.0)
ISO	International Organization for Standardization
ISSP	institutional support and strengthening program
ITA	information technology agreement
JEPA	Jordan Exporters and Producers Association
JFDA	Jordan Food and Drug Administration
JISM	Jordanian Institution for Standards and Metrology
JNCO	Jordan National Competitiveness Observatory
JOD	Jordanian Dinar
JRV	Jordan Rift Valley
JV	Jordan Valley
JVA	Jordan Valley Authority
JVWF	Jordan Valley Water Forum
KAC	King Abdullah Canal
KTD	King Talal Dam
LCD	litres per capita per day
MCM	million cubic meters
MENA	Middle East and North Africa
MERCOSUR	Mercado Común del Sur (Southern Common Market)
MFN	most favoured nation
MoA	Ministry of Agriculture
MoE	Ministry of Environment
MoH	Ministry of Health
MoIT	Ministry of Industry and Trade
MoM	Ministry of Municipalities
MoPIC	Ministry of Planning and International Cooperation
MT	metric tonne
MWI	Ministry of Water and Irrigation
OECD	Organisation for Economic Co-operation and Development
OIE	Office International des Epizooties (World Organization for Animal Health)
OIML	International Organization of Legal Metrology

PSSG	Private Sector Engagement for Good Governance program
RoC	return on costs
SPSs	sanitary and phytosanitary measures
TBT	technical barriers to trade
TDS	total dissolved solids
TSS	total suspended solids
TWW	treated waste water
UAE	United Arab Emirates
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
USD	United States Dollar
USDA	United States Department of Agriculture
VCA	value chain analysis
WAJ	Water Authority of Jordan
WB	World Bank
WBI	World Bank Institute
WHO	World Health Organization
WIS	water information system
WREC	water reuse and environmental conservation
WRG	Water Resource Group
WSP	waste stabilization pond
WTO	World Trade Organization
WUAs	water user associations

EXECUTIVE SUMMARY

Jordan is capable of moving away from all unsustainable, agricultural and food activities that are high water consumers and water inefficient. This will be possible if investments target profitable food chains that have made clear efforts to improve their water efficiency level and have the potential to further enhance the productivity of each drop of water consumed. In this regard, the poultry meat sector for domestic consumption and some selected high-value market fruits and vegetables of the Jordan Valley (JV) deserve priority attention.

Country and sector outlook

Jordan is a low, middle-income country with a population of 6.4 million people. In 2013, it had a per capita gross domestic product (GDP) of JOD 3 800. Inequality in the country is high with about 13 percent of Jordanians living below the poverty line. The service sector leads the Jordanian economy, followed by industry and agriculture. These three sectors contribute to the GDP respectively by 66 percent, 31 percent and 3 percent. The overall contribution of the agrifood sector (agriculture and food industry) to the national economy amounts to 6 percent.

In 2011, the food industry represented about 15 percent of the total industrial sector's value added and 15.5 percent of the total wages coming from the industrial sector. It also provided employment opportunities for about 2.5 percent of the national economy's total labour force. Approximately 99 percent of the industrial facilities in Jordan are classified as micro-, small and medium enterprises. The meat processing sector, holding a 24 percent share, is a major contributor to the food industry's GDP and it forms 15 percent of the industry's gross value added. The poultry sector is considered one of the highest potential sectors within the meat industry. In fact, ever since Jordan's accession to the World Trade Organization (WTO) in 2000, the commercial poultry industry has undergone a rapid development. New high-tech farms were established and an integrated production system was adopted by large companies — the sector has since consolidated significantly.

The contribution of agriculture to the GDP has declined in relative terms from 20 percent in 1974 to less than 3 percent in 2011, while its contribution in absolute terms has increased manifolds. Recently, agriculture has become an important source of hard currencies earned from exports, while continuing to be a relevant employer of the rural communities. The sector generates strong forward and backward linkages with other sectors and activities; in fact, it employs about 124 000 people (about 7.7 percent of the active labour force) and generates 17 percent of total national exports.

Animal production accounted for more than 60 percent of the agricultural GDP in 2011. In terms of gross output value, the poultry subsector represented about 18 percent of the livestock sector and 11 percent of the overall agriculture sector. In 2011, this subsector was the best performing in terms of gross margins compared with the overall livestock sector: 69.5 percent against 16.5 percent.

Around 40 percent of the agricultural GDP is generated by crop production. In Jordan, only 5–6 percent of lands is arable. In fact, in 2011, only 260 000 hectares were used for crop production, of which 100 000 hectares were irrigated.

The JV is considered a natural greenhouse with some 0.3 million largely irrigated dunum cropped land. Over half of its arable lands is used for vegetable production, while more than one-third is used for fruit crops. Despite accounting for a limited 23 percent of the entire Jordanian fruit and vegetable (F&V) land use, the JV produced almost half of the national output of these crops, in 2011. During the same year, the valley managed to produce over 170 thousand tonnes of fruits and more than 875 thousand tonnes of vegetables, predominantly during the winter season targeting mostly off-season export markets.

Prior to 1980, horticulture in Jordan was very limited and the production of fruits and vegetables was targeted at the local market. However, the introduction of new technologies in irrigation, crop production, handling and export capacity allowed the country to enter the global F&V markets.

Jordan is a net importer with USD 12.8 billion of deficit in the balance of payments as registered in 2012. According to the Global Trade Atlas (GTA), during the same year, the country registered USD 2.3 billion of deficit in the trade of agrifood products. Jordan's

trade regime went through significant reforms during the process of its accession to the WTO, which was successfully concluded in 2000. The country has bound customs tariffs on all products, except electricity, and is among the most liberal trade regimes in the region.

The contribution of agrifood products to total merchandise exports slightly grew from 13 percent in 2008 to 17 percent in 2012 reaching USD 1.4 billion. Horticulture represents almost half of all agricultural exports of the country. F&Vs were in fact Jordan's third largest merchandise exports in 2012, after textiles and fertilizers.

The share of agrifood imports has remained stable during the last five years with 17–18 percent on average. Jordan is self-sufficient in vegetables and fruits and has a good rate of self-sufficiency for poultry meat and eggs. In 2012, Jordan imported about 60 thousand tonnes of poultry meat (24 percent of domestic consumption), half of which from Brazil. Jordan's poultry — and also dairy — production systems rely to a large extent on imported feed grains and fodder and irrigated forage crops (clover). The natural consequence of this situation is that Jordan continues to be a net food importing country, with large amounts of cereal imports.

Water Outlook

Water is an essential factor of economic growth and social development. In Jordan, water is scarce and the country is bound to an imbalance between available resources and their annual use by all sectors. According to the 2011 water budget of the Ministry of Water and Irrigation (MWI), the renewable water resources are estimated to be 853 million cubic meters (MCM) per year. This budget shows an amount of groundwater used for all purposes of 517 MCM and a total amount of surface water (again, used for all purposes) of 382 MCM. As a result, the resources versus use of water balance for 2011 is negative 46 MCM. This imbalance is evidently at the cost of over-abstracted groundwater, which at the same time is the only reliable drinking water supply source in many areas of Jordan. The historical and projected water-use by sector indicate an endemic imbalance that will continue in the future. Moreover, climate change scenarios all predict a further decline of water resources. Huge investments are in the pipeline or are being planned to mitigate the imbalance as much as possible.

The National Agenda — the overarching strategy document of Jordan — and other water-related policy engagements consistently aim at increasing the availability of adequate water sources, advocating effective water-use and emphasizing the need for leveraging non-conventional water sources, all as a means to achieve sustainable development. In order to achieve this last objective, as well as effective governance and efficient use of available water resources, the following implementation targets should be pursued:

- drastic reduction in groundwater exploitation;
- implementation of major water conveyance investments (Disi and Red-Dead);
- irrigated agriculture in the Highlands capped and regulated with enforcement measures;
- appropriate water tariffs and incentives introduced to promote irrigation water efficiency and economic productivity.

The current performance of the different areas is substantially aligned with the agenda targets but have some discrepancies due to the global financial crisis.

Treated Waster Water (TWW) is considered a key element of Jordan's water strategy. Jordan has already pursued this water saving/recycling technology, which is currently providing about one-sixth and up to one-fifth of its water resources. There is scope for further investment in this direction as the country intends to almost double the current level of its annual contribution of TWW to its surface water resources (from the present 100 MCM to 180 MCM).

The donor community is assisting and supporting the country in the endeavour of achieving sustainable water management in a continued manner.

The policy framework calls for employment and socioeconomic development through the growth of labour-intensive and export-oriented industries and trade services. It prioritizes the food industry and agriculture as important thematic investment areas.

Irrigation consumes about 60 percent of the total water used in Jordan while agriculture's share of the GDP is only 3 percent. The agribusiness sector as a whole contributes to the national GDP with a direct aggregated value of some 6 percent (almost

JOD 1.2 billion), making it an important factor and opportunity of the Jordanian economy. An analysis of all the backward and forward linkages determined by the agribusiness sector (with the industry and the services production sectors), while being out of the scope of this study, would show that the actual contributions to the national GDP are more complex and higher. In all cases, specific initiatives will need to direct production toward high-yield revenue crops, which optimize water-use efficiency and improve the competitiveness of the most promising segments of the food industry (allowing competitive import substitution), which already show high water productivity.

Agricultural production in Jordan, even through a very fragmented structure, is already using advanced irrigation technologies to a large extent. Despite this, the overall productivity of the agricultural sector per m^3 of water (at gross output level) is very low, 1.2 JOD/m^3, and is highly dependent on the market price of produce. This pre-condition suggests that in Jordan there is little, if any, scope to focus investment attention in water 'wasting' sectors, while it is otherwise imperative to promote sectors that are already characterized by high water efficiency levels but require investment support to increase water productivity and overall competitiveness. Water productivity is lowest when used for irrigation in the Highlands (as it is mainly used for summer vegetables), which is exclusively sourced from its groundwater aquifers.

The food industry absorbs 10 percent of the total industrial water withdrawal with a quite high water productivity both intra- and inter-sectoral. The contribution of the food industry to total industry and the country's economy is significant. It accounts for about 15 percent of the total industry value added and 3 percent of the country GDP and provides employment for 20 percent of the labour force in the industrial sector or about 2.5 percent of the total labour force of the national economy. A total gross value added of JOD 0.6 billion makes for a quite high water productivity at 173 JOD/m^3 in 2011. This is a high performance compared with the average water productivity of the entire industrial sector at 113.5 JOD/m^3.

Rationale

The JV draws on surface water as its main irrigation source while also using almost all of the TWW generated in the country, thus maximizing the opportunity use and value of this source. The valley

is equipped with a centrally controlled pressurized pipe irrigation conveyance system managed by the Jordan Valley Authority (JVA). The farmers of the valley have made huge investments over the years to improve water efficiency (with localized irrigation) and to increase the competitiveness of their products (with greenhouses[1] and crop substitution with high-value produce). Eighty-five percent of the valley's vegetable output is in the winter season. A number of specialty crops such as strawberries, Brussels sprouts, ginger, specialty peppers and Medjool dates show high water values and offer potential for expansion.

Exporting fruits and vegetables to the European Union (EU), Balkan, and Russian Federation markets, which are able to generate the best prices, results in significantly higher water productivity values compared with Jordan's traditional export markets. Improvements are necessary in the quality and marketing of Jordanian horticultural exports to obtain the highest possible value added in high-end markets in order to increase competitiveness and achieve the highest value per cubic meter of water. Winter vegetables also provide significant employment opportunities by absorbing 53 percent of the labour market in the JV and makes up 52 percent of its total value added;[2] citrus, which is the main fruit tree cultivation in the JV, provides about 18 percent of employment opportunities.

Within the food industry, the meat processing sector is a primary contributor holding 24 percent of the GDP subsectoral share and 15 percent of the gross value added. This industry (processed poultry, lamb and beef) includes three to four market leaders, each with an average market share ranging between 20–40 percent. The increasing electricity, labour and water costs are just a few of the operational costs that are decreasing the sector's competitiveness. However, sector players have managed to increase the gross value added from year to year.

In particular, the poultry sector has undergone a rapid development in recent years and broiler meat production in Jordan has achieved a high level of self-sufficiency (89 percent in 2012, which is

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1 In technical terms, they are mainly high tunnel-type greenhouse covered by plastic film.

2 USAID. 2012; disaggregate economic value of water in irrigated agriculture in Jordan from perspective of VCA, Institutional support and strengthening program (ISSP).

3 percent more compared with 2011).[3] New high-tech farms have been established and an integrated production system has been adopted by the large companies. From a competiveness standpoint, the meat sector scores well in its application of standards including ISO 14001 environmental management systems. Overall the achievements in regard to international standards by Jordanian meat and poultry companies are promising, as a high percentage of companies adopt several voluntary quality and food safety standards, such as ISO 9001, ISO 22000 and HACCP.

The sector's directive to maintain a good level of competitiveness must target innovation and sustainability practices. The best environmental performance can only be achieved by significantly reducing energy and water consumption and improving waste management. Upon its completion, a United States Agency for International Development (USAID) survey on 40 companies in the industrial sector (including the food industry) will be instrumental to identifying the required investments to prevent pollution and conserve both water and energy.

Food chain analyses and indications on the way forward

Poultry meat chain

Prospects of the industry are positive. The continued increase in domestic consumption is a promising sign for the sector, which is likely to experience a further demand-driven expansion in the upcoming years. This analysis confirms that modern, vertically integrated production systems have the highest profitability rates and are more sustainable. The chain is overall profitable and quite balanced along its key segments. Each segment of the chain, at the market price of its specific output, shows positive margins of profit. At the same time the industry faces some serious issues regarding 35 percent of its industry share. This 35 percent represents the broiler farms that are implementing old farming technologies. Their productivity level is very low and margins of profit are near to negative. In the absence of, or pending the implementation of investment interventions that would address such issues, it is likely that many small to medium — and by definition old — farms would need to cease their activities in the near future with a consequent output gap imposition on the national production level. This supply gap can be filled only by an

[3] Department of Statistics (DoS). 2011.

increased share of imports of poultry meat or by an improved production capacity of the bigger domestic players, or through a mix of the two. At a time of demand expansion and in the likely coming event that considerable market shares of minor producers will be left vacant, an opportunity window has also opened to the most progressive portion of the poultry industry. This however doesn't come at zero-cost. Instead, important investments will have to be made by the poultry industry.

Each major industrial player will have to identify its own inefficiencies (organizational, infrastructural, transport, energy, water consumption, waste management and environmentally related) that need to be addressed in order to improve overall competitiveness through ad hoc investment plans. Efficiency improvements are required wherever the industry appears to be operating at a sub-optimal level: primarily the feed and the farming/breeding segments. The sector has strong internal discrepancies because water-use efficiency changes dramatically from farm to farm and from slaughter house to slaughter house. The analysis shows that fully-integrated and highly efficient systems consume half the water (6.86 litre/kg of meat produced) consumed by non-integrated and less efficient market players (12.9 litre/kg of meat produced). Investments in modernization and up-scaling of the sector will definitely have a strong positive impact on water-use efficiency and the water productivity of the sector.

Fragmented production systems need to improve efficiency or specialize (e.g. in niche markets) through modernization and integration (e.g. creating consortium arrangements, specialized contract farming, etc.); otherwise, those unable to upgrade will have to work out an exit strategy (total diversification). Each of these instances would require significant investment and programming of development efforts.

The vegetable chain

The JV is the actual agribusiness centre of the country but its prospects will remain dim unless targeted and concerted investment is made soon. The private sector (producers and agribusinesses), which has made major investments over the years to improve its on-farm water efficiency, now needs to make a decisive move towards the ultimate maximization of water productivity. Water productivity and agribusiness economic profitability are in fact closely related concepts. Producers need to switch to new crops and markets that will allow them to produce more value without increasing water-use. Producers also need to

invest in energy efficiency improvement and labour productivity enhancement as these are currently the most problematic issues affecting future sector development undermining investment attractiveness. An upgrading is certainly feasible as is evident by mirroring the West Bank agribusiness economic indicators on the other side of the Jordan Rift Valley (JRV).

At the primary production level, a paradigm shift is required that targets more and more — eventually in an exclusive manner — high-end market demanded produces. This however is only possible if improved backward and forward linkages are established between primary production and the agribusiness industry. To this end, a concerted action among farmers and agribusinesses needs to be established with the targeted support of the public sector.

The agribusiness industry will need to invest in further enhancing its agricultural productivity (e.g. water efficiency and desalinisation) and enlarging its production base either directly (e.g. high-tech greenhouses and large multi-span protected units) or through improved contractual arrangements (showing equitable reciprocal value) with primary producers. Investment is also required here to improve and expand value addition capacity in terms of: modern packaging/processing systems and cold chain (including pre-cooling, refrigerated and non-storage, which would require energy-saving investments — e.g. in solar power); efficient trading (advantageous and reliable freight contracts, including refrigerated transport); better food losses and waste control management systems and marketing organization (ensuring trustworthy market outlets).

A technical and organizational upgrading of the producers is also required. This shift entails a number of investments at the production level which mainly regard: optimising cropping systems/practices (the quality input level — e.g. seed and seedlings), technological improvements of protected agricultural gears and means (greenhouses), broader, more widespread capacity development for compliance to international good agricultural practices (GAPs)/ sanitary and phytosanitary measures (SPSs) standards (encompassing "soft" and "hard" investments), and organizational adaptations. A continued and sustainable expansion of the Water Users Associations (WUAs) organization is also needed in order to responsibly empower the users to obtain water of reliable quantity and quality.

The dates chain

Dates have a short chain that is highly profitable along its segments. Its water productivity is also among the highest. The industry is expanding fast and should be further incentivized in the JV. The Medjool variety has the best prospects but other varieties (e.g. Bahri) are also promising. Major investment areas regard an expansion of its irrigated production base (also equipped with a mechanized harvesting capacity) and an increase of its (likely automated) packaging/processing and cold chain capacity, which would need to be aligned to the pace of the production base growth.

Furthermore, the analyses of the three selected food chains also confirm that all are capable of generating high economic water productivity levels, while also confirming that further investment in the improvement and expansion of the production base of the most profitable lines of such chains (modern broiler meat, high-value export market vegetables and dates production systems), to the detriment of others that do not provide comparable economic returns, will allow for further gains in water productivity. For a country like Jordan, which is the fourth water poorest country in the world, this is believed to be the right direction to pursue.

Investments are also needed in all practices that can increase the efficiency of the food value chain, thus reducing food losses and waste, and in turn reducing the waste of water. Investments should be made in improving the markets' infrastructure (especially wholesale markets) and in good handling practices (both at the service and consumer levels) of foods.

The enhancement of the sustainability and competitiveness of the poultry meat sector is a private sector undertaking, with the only obligations of the public sector being those inherent to its specific mandate as the guarantor of a fair and level enabling environment.

On the other hand, in order to ensure a sustainable economic future for the JV, a number of long-term conditions should prevail and related short-to-medium-term priority actions need to be taken. The private sector needs to show interest and commitment in investing in a renaissance of the JV agribusiness. Champions of the private sector need to emerge first among agribusinesses. A starting point of the work plan may foresee the contextual investment plan upgrade their own production

units and facilitate investment interventions in contracted farming units for outsourced production. In parallel, a number of smaller but progressive producers in the JV (particularly but not exclusively in the southern part of the valley), who are already organizing themselves under a cooperative form of arrangement (institutionally emerging in Jordan), could possibly scale up their economic and organizational status and become eligible to access ad hoc credit lines for investment financing.

The public sector would moreover have to play an important role. Firstly, it would need to acknowledge the JV as a priority area by declaring it the "Agribusiness Hub" of the country. A public sector sponsor would have to champion this process. Secondly, special policy and institutional attention on key specific areas is required. In terms of "hard" investment, public sector responsibilities and related investment endeavours would have to address JVA system interventions to improve irrigation water management and distribution to guarantee the JV producers long-term certainty on a set amount of good quality water. There is also scope to accelerate investment in order to increase the availability of TWW for irrigation purposes. Eventually, public-private partnership investment areas would likely focus on food quality and safety control systems (particularly but not exclusively for export commodities), R&D and marketing information.

OVERVIEW

Country profile

Jordan, with a population of 6.4 million people (Department of Statistics — DoS, 2012), is a heavily urbanized (79 percent of its total population), low middle-income country with limited natural resources. In spite of being in the centre of a geopolitically unstable environment, the Jordanian kingdom has maintained, over several decades: political stability, favourable policies and an open government system. In 2013, per capita GDP in Jordan amounted to JOD 3.8 thousand (Table 1). According to the International Monetary Fund (IMF),[4] the economy expanded at an average annual growth rate of 6 percent between 2000 and 2010, while the real GDP annual growth rate doubled from 4 percent in 2000 to 8 percent in 2007, which also reflected a strong global growth rate during the same period. Inflation remained generally low, and efforts to tighten fiscal policy facilitated a substantial decline in public debt. However, the years after 2007 witnessed a decline in economic growth rates, which was amplified by the global financial crises. A particularly challenging year for Jordan was 2011 due to the sweeping changes in the Arab region, from the global shocks of increasing food and fuel prices to a sharp decline in tourism, remittances and foreign direct investment. Other main macroeconomic indicators can be seen in Table 1 below.

Table 1: Main Macroeconomic Indicators in Jordan

Indicator	2010	2011	2012	2013
Nominal GDP at Current Prices (JOD million)	18 762.0	20 394.3	22 229.8	24 274.9
Real GDP at Constant Prices Growth Rate (%)	2.3	3.0	4.0	5.0
Per Capita Income of GDP in Current Prices (JOD)	3 069.0	3 331.0	3 551.7	3 786.1
Inflation, Consumer Price % Variation	5.0	5.5	4.5	4.0

[4] IMF. 2012. IMF Country Report No. 12/120.

Indicator	2010	2011	2012	2013
Budget Deficit before grants as a % of GDP	-7.8	-11.7	-6.2	-5.1
Public Revenues (JOD million)	4 661.9	4 958.7	5 208.8	5 695.8
Public Debt as % of GDP	61.1	65.3	64.7	63.0
Current Account (JOD million)	-938.1	-1 998.6	-1 667.2	-1 699.2
Current Account as % of GDP	-5.0	-9.8	-7.5	-7.0
Exports (FOB) (JOD million)	4 214.8	4 847.0	5 428.7	5 971.5
Exports Growth Rate (%)	17.8	15.0	12.0	10.0
Imports (FOB) (JOD million)	10 836.2	12 353.3	13 588.6	14 811.6
Imports Growth Rate (%)	7.2	14.0	10.0	9.0

Source: DoS provisional IMF projections and Authors' elaborations.

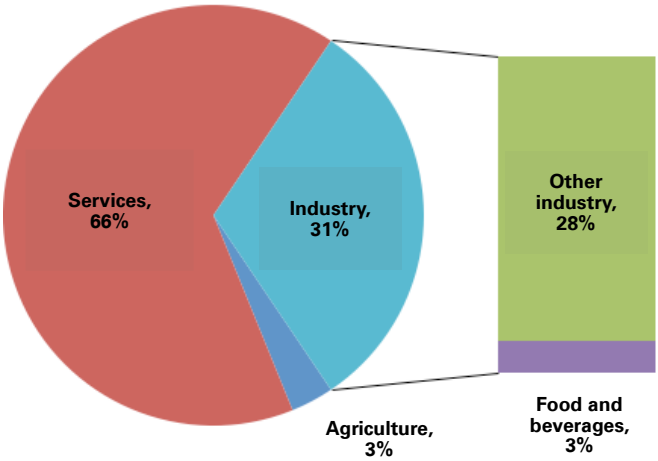
About 13 percent of Jordanians live below the poverty line.[5] Inequality in the country is high (the GINI coefficient was 38.8 percent in 2011),[6] with poverty levels higher in the rural areas than in the urban areas. The rural poor are mostly located in isolated and remote areas with a poor resource base and low population density. A major obstacle to poverty reduction in Jordan is insufficient employment opportunities. Unemployment in Jordan is a youth phenomenon.

Services is a leading sector of the Jordanian economy followed by industry and agriculture. According to Chart 1, the three sectors contribute to the GDP by 66 percent, 31 percent and 3 percent respectively. The overall contribution of the agrifood sector to the national economy amounts to 6 percent.

[5] Jordan Poverty Report (DoS 2011) based on an analysis of the 2008 household survey results. The Jordanian poverty line was estimated at 1.9 JOD per person per day.

[6] Source: World Bank, 2011.

Chart 1: Composition of GDP in 2011



Source: World Bank Data and Industry Survey. 2013. DoS.

The food industry

In 2011, the food industry represented about 15 percent of the total industrial sector's value added, provided employment opportunities for 20 percent of the industrial sector's labour force or about 2.5 percent of the total labour force of the national economy[7] and contributed to 15.5 percent of the industry's total wages.[8] According to the third revision of the International Standard Industrial Classification of all Economic Activities (ISIC3), which has been accredited by the DoS since 1994, the food and beverages industry consists of the following subsectors:

- processing, preserving of meat and its product;
- canning and preserving of F&Vs;
- manufacture of vegetable oil and fats;
- manufacture of dairy products;
- grain mill products;
- manufacture of prepared animal feeds;
- manufacture of bakery products;
- manufacture of cocoa, chocolate and sugar confectionary;

[7] DoS. 2011.

[8] Industry Survey. DoS. 2013.

- manufacture of other food products;
- distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials and manufacture of malt liquors malt;
- manufacture of soft drinks.

Table 2: Main economic indicators of the food and beverage industry in Jordan, 2011

Economic activity	Gross output (thousand JOD)	Intermediate consumption (thousand JOD)	Gross value added (thousand JOD)	Compensation of employees (thousand JOD)
Production processing of meat	502 265	407 081	95 184	28 310
Production preserving of fruit & vegetables	77 288	56 065	21 222	5 949
Manufacture of vegetable & animal oils & fats	249 056	165 627	83 429	6 212
Manufacture of dairy products	156 767	115 840	40 927	12 951
Manufacture of grain mill products	86 425	73 391	13 034	5 203
Manufacture of bakery products	287 382	204 167	83 216	43 145
Manufacture of chocolate & sugar confectionery	86 307	61 543	24 764	6 286
Manufacture of other food products	216 603	142 458	74 145	16 983
Distilling spirits & alcohol production	103 170	32 199	70 971	3 813
Manufacture of soft drinks & mineral waters	321 032	188 861	132 171	35 603
Manufacture of food products and beverages	2 086 295	1 447 232	639 062	164 455
Meat sector as % of food industry	24%	28%	15%	17%
Total industry	14 160 231	9 968 924	4 191 305	1 085 241
Food industry % to all industry (2011)	14.73%	14.52%	15.25%	15.15%

Source: Industry Survey. 2013. DoS.

Approximately 99 percent of the industrial facilities in Jordan are classified as micro-, small and medium enterprises.[9] The Jordan food manufacturing industry comprises over 3 500 operating companies that employ a labour force of almost 30 000 people. According to the National Agenda Committee of Jordan, the food and beverage industry is expected to gain importance over time by increasing its contribution to export and employment (see Table below).

Table 3: Selected performance indicators of food and beverage industry

	2008	2012	2017
Sector output (JOD million)	560	1 600	2 300
Export (JOD million)	150	810	1 200
Cumulative employment	26 000	50 000	53 000

Source: Jordan National Agenda. 2020. National Agenda Committee. 2009.

In spite of developments over time, agriculture production provides only a small fraction of the food industry's needs in terms of agricultural material, both crop and animal. In general, almost all Jordanian food industries, including meat processing, depend on imports of raw materials. The main players of the food industry are all registered at the Chamber of Industry of Jordan.

[9] The Central Bank of Jordan. 2009.

Table 4: Food industries of Jordan

1	Amman	Hejazi & Ghosheh Company
2	Amman	Hammodeh for food industry
3	Amman	Company appetite for food industries
4	Amman	Al-Nabil Company for food industries / Nabil Plant/Factory for products
5	Amman	Saudi Jordanian Company for industrial development
6	Amman	Al-Nabil Company for food industries / Nabil Plant/Factory for products
7	Amman	Al-Halawani Industrial Co.
8	Amman	Al-Thuraya processing and marketing of poultry and poultry products
9	Al-Thlail town (Zarqaa)	Jordanian Company for processing and marketing of poultry and poultry products
10	Al-Halabat town	Allied Company for the dairy industry, cheese and juices
11	Al-Hasmiah town (Zarqaa)	Union for Agricultural Development and slaughterhouses
12	Al-Thlail town (Zarqaa)	International Company for Poultry
13	Amman	Jawad Modern Bakeries
14	Amman	Arab Food Industries Company
15	Amman	Numan Al- Junaidi Food Industries
16	Amman	Al-Kaseeh Company for the manufacture of canned foods

Source: Jordan Chamber of Industry. 2013.

Contrary to the primary sector, the meat processing sector, holding a 24 percent share, is a major contributor to the food industry's GDP and it forms 15 percent of the industry's gross value added. In 2011, only 17 subjects of the meat processing sector were registered as established economic operators and 11 of them reported to have revenues above JOD 1 million per year. Nine operators have an active established capital above JOD 10 million.

The meat processing industry includes few market leaders each with an average market share ranging between 20–40 percent. All companies are privately owned.

The poultry sector is considered one of highest potential sectors of the meat industry. The average poultry meat consumption for a Jordanian individual was estimated at over 25 kg annually (2000–2009 average), notably higher than the mean of poultry meat consumption in developed countries. Changes in income can significantly impact meat demand. As the average household income increases, the expenditure on meat, including poultry will also increase.

The commercial poultry industry has undergone a rapid development in recent years and poultry production in Jordan has achieved a high level of self-sufficiency (89 percent in 2012). Its development started in the eighties and expanded in the nineties. Upon becoming a member of the WTO in 2000, Jordanian poultry producers had to face competition with good quality imported poultry products at low prices and were forced to upgrade their farms and processing facilities. As a result, new high-tech farms were established and integrated production systems were adopted by the large companies. Since then, the evolution of the sector has seen a decrease in the number of players, which has however significantly improved their efficiency level — the sector has since consolidated significantly.

Agriculture

In spite of the increase in absolute monetary terms, the proportionate contribution of agriculture to the national economic growth is modest, which is reflected in the decline of the sector's share in employment and GDP, despite its high water-use compared with other sectors. The contribution of agriculture to GDP declined in relative terms from 20 percent in 1974 to less than 3 percent in 2011[10] while its contribution in absolute terms has increased as shown in Table 5 below.

[10] The Central Bank of Jordan. 2011.

Table 5: Main indicators of the agricultural sector

	2008	2009	2010	2011
Value added at current prices (JOD million)	376.8	459.2	560.9	598.3
Value added at current prices growth rate	9%	13%	7%	4%
Contribution of agriculture to country nominal GDP	2.4%	2.7%	3.0%	2.9%
Deflator of agricultural sector's value added * (JOD million)	122.4	132.2	151.1	155.0
Quantity index of ag. exports * (JOD million)	257.1	279.6	247.5	289.6
Price index of ag. exports* (JOD million)	216.4	208.1	270.7	278.6
Number of registered ag. companies	651.0	593.0	841.0	919.0
Capital of registered ag. companies (JOD million)	151.9	161.6	100.9	332.1
Outstanding credit facilities extended by licensed banks (JOD million)	210	231.2	211.8	229.2

* 1994=100

Source: DoS.

However, the importance of the agricultural sector stems from the fact that it is not only the major source of food items (especially poultry, dairy products, fruits and vegetables) but also one of the sources of hard currencies earned from exports. Agriculture is also an important employer of the rural communities, and due to its strong forward and backward linkages with other sectors and activities, it remains a very important sector in rural development and poverty reduction plans. The sector employs about 124 000 people (2.1 percent of the total population or about 7.7 percent of the active labour force of 1 771 million people in 2012);[11] and generates 17 percent of the total national exports (equivalent to JOD 795 million) in 2011:[12] JOD 313 million for vegetables and JOD 67.9 million for fruits.

[11] DoS. 2012. http://www.dos.gov.jo/dos_home_a/main/index.htm.

[12] Source: MOA Directorate of Studies and Policies (2012).

Table 6: Agriculture sector: gross outputs, intermediate consumption and total value added, 1990–2011

Indicators	1990	1995	2000	2005	2010	2011
Crops Gross Output (JOD million current prices)	173	221.1	201.1	307.2	587.3	626.5
Livestock Gross Output (JOD million current prices)	266	351.4	339	458.3	928.7	990.6
Total Agricultural Gross Output	439	572.5	540.1	765,5	1 515.9	1 617.1
Food items consumer price index (2006=100)	-	-	82.08	93.05	137.67	143.36
Crops Intermediate Consumption (JOD million current prices)	49.1	121.4	139.2	188.1	179.3	191.3
Livestock Intermediate Consumption (JOD million current prices)	198.9	274.8	280.8	331.3	775.8	827.6
Total Intermediate Consumption	248	396.2	420	519.3	955.1	1 018.9
Crops Value Added (JOD million current prices)	123.8	99.7	61.9	119.1	408	435.2
Livestock Value Added (JOD million current prices)	67.1	76.7	58.3	127.1	152.9	163
Total Value Added (Ag. GDP) (JOD million current prices)	190.9	176.3	120.2	246.2	560.8	598.2

Source: DoS.

Animal production accounted for more than 60 percent of the agricultural GDP in 2011.[13] Sheep and goats are the most important kinds of livestock raised in Jordan. About 57 percent of the small ruminants are raised in northern Jordan, 27 percent in the centre and 16 percent in the south. Their production is still highly subsidised, despite the failed attempts to cancel subsidies from 1995–2001 and 2006–2007. The subsidy is mainly through feed distribution as animal production depends highly on imported feed (maize, barley, soybeans, wheat bran and others). For instance, dairy farming in Jordan includes large-scale plants and small-scale household producers (one to ten cows) and regardless of subsidies and free veterinary services for the majority of animal diseases, the result is very costly.

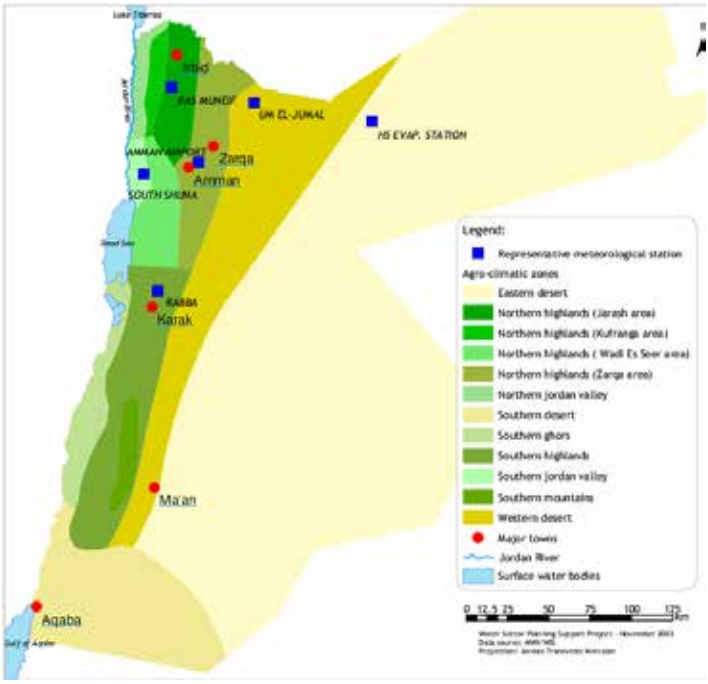
[13] DoS. 2013.

In terms of gross output value, the poultry subsector represented about 18 percent of the livestock sector and 11 percent of the overall agriculture sector.[14]

The performance of the crops sector, in terms of gross margin,[15] is higher compared with that of livestock: 69.5 percent against 16.5 percent, in 2011. Crop sector performance has regained momentum after a less advantageous behaviour in the mid-1990s and early 2000s.

The vast land surface of Jordan (892 000 km^2) is mostly government owned. Only 5–6 percent of the land is arable. An average 260 000 hectares were cultivated in 2011, of which 100 000 hectares were irrigated.[16]

Figure 1: Physiographic map of Jordan



Source: MWI.

[14] DoS. 2013.

[15] Calculated as gross added value/gross output.

[16] Rounded from DoS figures, www.DOS.gov.jo.

Irrigation consumes about 60 percent of the total water used in Jordan, while agriculture's share of the GDP is only 3 percent. The production of food in Jordan is however hardly possible without irrigation. The irrigated areas are located in the JV (some 33 000 hectares) and in the Highlands (some 44 000 hectares). The chief source for irrigation in the latter is ground water, whereas in the JV two main sources are used. Namely, the northern part is served by surface water supplies transported via the King Abdullah Canal (KAC) from the Yarmouk River, while the middle and southern parts are mainly served by water coming from the Kind Talal Dam (KTD — which is the major collector of TWW) after mixing that with what comes from the KAC.

According to the goals of the water strategy (see Annex 1), in 2022 the annual water allocation for irrigation in the JV will be limited to about current levels but at an increased price,[17] and in the Highlands highly reduced but serviced at full market price.

Table 7: Crop production and cultivated areas in the Jordan Valley and Highlands, 2011

	Production (in million tonnes)			Cultivated Areas (in ha)		
	JV	Highlands	Total	JV	Highlands	Total
Field crops	30.6	157.2	187.8	2 132	110 772	112 904
Total vegetables	876.1	1 052.1	1 928.3	18 367	24 496	42 863
Winter veg	747.2	384.8	1 132.1	14 414	9 714	24 129
Summer Veg	128.8	667.2	796.1	3 953	14 781	18 734
Fruit trees	171.5	254.9	426.5	10 905	74 100	85 005
Total	1 078.3	1 464.4	2 542.8	31 404	209 368	240 771

Source: DoS.

Prior to 1980, horticulture in Jordan was very limited and production of fruits and vegetables was targeted at the local market. However, the introduction of new technologies in irrigation, crop production, handling and export capacity allowed the country to enter global F&V markets.

[17] Currently and according to the indications of the World Bank study "Irrigation Water Pricing in the Jordan Valley", the MWI started to increase water tariffs in 2014 with a phased plan that will stabilize by 2017.

To date, the use of localized irrigation is certainly predominant in the country. The use of green/plastic houses is also increasing with a growing trend. While production was initially focused on vegetable varieties, specifically tomatoes, cucumbers and eggplant, since 2005, date production has begun to emerge as an important new subsector. Currently, date fruit has become a priority area among horticultural exports due to its low water consumption during production and net higher returns as compared with traditional products, and especially due to the use of proper varieties.

The Jordanian packing segment lacks competitiveness in EU markets for many reasons that may include but are not limited to the quality of labour, access to proper transportation services and routes and the availability of proper packing and packaging systems and materials. Until recently, a portion of Jordanian produce directed to the European market was first exported to neighboring countries, such as Turkey and Syria, where it was graded, repackaged, labeled and exported to the Euopean Union and the Gulf at higher prices.[18] The enduring Syrian crisis has, however de facto interrupted this window.

Jordan is a food deficit country.[19] The country imports above 90 percent of its cereals for food consumption and 80–90 percent of its animal feed requirements given that its rangelands cannot provide more than 10 percent of feed to the existing flocks in normal years and no more than 20 percent in very good years.

The agricultural sector remains subsidised,[20] even though in the last five years state subsidies to agriculture, calculated as a percentage of GDP, have decreased. In 2012, the agricultural subsidies amounted to 1.5 percent of GDP (Table 8). According to the National Agenda Committee, the subsidies are expected to substantially decrease in the forthcoming years.

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18 Jordan National Competitiveness Team. 2000.

19 The WTO and FAO classify Jordan as a net importing country of food and animal feed.

20 Particularly for animal production but excludes poultry production.

Table 8: Subsidies and water-use efficiency in agriculture

	2008	2012	2017
Agriculture subsidies as a % of GDP	2.70	1.50	0.50
Agriculture GDP as a % of agriculture subsidies	81	250	350
Agriculture output per unit of water (USD per m^3)		3.6	5.0

Source: Jordan National Agenda 2020. National Agenda Committee. 2009.

The Jordan Valley

The JV[21] is considered a natural greenhouse with some 0.3 million largely irrigated, dunum cropped land. Over half of its arable lands is used for vegetable production, while more than one-third is under fruit crops.

Table 9: Irrigated and non irrigated area in the Jordan Valley, 2011

Crops	Total Area (Dunum)	Irrigated Area (Dunum)	Non-Irrigated Area (Dunum)
Tree crops	109 051.9	107 672.1	1 379.8
Field crops	21 315.1	20 282.6	1 032.5
Vegetables	183 671.7	183 626.7	45.0

Source: DoS.

Eight broad, farm-type systems prevail. Based on recent survey data[22] and compared with current cropping pattern information (DoS), their distribution would appear to be as follows in Table 10.

[21] The valley is essentially made up of quaternary sediment layers inside a depressed rift. Its altitude ranges from -212 m near the Tiberius Lake to -408 m at the Dead Sea shore. It is 250 km long and 5–15 km large. The valley has a semi-arid, hot climate with average temperatures ranging from 15–22 °C from November to March and from 30–33 °C in the summer. Precipitation levels are very irregular: ranging from 50 mm/year in the south to 400 mm/year in the north of the valley.

[22] World Bank commissioned 2012 survey under the "Irrigation Pricing for the Jordan Valley" study.

Table 10: Major production systems in the Jordan Valley

	Share
Citrus farms — surface irrigation (partially localized)	9%
Citrus farms — drip irrigation	9%
Vegetables — open field	31.3%
Vegetables — greenhouses	11.1%
Vegetables — open field and greenhouses	10.6%
Bananas	7%
Dates	3%
Mixed	19%

Source: Authors' calculations and DoS data.

The relative importance of the F&V production of the JRV is shown in the Table below. The most important feature appears to be the large acreage (with respect to major export destinations) of the off-season winter vegetables area, which has been quite stable over time.

Table 11: Cropping patterns of fruits and vegetables (dunum)

	2007	2008	2009	2010	2011
Cropped area in Jordan	1 871 886	2 313 877	2 241 907	2 593 501	2 407 713
Jordan Valley	317 672	342 978	323 704	336 875	314 039
Field crops	724 064	1 076 322	1 007 550	1 285 567	1 129 037
Jordan Valley	29 195	33 451	30 470	33 337	21 315
Fruits area in Jordan	813 054	818 853	822 563	827 128	850 049
Jordan Valley	100 510	102 386	104 594	106 592	109 052
Vegetables area in Jordan	334 768	418 703	411 794	480 806	428 628
Jordan Valley	187 967	207 141	188 640	196 946	183 672
Winter vegetable area in JV	149 409	153 106	144 898	149 125	144 144

Source: DoS.

Despite a limited 23 percent of the Jordanian fruits and vegetables land use, the JRV produced in 2011 almost half of the national output of these crops. During this year, the region managed to produce over 170 thousand tonnes of fruits and more than 875 thousand tonnes of vegetables — predominantly winter season produce, which mostly targeted export markets.

Table 12: Fruit and vegetable production, 2011

	2007	2008	2009	2010	2011
Total in Jordan (MT)	1 765 695.60	1 780 873.80	1 927 880.80	2 250 381.20	2 354 831.40
Jordan Valley (MT)	948 365.40	894 048.40	948 610.30	980 340.50	1 047 686.40
Fruits total in Jordan (MT)	361 787.1	348 788.9	419 061.4	460 241.5	426 526.7
Jordan Valley (MT)	138 864.4	150 274.2	165 987.8	182 066.8	171 546.2
Vegetables total in Jordan (MT)	1 403 908.5	1 432 084.9	1 508 819.4	1 790 139.7	1 928 304.7
Jordan Valley (MT)	809 501.0	743 774.2	782 622.5	798 273.7	876 140.2
Winter vegetables in Jordan Valley (MT)	683 603.5	586 447.5	658 769.0	659 855.4	747 263.6

Source: DoS.

Vegetables land use in the JV include mainly tomatoes, squash and eggplants. In terms of output, tomatoes are the leading crop, followed by cucumbers and eggplants. While vegetables in the valley are mainly produced in the winter, few farmers, with modern greenhouses (temperature controlled) and proper management systems, produce summer vegetables in a profitable way by exporting them as 'off-season' produce to the Gulf markets (which are much hotter and lack horticultural production systems).

Table 13: Area, average yield and production of selected vegetables in Jordan and in the Jordan Valley, 2011

Crop	Total			Autumn			Summer		
	Area (dunum)	Average Yield (MT/dunum)	Production (MT)	Area (dunum)	Average Yield (MT/dunum)	Production (MT)	Area (dunum)	Average Yield (MT/dunum)	Production (MT)
Total Vegetables	428 628			241 287			187 341		
JV	183 672			144 144			39 528		
Tomatoes	129 536	6	777 820	87 865	6	506 407	41 671	7	271 414
JV	67 803	5	368 095	60 837	6	336 771	6 966	5	31 324
Cucumbers	19 563	12	227 151	12 960	12	155 372	6 603	11	71 778
JV	12 376	12	151 161	12 120	12	148 382	256	11	2 779
Sweet peppers	7 407	6	47 888	5 771	7	38 499	1 637	6	9 389
JV	6 094	7	40 520	5 722	7	38 207	372	6	2 314

Source: DoS.

Fruit trees in the JV are grown on 35 percent of the cropped lands (see Table 14). Over the last few decades, the cropping dynamics of separate fruit trees have shown different trends. Citrus cropping has maintained a stable area share of around 65 000 dunums and banana cropping has held a strong position of around 16–17 000 dunums of cropped area. Date palm is the only crop that has had a relatively remarkable area expansion, which is expected to continue in the near future.

Table 14: Area, number and production of fruit trees in the Jordan Valley, 2011

Crop	Area (dunum)	Total number of trees	Number of bearing trees	Production (MT)
Total	109 052	4 982 938	4 195 853	0
Oranges	25 539	812 115	760 935	38 272
Bananas	19 617	2 026 816	1 571 092	48 105
Lemons	15 472	489 271	477 201	25 025
Clementines	13 036	414 931	378 675	22 360
Dates	10 712	191 075	148 385	7 583
Mandarins	6 274	198 943	182 098	11 627
Others	18 403			18 573

Source: DoS.

Over the last years, trends of citrus production have reflected the farmers' marketing coping strategies through changes in orchard specialization (i.e. species conversion from clementine and mandarin cultivars to lemon and oranges) with consequential low productivity periods during the plantation maturing time. While banana production has overall increased as a result of improved productivity levels — around two to two-and-half times higher than in 2000 it has remained stable in recent years. Banana is a profitable and the most water-consuming crop grown in Jordan. The crop holds a stable position, mainly concentrated in the South Shouna area of the JV, in line with its (artificial) competitive advantage (via imposed tariffs on imported banana):[23] banana producers are thus subsidised by consumers. Apart from a

[23] Custom duties on banana imports consist of a fixed tax of USD 350 for each imported tonne.

possible lift of current custom barriers (as mentioned in the Greater Arab Free Trade Area (GAFTA) and WTO agreements), banana growing is however threatened by decreased freshwater availability and increased substitution with TWW to which banana is not suitable.

There are also labour issues to be considered. Less than 10 percent of the labour requirements is provided for by the Jordanian workforce. Only a few trustworthy functions are delegated to Jordanian male (e.g. supervision, mechanical operations, plant protection, seedlings production and asset maintenance) and female workers (e.g. selection, grading, handling and packaging). Producers and processors rely mainly on immigrant labour, primarily from Egypt. The agricultural sector is in fact granted higher immigration quotas compared with other sectors. However, foreign workers increasingly (although illegally) move to other sectors (civil works), which offer better salaries. The situation is perceived as being critical by producers and a labour crunch issue is becoming a grim reality in many areas of the valley. The cost of labour is also reported to be rising significantly. The transient nature of the workforce is also a limiting incentive for private sector investments in skill development. Only a few large producers provide in-house training on produce handling and packing so as to meet export standards because they understand that skill development is needed, according to global marketing standards, during harvesting and along produce preparation and packing. Producers are furthermore requesting higher political attention from the government on two issues in particular: an increased liberalisation of migration quotas, asking that it be extended to countries which can supply cheaper labour — e.g. India — and for legal enforcement capacity towards workers who break their contractual obligations).

In the JV, land development (in terms of irrigation equipment at unit outlet), distribution and ownership transfer is based on the original regulations instituted by the JVA (in the mid-1970s). The irrigated command area of about 360 thousand dunums has been organized around some 10 thousand farms of 30–40 dunums each. Property eligibility is reserved only for individual Jordanian citizens, who then also acquire hereditary rights and rights to sell land to eligible peers. A land ownership ceiling for each individual is set at 200 dunums. Given the resource limitation and the conspicuous sunk investment on land, its value has escalated over time. As a result, the current prevailing management regime (over 80 percent of cases) is one based on rental agreements

(at a current average rental rate of about 143 JOD/dunum), with legal rights again exclusively extended only to Jordanian citizens. The land redistribution programme in the JV was originally meant to create a class of small, self-supporting (mixed in with the aid of their family) farmer-operators, viewed as essential for stability and social integration into a 'new rural community'. Acknowledged amendments to such regulations are desirable, which would facilitate a transformation of the valley into an effective and modern agribusiness.

Accordingly, the rationale for a sustained production of fruits and vegetables in the JV may be summarized as follows:

- irrigation in the JV is conveyed to contiguous farming units through a collectively organized system that is centrally managed and controlled (by the JVA);
- the bulk of the irrigation is through surface water,[24] about 60 percent of which is actually TWW determining in such a way its best opportunity use;
- the JV has made over time major technological investments in water efficiency (both off- and on-farm), in modernized cropping systems (greenhouses) and in substantial capacity building of producers on GAPs and SPSs international compliances;
- vegetable crops are predominantly harvested off-season in the winter;
- water productivity levels are reported twice those of the Highlands.

All such reasons lead to a better and more efficient utilisation of the national water budget and allow for the production of export produces that yield price premiums.

Agrifood Trade

Jordan is a net importer registering, in 2012, USD 12.8 billion of deficit in its balance of payments.[25] According to the GTA, the country registered, in the same year, USD 2.3 billion of deficit in the trade of agrifood products. As one of the most open economies of the region, Jordan is well integrated in foreign markets, particularly with the neighbouring Arab Gulf economies

[24] Partial use of brackish groundwater makes up for JVA system allocation deficiencies.

[25] WTO Trade Balance Data.

via trade, remittances, foreign direct investment and tourism. As a result, Jordan is also vulnerable to the political, economic and social volatility of the region. Economic and fiscal conditions improved slightly in early 2013, after a challenging 2012. When gas supplies from Egypt shrunk to 16 percent of the contractual terms in 2012, Jordan had to rely on expensive fuel imports from other sources to generate the country's electricity.[26] This led to a rapid deterioration of Jordan's balance of payments and fiscal position in the first half of 2012. Another example of Jordan's regional vulnerability is the encroaching Syrian conflict. The large refugee inflow into Jordan is giving rise to substantial fiscal costs and straining labour markets, putting pressure on inflation, and negatively impacting the balance of payments through increased food imports, disruptions to transit trade and increasing pressure on natural resources, water in particular.

Trade policy and tariffs

Jordan's trade regime went through significant reforms during the process of its accession to the WTO, which successfully concluded in 2000. The country has bound customs tariffs on all products, except electricity, and is among the most liberal trade regimes in the region. The Jordanian market is considered one of the most developed Arab markets outside the Gulf States. In the 2012 Global Enabling Trade Report, Jordan ranked 6th in the Arab World following the United Arab Emirates (UAE), Oman, Saudi Arabia, Bahrain and Qatar, preceding Tunisia and Morocco.

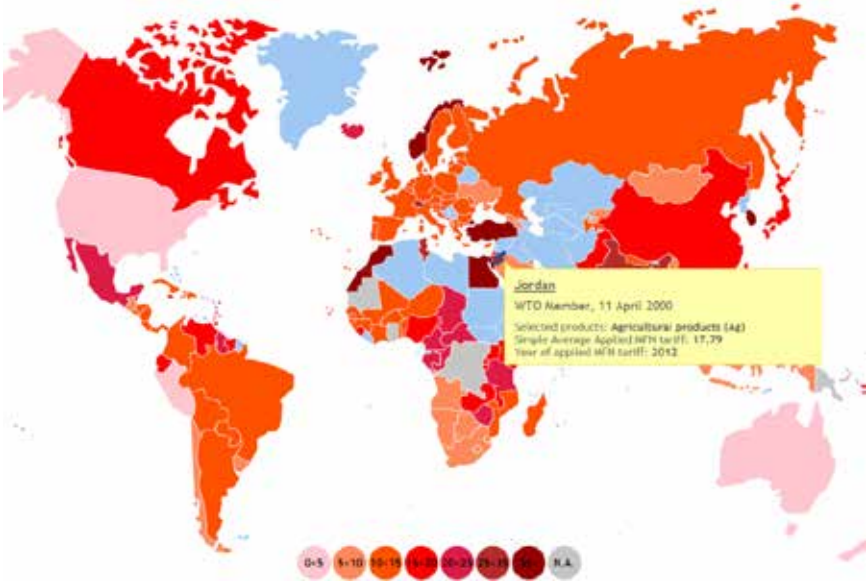
Since its accession to the WTO, Jordan has granted the "most favoured nation" (MFN) treatment to all trading partners. Jordan is a signatory of the Information Technology Agreement (ITA) and an observer of the multilateral Agreement on Government Procurement. As a member of the GAFTA, Jordan has cancelled most trade tariffs with the other 16 member states. It also has a free trade agreement (FTA) with the United States: its second largest exports market in 2012 (after Iraq). It also holds bilateral agreements with the EU, the European Free Trade Association countries and Singapore. Jordan is a participant of the Agadir Agreement (a free trade agreement between Egypt, Jordan, Morocco and Tunisia). In 2012, the government was negotiating with Iraq, Kazakhstan and Pakistan and is currently pushing for FTAs with MERCOSUR and The Russian Federation.

[26] The World Bank, Jordan Overview.

Jordan's agricultural policy has become more market-oriented over the past decade. The country is pursuing a strategy of trade liberalisation at the multilateral, regional and bilateral levels. It has made great strides in reforming its economy and liberalising its trade regime. These and other structural problems (including water shortage) are being addressed through a policy agenda in which privatisation, investment and trade liberalisation have key roles.

In 2012, Jordan's simple average applied import duties were 10.9 percent (with the final bound at 16.3). Duties in Jordan significantly vary from product to product. For example, most raw materials and intermediate goods used in industry face zero duties. Similar to the majority of other countries in its comparator groups, Jordan has higher trade barriers for agricultural (an import duty of 17.8 percent) than for non-agricultural products (an import duty of 9.8 percent).

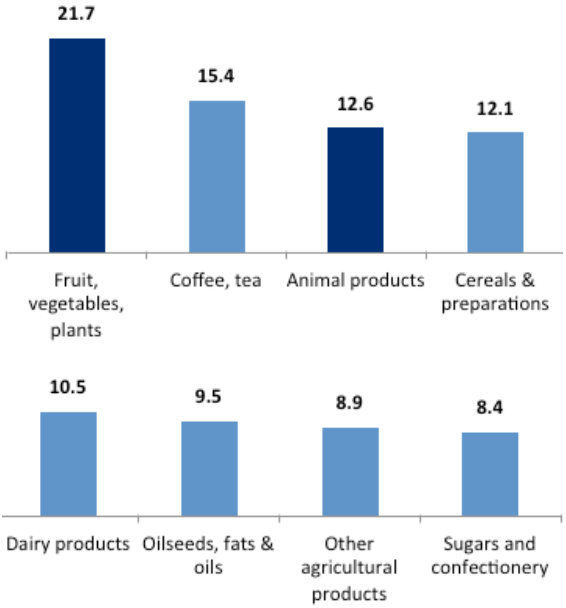
Figure 2: Jordan and other WTO members simple average applied MFN tariff on agricultural products



Source: WTO, International Trade and Market Access Data.

The simple average applied MFN tariff for fruits and vegetables is 21.67 percent, while on animal products it is 12.63 percent.[27]

Chart 2: Average applied MFN imports duties on selected agricultural products in Jordan



Source: WTO, Tariffs and imports by product groups (2012).

Applied MFN tariffs in the livestock subsector are 5 percent for live animals and 12.9 percent for meat (including edible offal). Import tariffs are: 5 percent on beef, lamb and goat meat, with the exception of ground meat for hamburgers (21 percent); 22 percent on pork and 10–30 percent for poultry meat. Live bovine animals, sheep and goats are subject to compound duties.

Import tariffs for fruit are in the range of 10–35 percent, with a simple average of 25.7 percent. Imports of oranges carry an MFN tariff of 35 percent from May to the end of February. Imports of bananas, grapes and apples are subject to even higher compound duties (e.g. the banana tariff is equal to USD 350/tonne).

[27] WTO. 2012. Tariffs.

Import tariffs for vegetables reach 30 percent. High MFN tariffs are applied in Jordan even to products for which Jordan appears to have comparative advantages, such as: tomatoes, its main agricultural export product by far.

In comparison to other Middle East and Northern Africa (MENA) countries — Egypt, for instance — Jordan has very high MFN tariffs on products for which the country's self-sufficiency ratio is in excess or close to 100 percent.

Table 15: Applied average of ad valorem duties

HS code and description	Jordan	Egypt
0207 - Meat and edible offal of poultry, fresh, chilled or frozen	10–30% (*)	30%
07 - Edible vegetables and certain roots and tubers	30%	3.5–5%
08 - Edible fruit and nuts; peel of citrus fruit or melons	25.7%	8.1%

Note (*): where 10% applies to turkey meat and 28–30% to Gallus domesticus.
Source: Integrated Database (IDB) notifications.

Jordan has only to gain from further dismantling its tariff and non-tariff barriers to trade. The country would also benefit from further opening its key service subsectors (like transportation, construction and distribution) to foreign competition, as infrastructure is the major bottleneck to further expansion of agricultural exports.

Jordan is subsidising exports through income tax exemption on profits generated from exports (in force until 2015 at the latest). Exports are also promoted through free zones and qualifying industrial zones, which allow designated industrial parks in Jordan to export duty-free and quota-free to the United States. In addition, 98 percent of foreign inputs used in the production of exports are exempt from customs duties; all additional import fees are assessed on a reimbursable basis.

Trade flows

Jordan's economy is increasingly dependent on international trade: the ratio of merchandise trade to GDP averaged 98 percent in 2012. In the same year, Jordan ranked 45th among world merchandise exporters and 40th among importers.[28]

Jordanian merchandise export has been relatively stable in the last five years (2008–2012) with about USD 7.9 billion a year (with the exception of 2009 and 2010 when exports dropped to USD 6.3 and USD 7 billion respectively). Jordan's major export markets include Iraq (15 percent of Jordan's total exports), the United States (13 percent), India (11 percent), Saudi Arabia (9 percent) and the EU (4 percent).

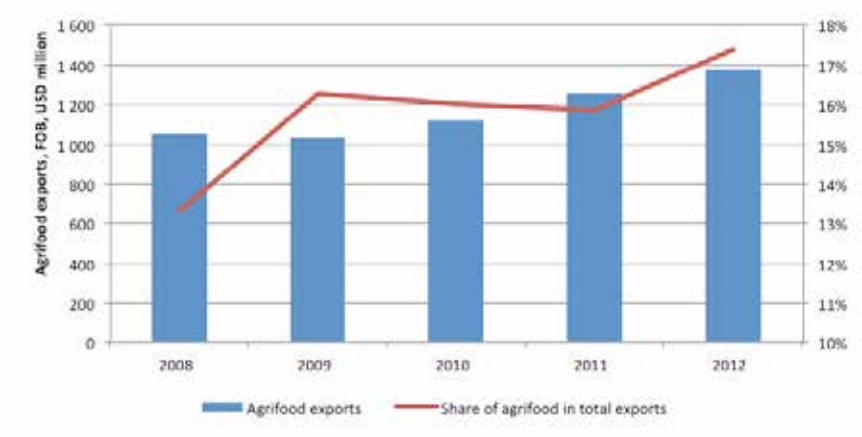
Figure 3: Jordan's top trading partners (share in total merchandise export)

Source: WTO, Trade and tariff indicators.

In terms of commodities, Jordan has a relatively diversified export base, with chemical products representing 30 percent of the total exports, followed by textiles and clothing products (14 percent), vegetable products (9 percent), minerals (9 percent) and machinery and equipment (7 percent).

[28] GTIS (Global Trade Information Services). European Union 27 aggregated external trade data.

Chart 3: Recent trends in agrifood exports



Source: GTIS, retrieved in February 2014.

The contribution of agrifood products to total merchandise exports slightly grew from 13 percent in 2008 to 17 percent in 2012 reaching USD 1.4 billion, growing however in absolute terms by 31 percent in the same period. The major buyers of Jordanian agricultural products are: Iraq (USD 350 million Free on Board (FOB) in 2012: 26 percent fruits and 11 percent vegetables), Saudi Arabia (USD 210 million: 47 percent live animals and 17 percent fruits), Syria (USD 133 million: 81 percent vegetables), UAE (USD 121 million: 72 percent vegetables) and Qatar (USD 83 million: 45 percent vegetables and 40 percent live animals).

Table 16: Jordan's recent developments and agricultural exports structure

Description	2008	2009	2010	2011	2012	Share in 2012 exports
Total merchandise exports (USD million)	7 898	6 349	6 999	7 945	7 924	
Chapters 1 to 24 (USD million)	1 049	1 032	1 121	1 257	1 377	100%
Edible vegetables & tubers (chapter 7) (USD million)	391	375	438	478	470	34%
Edible fruit & nuts; citrus fruit or melon peel (chapter 8) (USD million)	57	73	91	126	185	13%
Live animals (chapter 1) (USD million)	8	31	47	118	139	10%
Miscellaneous edible preparations (chapter 21) (USD million)	66	66	101	92	85	6%
Meat and edible meat offal (chapter 02) (USD million)	51	71	100	70	74	5%
Other chapters (USD million)	475	417	345	373	423	31%

Source: GTIS.

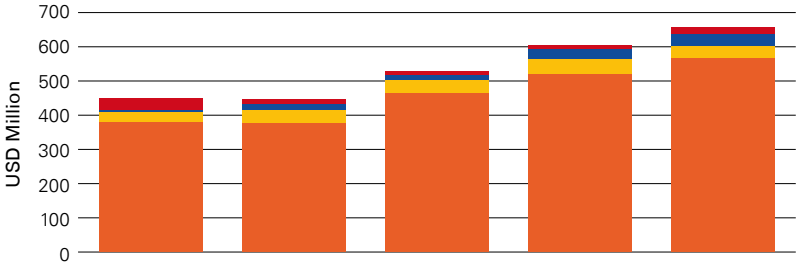
Horticulture is an important subsector and foreign exchange earner in Jordan's economy. It represents almost half of all agricultural exports in the country. Fruits and vegetables were Jordan's third largest merchandise exports in 2012, after textiles and fertilizers. Most of the F&V produce is consumed domestically; although, depending on the product, sizeable shares are exported. In the case of tomatoes, Jordan's largest crop, over half of domestic production was exported in 2012.

A lion's share of Jordan's horticultural exports (86 percent)[29] goes to the Arab countries of the region, 5 percent is directed to the emerging markets of the Russian Federation, Ukraine and Turkey, while another 5 percent goes towards the European market. The latter absorbs only premium quality produce, while the former lower standard produce. In fact, the FOB price of vegetables shipped in 2012 to UAE or Saudi Arabia was around USD 600 per tonne, while the Russian Federation, Ukraine and Turkey bought at USD 1 400 and the EU even at USD 1 905.[30]

[29] 2012 Figures.

[30] GTIS, FOB export prices, Chapter 7.

Chart 4: Jordan's horticulture export and main destinations



Destination	2008	2009	2010	2011	2012
Arab countries	379 031 754	376 871 513	463 234 807	518 752 512	566 733 188
EU-27	30 800 203	35 660 841	38 312 763	45 284 864	34 744 055
RF+UA+Turkey	5 724 144	17 615 403	17 100 869	26 884 977	36 001 074
Other	32 799 041	17 525 768	10 485 897	13 453 532	17 766 083

Source: Authors' calculations.

In the last five years, the EU's share in horticultural exports has slightly shrunk from 7 percent in 2008 to 5 percent in 2012, due to growing exports to the Arab region (having grown 1.5 times during 2008/12) and to new emerging markets (Russian Federation, Ukraine and Turkey — growing 6 times over for this group during the same period), but most importantly because of the limited road access to the European zone, which are entrenched by regional conflicts.

Table 17: Share of horticulture in total agricultural exports

Commodity	2008	2009	2010	2011	2012
Food and Agriculture (HS 01 to 24) (USD million)	1 049	1 032	1 121	1 257	1 377
Horticulture (HS 07 & 08) (USD million)	448	448	529	604	655
Share of horticulture in agrifood exports	43%	43%	47%	48%	48%
Tomatoes (HS 0702) (USD million)	193	168	231	224	250
Share of tomatoes in horticultural exports	43%	38%	44%	37%	38%

Source: GTIS, retrieved in February 2014.

Major export products include: tomatoes (418 516 tonnes in 2012, 18 percent of the agrifood export value); live sheep and goats (about 405 thousand heads, 10 percent of the agrifood export value); fresh apricots, cherries, peaches and plums (50 099 tonnes, 8 percent of the agrifood export value); and cucumbers (50 360 tonnes, 6 percent of the agrifood export value).

Table 18: Production and trade of tomatoes in Jordan

Year	Production	Imports	Exports	Self-sufficiency (est)
	(tonnes)	(tonnes)	(tonnes)	
2012	738 227	-	418 516	231%
2011	777 820	-	434 830	227%
2010	737 262	459	371 257	201%
2009	654 306	-	431 688	294%
2008	600 336	-	393 983	291%

Source: production data - DoS; trade — GTIS.

Table 19: Production of broiler meat in Jordan and trade

Year	Production	Imports	Exports (*)	Self-sufficiency (est.)
	(tonnes)	(tonnes)	(tonnes)	
2012	256 616	61 950	19 130	86%
2011	256 847	54 317	18 670	88%
2010	248 098	49 335	19 474	89%
2009	203 432	42 061	22 041	91%
2008	187 822	45 116	20 200	88%

Source: production data - DoS; trade — GTIS.

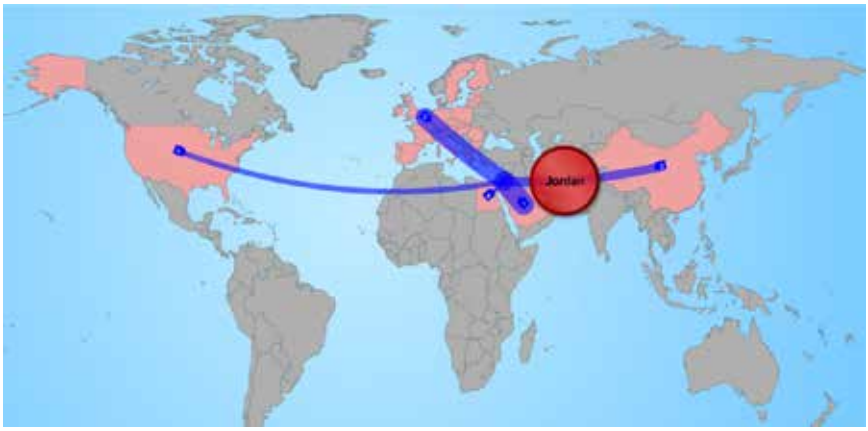
Note (*): half of the exports goes to the International Free Zone.

Jordan has set ambitious export targets for horticultural products. Comparative advantage, not fully exploited, is seen in certain areas for production in the winter months, especially in the JV. The infrastructure for post-harvest operations are, however, inadequate and there has been a lack of support services, such as extension services and market information. Overall, Jordanian produce,

except for out-of-season production, has been difficult to sell in new markets, especially in Europe.

Jordan's imports have increased in line with its economic growth over the last few years. Total merchandise imports reached USD 20.7 billion in 2012, growing by 22 percent since 2008. One-third of total merchandise imports are mineral products, mainly fuels, followed by machinery and equipment (10 percent of total merchandise imports in 2012). Jordan's main trade partners are Saudi Arabia (24 percent of imports), the EU (21 percent), China (9 percent), the United States (7 percent) and Egypt (4 percent). While Saudi supplies have increased gradually (36 percent more in 2012 compared with 2008), trade relations with some countries like Turkey, UAE, the United Sates and Italy have grown exponentially as a result of FTAs signed after 2008. Imports from these countries have grown respectively: 112 percent, 91 percent, 79 percent and 79 percent from 2008 to 2012.

Figure 4: Jordan's top trading partners (total merchandise imports)



Source: WTO, Trade and tariff indicators (Interactive Tool).

The share of agrifood imports has remained stable during the last five years holding 17–18 percent on average. In this merchandise category, Jordan doesn't have a dominant supplier and roughly equal shares are distributed between Argentina (mainly animal feed and cereals), Saudi Arabia (sugar, fats & oils, beverages) and the United States (mainly cereals, but also nuts and meat) holding 7–9 percent on average.

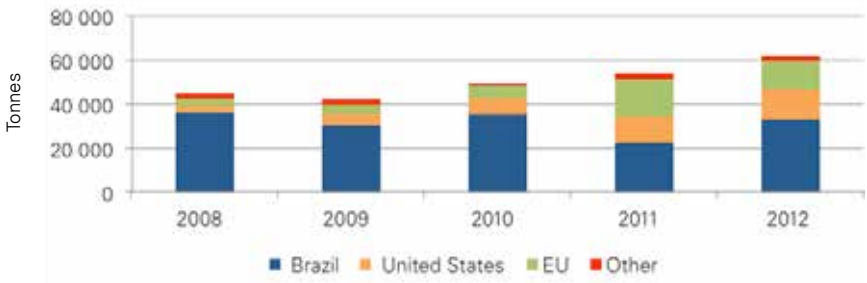
Table 20: Jordan's recent developments and agricultural imports structure

Description	2008	2009	2010	2011	2012	Share in imports, 2012	2012/08
Chapters 1 to 24 (USD million)	2 881	2 471	2 543	3 150	3 641	100%	26%
Cereals (chapter 10) (USD million)	921	562	432	712	897	25%	-3%
Meat and edible meat offal (chapter 2) (USD million)	195	220	279	329	397	11%	104%
Sugars and sugar confectionary (chapter 17) (USD million)	160	139	228	244	263	7%	64%
Dairy products; birds eggs; honey; animal prep. (chapter 4) (USD million)	235	212	205	226	252	7%	7%
Food industry residues & waste; prep. animal feed (chapter 23) (USD million)	146	141	155	174	212	6%	45%
Other chapters (USD million)	1 224	1 196	1 243	1 464	1 619	44%	32%

Source: GTIS, retrieved in February 2014.

Jordan is self-sufficient in vegetables and fruits and has a good rate of self-sufficiency in poultry meat and eggs. In 2012, Jordan imported about 60 thousand tonnes of poultry meat (24 percent of domestic consumption), half of which from Brazil (see Table above and Figure below).

Chart 5: Jordan's imports of poultry meat and main suppliers



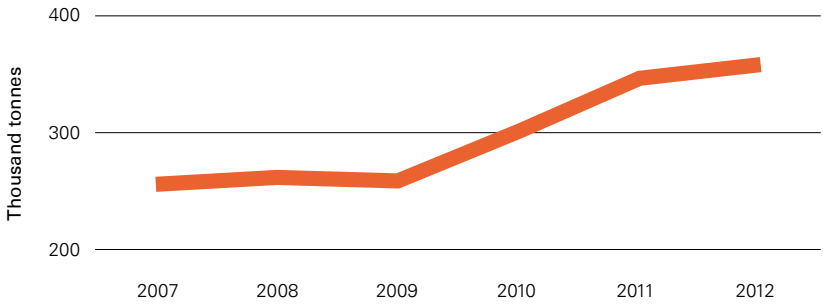
Source: GTIS, retrieved in February 2014.

Jordan's poultry — and also dairy — production systems rely to a large extent on imported feed grains and fodder, as well as on irrigated forage crops (clover). The natural consequence of this situation is that Jordan is a net food importing country, with large amounts of cereal imports. Having a good capacity of compound feed production (yet lacking resources for its ingredients), Jordan also imports soybean oilcake (297 693 tonnes imported in 2012, 86 percent from Argentina), corn (583 871 tonnes: 44 percent from Argentina, 19 percent from Ukraine and 15 percent from Brazil) and forage and straw (59 896 tonnes in 2012, whereby Israel is the biggest supplier of straw and husks with 74 percent of total imports while Spain leads on forage supplies with 78 percent in 2012). The excess of compound feed is exported to the neighboring countries of the region.

The Kingdom's annual fodder requirements are estimated at around 1.7 million tonnes, although the country produces only 21 percent of these needs.[31] The agriculture sector, including poultry farming, is currently struggling to cope with a global rise in grain prices.

Jordan's imports of animal feed grew exponentially following the expansion of domestic meat production (See Chart 6). In 2012, Jordan imported 80 percent (about 230 thousand tonnes) of animal feed from Argentina.

Chart 6: Jordan's imports of animal feed (HS 23: Residues and waste from the food industries; prepared animal feed)



Source: GTIS, retrieved in February 2014.

[31] WTO. Trade Policy Review. 2009.

The livestock subsector receives support through subsidised feedstuffs (barley and wheat bran) procured by the government, mainly through imports but also domestic purchases and sold at a reduced price to livestock producers. Since July 2007, only producers of sheep and goats receive the feed subsidy, while cattle and poultry producers are no longer eligible.

Jordan's poultry sector, broiler farms to a greater extent than egg producers, remains competitive thanks to a good feed conversion factor obtained by local commercial producers (modern technologies, good premixes, etc.) Another factor in favour of domestic meat is that Jordanian consumers prefer fresh meat rather than frozen products, making competition with the imported chicken meat almost irrelevant. However, this situation may change rather quickly with further opening towards international markets.

Food safety standards

Jordan is a member of the International Organization for Standardization (ISO), the Codex Alimentarius Commission, the World Organisation for Animal Health (OIE), the World Health Organization (WHO), the International Plant Protection Convention (IPPC), the International Atomic Energy Agency (IAEA), the Institute of Refrigeration (IOR), the International Organization of Legal Metrology (OIML), and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. The Jordanian Institution for Standards and Metrology (JISM) is the national standardization body and acts as the technical barriers to trade (TBT) enquiry point.

Given the strong reliance of the country on food imports, ensuring the safety and quality of imported food is a recognized concern in Jordan. In the context of extremely scare recourses, especially water, and the rapidly growing population, meeting food needs and ensuring food security depend to a large extent on food imports. Therefore, systems to control their quality and safety are vital for public health. Effective food safety systems are also critical to maintain and expand market shares in food and agricultural exports.

Regulation of agrifood products imported to Jordan

Import licenses, or advanced approvals to import goods, are required for specific food and agricultural goods, and are granted by the Ministry of Agriculture (MoA) and the Ministry of Health

(MoH). In addition to the special requirements for certain agricultural products, Jordan requires that importers of commercial goods be registered as traders or commercial entities. All unprocessed agricultural products are by law under the mandate of the MoA, while processed food is under the Jordan Food and Drug Administration (JFDA).

Jordan Customs developed and launched the Customs Integrated Tariff System (CITS) in August 2005 to assist importers. In addition to commodity tariffs, import conditions and commodity trade agreements, the CITS system enables importers to review all regulations and requirements of the commodity or product being traded.

All agricultural products may be imported by the private sector if the products meet local quality standards, which are set by the JISM on the basis of the Codex Alimentarius. The JFDA has the authority to inspect food products at the retail and wholesale distribution levels.

Organization of food control services

In Jordan, like in most countries of the Near East region, responsibility over food safety is shared among several agencies. Issues directly related to public health, such as food hygiene and sanitation and foodborne disease surveillance are dealt with by the health authorities at the central and local/municipal levels, while matters related to food production, processing and distribution including the inspection of the quality and safety of foods of animal origin fall under the authority of the MoA.[32]

A special effort has been made by the Government of Jordan in recent years to re-organize and streamline the food inspection activities at the national and provincial level through the establishment of the JFDA, with authority over the inspection of the safety of foods and drugs in the country.

[32] FAO–WTO Regional meeting on food safety for the Near East (March 2005).

The Jordanian food sector is governed by multi-official authorities in Jordan, namely:

- MoH — Now Food & Drug Administration, responsible according to the Food Law no. 79/2001 and Public Health Law no. 54/2002 (Departments involved: Food Control, Disease Control, Health Safety Education, Food laboratories and border control committees) as well as district Health Directorates;
- MoA — according to the Agriculture Law no. 44/2002 (Departments involved: Veterinary, Plant protection, Pesticide Residues centre, Veterinary laboratories and border agricultural centres);
- Ministry of Industry and Trade (MoIT) — (Registration and licensing);
- Ministry of Municipalities (MoM) — according to Municipal law, and Slaughterhouses according to the Law no.1/1985 (Departments involved: Public health, Slaughterhouse, Food and Meat laboratories);
- Jordanian Institute of Standards and Metrology (JISM) — according to their JISM Law no. 22/2000.

Food inspection. Food inspection work is usually carried out by officially recognized food inspection agents from different authorities (MoA, MoH, Ministry of Trade, Municipal authorities, etc). Jordan has initiated programmes to prioritize inspection procedures and improve cost-effectiveness. For example, the Aqaba Port Authority has set up inspection systems using customized software. Such systems enhance access to information, focuses attention on high-risk foods, accelerates the clearing process for food imports, increases incentives for better performance and improves overall food safety.

Quality assurance. Although Good Manufacturing Practices (GMP) and quality assurance systems like the Hazard Analysis and Critical Control Point (HACCP) have been introduced throughout the country, they are not fully integrated in the domestic inspection systems which continue to focus primarily on end-product control. In Jordan, some industries apply HACCP on a voluntary basis in order to improve food safety domestically as well as increase their share of export markets. EurepGAP[33] procedures are also applied

[33] EurepGAP is a common standard for farm management practice created in the late 1990s by several European supermarket chains and their major suppliers. GAP is an acronym for Good Agricultural Practices.

on a voluntary basis by a number of producers in the valley but more capacity development work and technical support, especially in the private sector, are required.

Food Control Laboratories. Despite the efforts to establish modern facilities and acquire modern equipment and supplies, the laboratory services in Jordan are in constant need of continuous improvement of capacity and capability. Jordanian laboratories have limited scientific and technical expertise, limited financial resources and equipment, have difficulty in obtaining necessary reagents and reference materials and lack internationally recognized accreditation. These are all major obstacles to improving the analytical capabilities in the country.

Food laws, regulations and standards

Jordan has enacted food laws that cover all foods and integrate the work of all concerned agencies. Food standards are generally issued by JISM, which covers not only food but also other consumer products.

Jordan has revised its food laws, harmonised their food safety standards according to the Codex Alimentarius and moved towards a food safety system based on risk analysis. These reforms have reduced laboratory analysis costs by half and decreased clearance time thanks to a semi-automated archiving system for tracking and reporting food products.

Economic analysis of food safety standards and its implication on agricultural trade in the context of EU-Mediterranean partnerships,[34] reports that the Jordanian business community sees several technical and commercial constraints that are currently facing the horticultural sector and impacting the food sanitary regulations.

The technical impediments include the following:

- lack of highly qualified labourers;
- absence of modern and efficient packing and grading facilities;
- the inferior quality of local produce;

[34] Economic analysis of food safety standards and its implication on agricultural trade in the context of EU-Med partnership: the case of SPS standards and EurepGAP requirements. FEMISE Research Programme. 2004–2005.

- low added value, especially with regard to packing and packaging procedures and materials;
- inefficient market infrastructure (especially wholesale) and marketing channels and systems;
- the tough requirements imposed by the EU;
- limited capacity of air cargo especially to East Europe; and
- absence of quality control laboratories in the region especially for testing chemical residues.

While the identified commercial impediments include the following:

- high cost of exported products from their original sources;
- difficulties in shipping and forwarding procedures to EU markets;
- lack of commitment of local producers in terms of dates of delivery and product quality;
- difficulties in issuance of needed certificates and other routine procedures;
- national rules and regulations;
- high shipping costs; and
- unorganized horticultural export industry.

The national horticultural sector targeting EU markets, would benefit from technical assistance on SPS and EurepGAP regulations as there is a serious lack of knowledge about SPS requirements and regulations. The timing of export needs to be synchronized to make the competition with the EU domestic produce irrelevant; this can be achieved through the utilisation of the comparative advantage of the early and off-season production in the JV. The knowledge gap is not the only impediment: the costs of infrastructure needed to meet SPS conditions are high and inspection mechanisms to monitor domestic production areas are absent.

Although Jordan has been taking considerable steps to develop new and improved food safety systems, capacity and efficiency need to be improved to control the safety of locally produced and imported food and to ensure and demonstrate compliance with food safety standards in export markets.

The country encounters difficulties in meeting international safety and quality standards because of its weak capacity in scientific research, testing, conformity and equivalence.[35] As a result, a major challenge is to raise the SPS and TBT standards of exports to reach internationally recognized levels, as well as the often higher standards set by developed countries.

Jordan faces unfavourable market access in the markets of greatest interest to it, like the EU. SPS standards applied by developed countries represent some of the most important barriers to food and agricultural exports.

This is particularly important as Jordan's exports are dominated by fruits and vegetables, for which food safety requirements are very strict and continuously changing, when compared with other products. Horticultural exports to the EU are in fact very low: 5 percent in 2012, while neighbouring Arab countries — mainly Iraq, Syria and UAE — absorbed 86 percent of produce of lower standards.

Bans on food exports from the region have also resulted in considerable difficulties to re-enter and regain market share in developed country markets.

Jordan should stand prepared for the upcoming challenges related to the testing and certification of food imports and exports, including the following: irradiated food, food derived from genetically modified organisms, traceability, organic food and the provisions of scientific risk assessment whenever there is diversion from international standards.

[35] FAO/WHO Regional meeting on food safety for the Near East. March 2005.

THE WATER OUTLOOK

Definitions

Water efficiency is the measured ratio between the amount of water required for a particular purpose and the amount of water that is actually used or delivered. For instance, it is used when measuring the application efficiency in agricultural irrigation: the water stored in the root zone of the crop divided by the water applied via a particular irrigation method (eg. sprinkler, drip, etc.). Similarly, it is used to measure the conveyance efficiency and other portions of the irrigation system infrastructure. The numerator and denominator are both of the same water unit, typically the volume, resulting in values that are non-dimensional. The theoretical limits of the ratio are always between 0 and 1, indicating the range between maximum and minimum/zero waste.

Water productivity is defined as the ratio of the net benefits from crop, forestry, fishery, livestock and mixed production (agricultural, industrial, etc.) systems to the amount of water required to produce those benefits. In its broadest sense it reflects the objectives of producing more food, income, livelihoods and ecological benefits at less social and environmental costs per unit of water used, where water-use means either water delivered to a use or depleted by a use. Essentially, it means growing more food/goods or gaining more benefits with less water. Physical water productivity is defined as the ratio of the mass of output to the amount of water used, while economic productivity is defined as the value derived per unit of water used. In this study we focus more on the latter.

Water budget

Water is a scarce resource in Jordan. The 6.4 million Jordanians share a current annual per capita water availability of about 130 cubic meters,[36] which is far below the international critical threshold of 500 m^3/year. The country is in fact ranked as the

[36] Own update: per capita availability is projected under business-as-usual (BAU) conditions to decline at an annual rate similar to that of population increases (2.2 percent). In 2008, the per capita water availability was estimated to be 145 m^3/year. According to USAID, per capita domestic consumption is projected to fall to approximately 90 m^3/year by 2025.

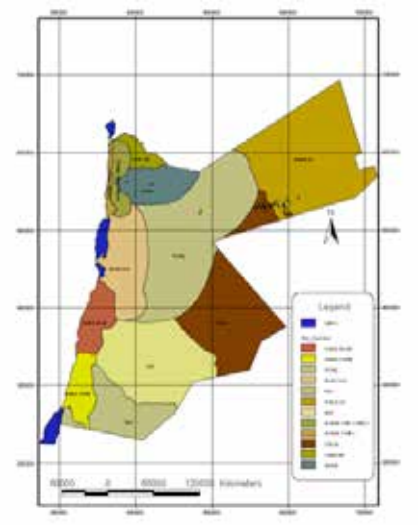
fourth water-poorest country in the world.[37] This scarcity contrasts the socio-economic development of the country.

Water resources in Jordan consist of surface, ground water and TWW. According to the latest (2011) MWI water budget,[38] the renewable water resources are estimated to be about 853 MCM per year, including the 293 MCM/yr underground water safe yield (distributed among 11 catchment basins) and 560 MCM/yr of surface water (distributed among 15 catchments) which also includes wastewater treatment and water recovery. Renewable water resources have ranged between 780 MCM/yr and 850 MCM/yr during the last few years.

Figure 5: Main water basins in Jordan

Surface Water

Ground Water



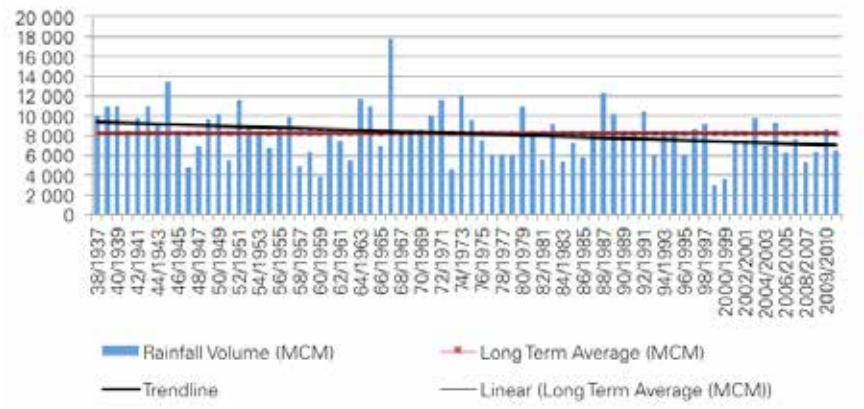
Source: MWI, Water Balance/Budget 2010–2011.

[37] http://www.worldbank.org/en/country/jordan/overview.

[38] 2013. MWI Water Budget for 2011.

Climate change scenarios[39] all predict a further decline of water resources. Surface water resources for 2011 have been computed at 560 MCM. A declining trend is observed due to decreased precipitation[40] and because of a flow reduction in the Yarmouk river given the upstream abstractions in Syria going beyond bilateral agreement levels. Linear trend analysis shows a decrease in rainfall from 1937 to 2011, which suggests a decline in total rainfall of about 25 percent over a period of 75 years. Using the generally accepted figure of 90–95 percent evapotranspiration losses, a reduced amount of water is available from surface flows with a groundwater recharge of only 5 percent in recent years. Models of climate change for the region suggest that rainfall will decline in the future, and that evapotranspirative losses will increase with higher future temperatures sharply reducing the groundwater recharge potential.[41]

Chart 7: Rainfall distribution for the water years, 1937/38–2010/11



Source: MWI, Water Balance/Budget 2010–2011.

[39] Most projections show that there will be a uniform warming across the country of about 3±0.5 °C in winter and 4.5±1 °C in summer by the end of the twenty-first century. There will either be little change in annual precipitation or a decrease in the average annual rainfall. As a result, the supposed increases in temperatures will lead to a significant increase in drought conditions by the end of the twenty-first century.

[40] For instance the 2010–2011 volume of rainfall was 78 percent of the long term average (1937–2010).

[41] Jasem and Alraggad, 2009.

Some 100 MCM of total surface water resources are annually sourced through the treatment of waste water, which is stored in the KTD where it is blended with fresh surface water and is subsequently released for irrigation use in the JV. TWW is considered a key element in the Kingdom's water strategy. Since the 1980s, Jordan has pursued this water saving/recycling technology, which is currently providing about one-sixth to one-fifth of its surface water resources. The use of this resource is mainly for irrigation in agriculture, almost exclusively[42] in the JV. Presently, there are 27 wastewater plants servicing the country. In order to cope with the growing supply of raw wastewater, two treatment plants are already under construction (South Amman and Wadi Al Shallalah) and several others are under study, including four that have completed studies and are ready to be implemented (North Shunah, South Shunah, Dead Sea BOT, Zarqa Industrial Plant BOT). One problem that all wastewater treatment plants face, is receiving domestic wastewater with high values in terms of biochemical oxygen demand (BOD5) (ranging from 500 to 1500 mg/litre) and total suspended solids (TSS). This is attributed to the low water consumption due to national water shortages as well as the type of treatment process technology.

[42] Limited use is made in small, irrigated areas neighboring the water treatment plants.

Table 21: Operational waste water treatment plants in Jordan, 2013

No	Treatment Plant Name	Year Of Operation	Type Of Plant	Av Design. Flow M^3/Day	Av. Flow M^3/ Day 2012 Actual	Remarks
1	Aqaba Natural	1987	W.s.p.	9 000	7 220.1	
2	Aqaba-Mech	2005	Extended Aeration	12 000	8 511.2	
3	Al-Baqa	1987	Trickling Filter	14 900	11 713.3	
4	Fuheis	1997	Activated Sludge	2 400	2 304.7	
5	Irbid (Central)	1987	Trickling Filter & Activated Sludge	11 023	8 635.1	
6	Jarash (East)	1983	Oxidation Ditch	3 250	3 333.3	Will Be Upgraded Soon
7	Al Karak	1988	Trickling Filter	785	1 753.4	Will Be Upgraded Soon
8	Kufranja	1989	Trickling Filter	1 900	2 763.0	Will Be Upgraded Soon
9	Madaba	1989	Activated Sludge	7 600	5 259.6	
10	Mafraq W.s.p	1988	W.s.p.	1 800	1 618.2	Will Be Upgraded Soon
11	Ma'an	1989	Extended Aeration	5 772	2 357.8	
12	Abu Nuseir	1986	Activated Sludge R,B,C	4 000	2 400.6	
13	Ramtha	1987	Activated Sludge	7 400	4 049.9	
14	As Salt	1981	Extended Aeration	7 700	6 529.2	
15	Tafila	1988	Trickling Filter	1 600	1 575.4	Will Be Upgraded Soon
16	Wadi Al Arab	1999	Extended Aeration	21 000	10 681.4	

Table 21: Operational waste water treatment plants in Jordan, 2013 [Continued from page 42]

No	Treatment Plant Name	Year Of Operation	Type Of Plant	Av Design. Flow M^3/Day	Av. Flow M^3/ Day 2012 Actual	Remarks
17	Wadi Hassan	2001	Oxidation Ditch	1 600	1 237.6	
18	Wadi Mousa	2000	Extended Aeration	3 400	2 536.4	
19	Wadi As Seeier	1997	Aeration Lagoon	4 000	4 052.8	
20	Alekeder Tankers	2005	W.s.p.	4 000	3 232.4	Need Upgrade
21	Allijoon Tankers	2005	W.s.p.	1 000	734.7	Will Be Upgraded Soon
22	Tall Almantah Tankers	2005	Trickling Filter & Activated Sludge	400	365.0	
23	Al-Jiza	2008	Activated Sludge	4 000	623.9	New
24	Samra	1984	Activated Sludge	267 000	240 925.5	
25	Al-Merad	2010	Activated Sludge	10 000	2 297.1	
26	Shoobak Tankers	2010	W.s.p.	350	67.2	
27	Al-Mansorah Tankers	2010	W.s.p.	50	12.5	

W.S.P.: waste stabilization pond.

Source: MWI-WAJ, 2013.

The 2011 budget shows a groundwater-use of 516.86 MCM for all purposes and a surface water-use of 381.93 MCM for all purposes (the latter including about 103 MCM of TWW).

Table 22: Water consumption by sector, 2006–2011

Sector	Amount consumed MCM							
	2011	2010	2009	2008	2007	2006	Average (2006–2011)	Average share
Municipal	347	352	326	315	294	291	321	37%
Agriculture	405	400	399	397	421	431	409	58%
Agriculture (Treated water)	103	103	101	101	91	80	97	
Other	7	7	8	8	8	8	8	1%
Industry	37	39	37	38	48	38	40	5%
Total	899	901	871	858	862	848	873	100%

Source: MWI, Water Balance/Budget 2010–2011.

In 2011, the imbalance between water resource availability and water-use for different purposes amounted to 45.79 MCM. This imbalance is evidently at the cost of over-abstracted groundwater. The historical and projected water-use by sector also indicates an endemic imbalance that is noted to continue in the future.

The unsustainable practice of overdrawing highland aquifers is resulting in lowered water table and water quality deterioration. Groundwater is the major water supply source for many areas, and the only resource in some others. It includes renewable and non-renewable resources. The availability of groundwater in 2011 amounted to 293 MCM. Some of the renewable groundwater resources are exploited to maximum capacity; in most cases exceeding the safe yield capacity. The water table is declining continuously and salinity at localized points has increased, as is the case of Amman-Zarqa, Jafer and the Azraq basins.

Table 23: Groundwater resources and their exploitation in 2011

Basin	Safe yield (MCM/Year)	Current abstraction	Agricultural use	Overpumping rate
Yarmouk	40	46.3	75%	116%
Jordan River (Side Wadis)	15	29.2	4%	195%
Jordan Valley	21	32.9	65%	157%
Amman-Zarqa	87.5	160.7	40%	184%
Dead Sea	57	81.1	36%	142%
Wadi Araba (North)	3.5	6.6	52%	189%
Red Sea	5.5	8.5	98%	155%
Jafer	27	31.8	46%	118%
Azraq	24	55.8	54%	233%
Wadi Sirhan	5	1.3	85%	26%
Hammad	8	1.7	7%	21%
Total	293.5	455.9	55%	155%
Disi (fossil)*	125	60.6	72%	48%

*Disi water-use as indicated in this Table refers to use up to 2011. This use was banned by the Government of Jordan (GOJ) in 2013
Source: Authors' elaboration based on MWI data.

Groundwater-use for irrigated agriculture has been declining, which is partly due to the 2002 groundwater by-law that imposed surcharges on pumping. Nevertheless, abstraction rates still exceed safe yield estimates. At the same time, groundwater is the only reliable drinking water supply source in many areas of Jordan. Over-exploitation of aquifers beyond their annual potential recharge has and will continue to contribute significantly to the degradation of groundwater quality in the exploited aquifers and thereby endanger the sustainability of these resources for future use.

Management of water resources by sector. The supply of municipal water in 2011 amounted to about 347 MCM, which is around 37 percent of the total budget. The average per capita supply for domestic-use was about 90 litres per capita per day (LCD). Comparing domestic use in Europe (250–350 LCD), in the Gulf States (280–350 LCD) and in Israel (280–300 LCD) with

Jordan, it has the lowest average. Municipal water is the highest priority set in Jordan's Water Strategy paper (see Annex 1).

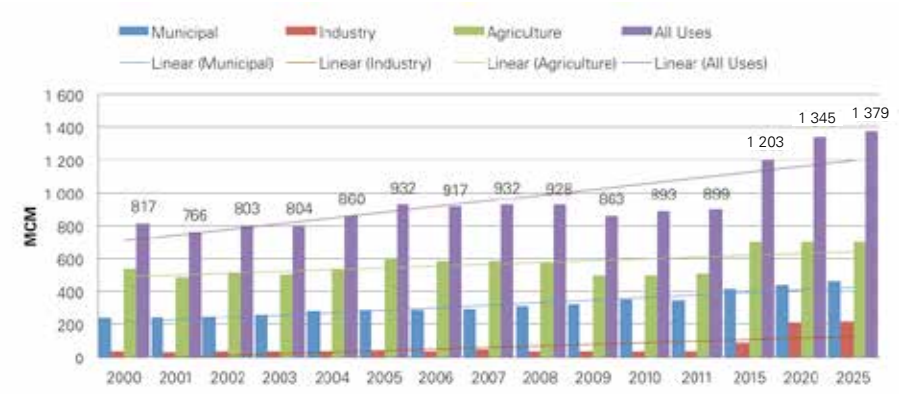
Industrial water requirements in 2011 were 37 MCM and 7 MCM for other uses (mainly services) — 6 percent of the water budget — the largest portion being consumed by the fertilizer industries (potash, phosphate), oil refineries and thermal plants. The food and beverages industry consumed about 10 percent of the total water consumed by the entire industrial sector. Most of the industries are suffering from water shortages, and therefore are forced to recycle their processed industrial wastewater, which is in many cases too expensive for small industries hence affecting their competitiveness. Meeting the water requirements of the industrial sector is the second highest priority, whose level is projected to grow four-fold in the total budget by 2025. One of the most pressing issues of the industrial sector is that it primarily relies on fresh water, which could be used instead for domestic purposes. Moreover, the industrial sector generates huge quantities of wastewater that require adequate management. The industrial water demand continues to increase in the face of a dire water shortage, while the negative environmental impacts of industrial wastewater have yet to be fully realized by the industrial facilities in Jordan.

Agriculture water-uses in 2011 were about 508 MCM including livestock — 58 percent of all uses. About one-third was used in the JV, while the other two-thirds were used to irrigate cultivated areas in the upland Highlands. Freshwater uses in the JV are decreasing, while TWW is increasing as a result of the reallocation policies over the years. It shows that the total amount of water being used in the JV is decreasing while the same size of irrigated land is maintained, indicating an increase of water-use efficiency. Overall, agriculture water-use is planned by the MWI to be capped at the current levels even in the future.

In all cases, the projected, future water supply availability from all sources indicates that the water deficit will increase with time. The water deficit for all uses will grow (in a BAU scenario) from about 314 MCM in 2015 to 490 MCM by the year 2025.[43]

[43] USAID, 2011.

Chart 8: Water-use (groundwater and surface water) by sector, 2000–2011, and projections to 2015, 2020 & 2025



Source: Authors' elaborations, USAID and MWI.

Out of necessity, Jordan has been strategizing over the years the use of alternative resources. Suppressed demand and rationing distribution programs for domestic uses and for irrigated agriculture can help mitigate the gap. Currently, the deficits are being covered by mining groundwater beyond their safe yields and by exploiting non-renewable groundwater. In the near future, where additional, naturally occurring freshwater is not available, domestic and industrial needs could eventually be met by desalinating the brackish and saline groundwater or seawater from Aqaba, providing that funding, assistance and international agreements are sought.

In agriculture and particularly in the JV, water-use efficiency is relatively high, being on average 700 m^3/dunum/year[44] for a minimum of two cultivation periods, including conveyance and on-farm efficiency. This is mainly due to farmers' awareness of water shortages and the water rationing program imposed by the MWI/JVA, which forced farmers to use high-tech solutions for irrigation like drip, micro-sprinklers, greenhouses, high-value crops, etc. On-farm efficiency in the valley is also a result of the establishment of WUAs with support and assistance from the German Agency for International Cooperation (GIZ). In addition,

[44] 1 Dunum = 1 000 square meters = 0.1 ha. Such consumption takes into consideration actual irrigation water distributed by JVA and water integration done by farmers through (unlikely legal) groundwater abstraction of brackish water.

a crop substitution policy — with highest priority given to trees and vegetables for export — has highly improved water efficiency and productivity over the years. More effort and determination is required in this direction.

Rainwater harvesting in the Highlands is to be enhanced, while desalinisation of brackish and seawater, given the high energy costs involved in the process, must be foreseen only when using water for drinking and other high productivity uses.

The USAID Water Reuse and Environmental Conservation (WREC) project is working throughout Jordan with four primary tasks: institutional capacity-building; pollution prevention and industrial water management; solid waste and wastewater management and water reuse. The project goal is to protect and conserve scarce resources through regulation, education and coordination with industry, local communities and the private sector. The objective of pollution prevention and the industrial water management task is to enable specific industrial facilities to prevent pollution and conserve both water and energy. Following a survey of 150 companies, the taskforce selected the 40 most promising companies to be targeted to receive dedicated assistance. The five industrial sectors selected include:

- food supplies (plants and livestock);
- engineering, electrical industries and information technology;
- chemical and cosmetics;
- therapeutics and medical devices;
- packing, packaging, paper, carton and stationery.

The assistance provided to the 40 companies (on-going) includes specific water and energy audits to identify the required measures for an improved Environmental Management System (EMS)/ Pollution Prevention (PP). The survey revealed a wide variation in water consumption, which is observed depending on the type of products manufactured in the industrial sector. Typical industrial facilities include: dairy products, beverage products, poultry products and processed food products. Industrial facilities producing beverages generally have much higher water consumption compared with other types of industrial facilities within the same sector, as water represents a major ingredient in the final product in such facilities.

For additional information on water policy in Jordan refer to Annex 1.

Water Productivity

Updated to 2011, the total gross agricultural sector output (2.5 million tonnes) is estimated at a value of about JOD 598 million. In physical terms, irrigated agriculture produces about 95 percent of total agricultural production with a value of JOD 490 million. This shows that irrigated agriculture contributed to about 82 percent of the total value of gross output in Jordan during 2011. The JV contributed to about 46 percent in gross output, whereas the Highlands contributed to 54 percent of total gross output. The overall water productivity of the agricultural sector (at gross output level) is low, amounting to some 1.2 JOD/m^3 (JOD 598 million/508 MCM of water).

Several recent studies have attempted to measure water productivity for its specialized agricultural uses. A recent World Bank assessment[45] provides a useful approximation for the JV, comparing crop output values[46] with the gross inflow of water, based on water quota allocations in the valley.

[45] 2013. Irrigation Water Pricing in the Jordan Valley, Draft. This study includes an FAO Investment Centre contribution: The Jordan Valley's Agro-economic Perspectives.

[46] Output farm gate prices are survey-derived from multiple primary informants. Sensitivity simulations have been attempted by using DoS average 2010 prices and by referring to FOB prices (source: 2012. GTIS.) deducting marketing costs (source: DoS), or by considering whichever best price is obtainable by the producers.

Table 24: Crop water productivity

Crop	Gross revenues per cubic meter of irrigation water required	
	Current Prices	Best Market Prices
Tomatoes GH (JOD/m^3)	8.17	20.27
Tomatoes OF (JOD/m^3)	1.60	4.10
Cucumbers GH (JOD/m^3)	8.33	16.59
Potato OF (JOD/m^3)	7.77	7.78
Melon GH (JOD/m^3)	9.72	9.72
Dates: non-Medjool (JOD/m^3) Medjool (JOD/m^3)	8.22 20.16	8.22 20.16
Bananas (JOD/m^3)	1.61	1.61
Citrus surface (JOD/m^3)	0.47	1.20
Citrus drip (JOD/m^3)	0.96	2.43

Source: FAO. 2012. The Jordan Valley's agro-economic Perspectives: a way forward. Discussion paper. Rome. GH: greenhouse; OF: open field.

As a result, crop water productivity appears to be highly dependent on crop prices and irrigation systems used. Evidently, drip irrigation tends to be associated with higher crop water productivity than surface water irrigation. Moreover, the use of greenhouses is associated with higher crop water productivity than the use of open field farming techniques.

The USAID undertook a comprehensive study, in 2012, measuring agricultural water productivity both in the JV and in the Highlands,[47] looking at water productivity as well for the industry sector (not distinguishing, however, between the different industrial sectors). Water value, in agriculture, varies widely across crops, seasons and production locations. Crops can be distinguished into four categories — field crops, winter vegetables, summer vegetables and fruit. Winter vegetables are shown to be the crop type with the highest overall water value, while field crops such as maize, barley and wheat produce the lowest average water value. Among fruits, irrigated olives show consistently low water value, while

[47] USAID. 2012. Disaggregated Economic Value of Water in Industry and Irrigated Agriculture in Jordan.

citrus is only marginally better. A number of specialty crops such as strawberries, Brussels sprouts and ginger, though presently grown only on a small scale, show high water values and offer potential for expansion.

Disaggregating water value by region, the JV confirms water values that are about twice as high as those prevailing in the Highlands. The main reason for this is that the JV produces 85 percent of its vegetable output in terms of winter vegetables, which have a relatively higher water value, while the Highlands mainly produce summer vegetables. For the purpose of this study, the water values of the JV reported by the World Bank study will be retained, while the USAID values computed for winter vegetables in the Highlands will be used for comparison.

Table 25: Water productivity of winter vegetables, Highlands

Crop	Area (dunum)	Water-use (MCM)	Water productivity (JOD/m^3)
Tomato	24 929	11 257	0.53
Potato	15 901	5 486	1.43
Broad beans	9 354	3 556	1.64
Onions, dry	5 327	2 714	0.47
Cauliflower	6 134	2 557	0.69
Squash	2 050	863	0.73
Cabbage	1 985	821	0.32
Peas	1 321	771	2.66
Lettuce	1 897	500	0.57
Cucumbers	1 187	425	4.84

Source: USAID.

The conclusions of the two studies are, by and large, similar: exporting vegetables to neighboring countries and to Gulf States has a relatively low value added per cubic meter compared with high-value European markets. Exporting fruits and vegetables to the EU, Balkan and Russian Federation markets generates three to four times higher water values compared with Jordan's traditional export markets. Improvements in the quality, safety, value addition and marketing of Jordanian horticultural exports to obtain the

highest possible value added in high-end markets is necessary to increase competitiveness and to achieve the highest value per cubic meter of water. It is necessary to reconsider the current production pattern through focusing on high-value crops that require lower water requirements.

In regards to the food industry, a total gross value added of JOD 639 million and a water withdrawal of 3.7 MCM (10 percent of total industrial water withdrawal), resulted with a quite high water productivity of 173 JOD/m^3 in 2011. This is a high performance compared with the average water productivity of the industrial sector at 113.5 JOD/m^3 (JOD 4.2 billion/37 MCM of water).

ANALYSIS OF SELECTED FOOD CHAINS

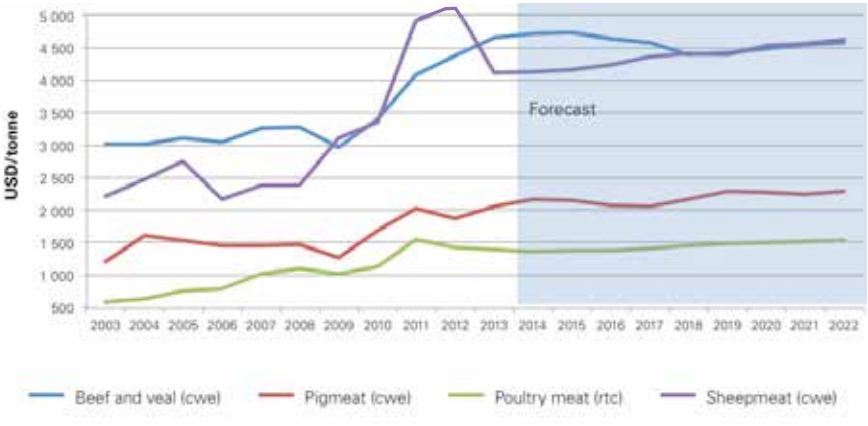
This section presents the value chain analysis (VCA) of a few selected food chains in Jordan. The VCA focuses on identifying water related costs and water productivity along the supply chain. The selection of food chains (broiler meat, high-value vegetables and dates) was performed during a scoping mission. The main outcomes of the scoping mission are discussed in the first two chapters.

Poultry meat

Global overview

The strong rise in feed grain prices in the past five years is reflected in higher meat prices. According to FAO–OECD (see Chart 9), the moderate, slight growing trend is expected to continue in the next years as long as feed and energy prices remain high, underpinned on the demand side by rapidly growing developing economies and on the supply side by high input costs, notably for feed grain and energy related inputs such as transport and cold chain storage. Real prices for poultry are projected to remain close to current levels.

Chart 9: World meat prices forecast

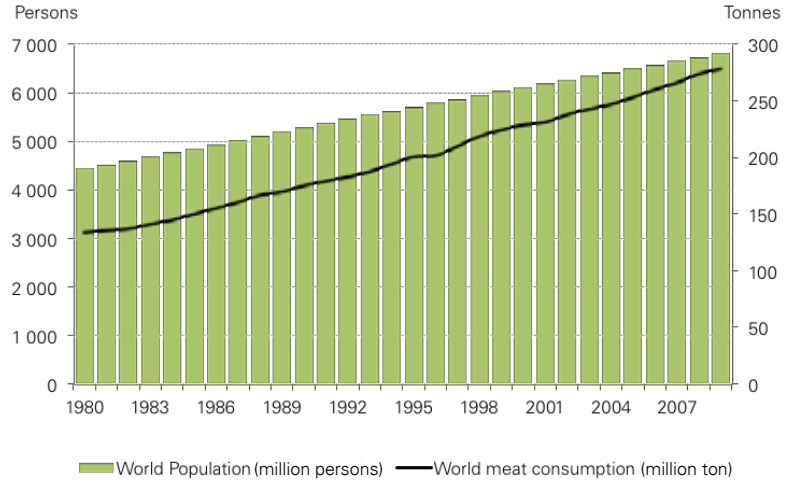


Source: FAO–OECD. Agricultural outlook, 2013-2022.

Note: Carcass weight equivalent (cwe), Ready to cook (rtc).

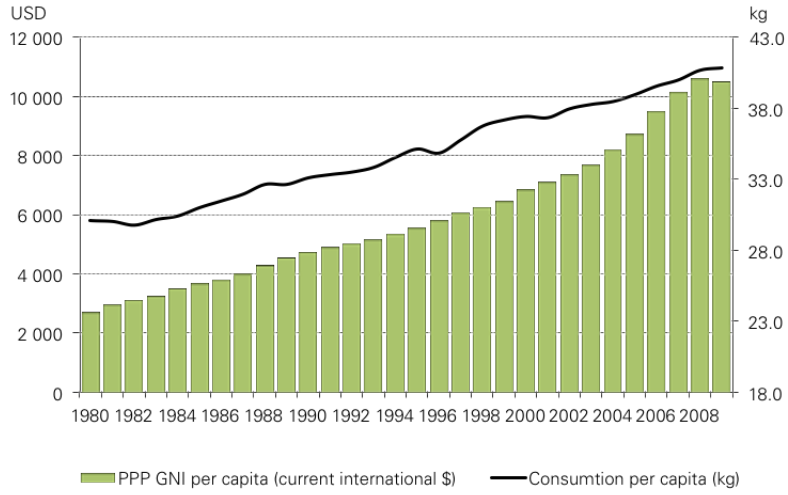
World meat consumption (see Chart 10) continues to grow at one of the highest rates among the major agricultural commodities. Considering that world population is on a continued increase along with the income level (see Chart 11) — this rate is expected to remain high also in the future.

Chart 10: World population and total meat consumption



Source: FAOstat and World Bank data.

Chart 11: World GNI and meat consumption per capita

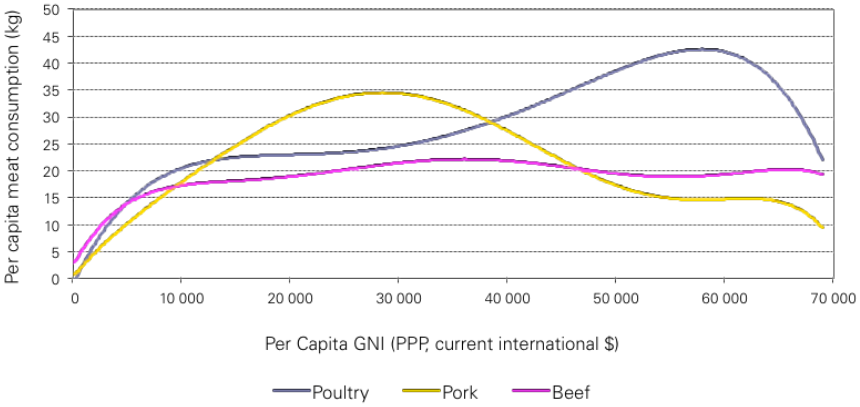


Source: FAOstat and World Bank data.

Growth in demand will derive mostly from large economies in Asia, oil exporting countries and Latin America, where income gains are expected to be significant. Emerging economies will also increase their demand as income growth and urbanisation strengthens the intake of animal proteins at the expense of foods of plant origin.

Growth in developing countries will capture 83 percent of the additional global consumption by 2022. Over the same period consumers in developed and developing countries will add in their annual baskets similar quantities of additional meat. Per capita meat consumption in those two groups of countries will increase by 3.6 kg and 3.2 kg respectively. However, meat type preferences by consumers are different. In developed countries, some 90 percent of the additionally consumed meat will be poultry, except for Eastern Europe where red meat has additional room for growth. Otherwise, the extra meat that consumers in developing countries choose for their baskets is more heterogeneous, with poultry contributing 62 percent of the increase (income elasticity of different types of meat consumption are shown in Chart 12).

Chart 12: Income elasticity of per capita meat consumption by type of meat

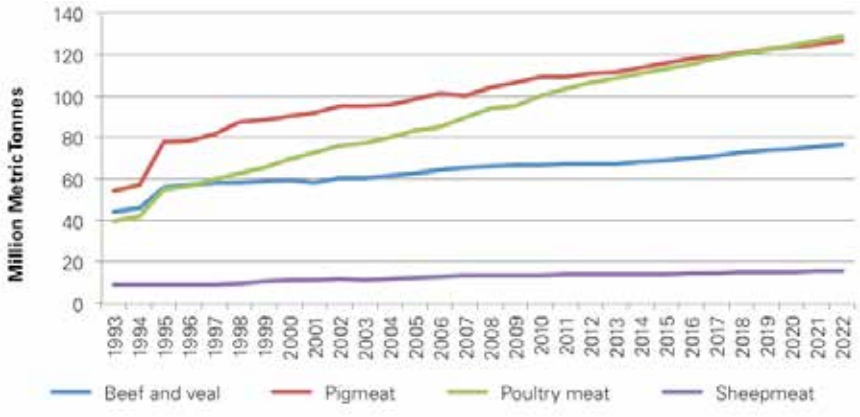


Source: FAOstat and World Bank data.

Greater domestic supply responses are expected from developing countries, particularly for cheaper meat and meat cuts (poultry). The supply response may be constrained in many countries by natural resource scarcity, competition for land and water from

alternative crops and insufficient investments on infrastructure in key regions richly endowed with natural resources for livestock production (Brazil, the Russian Federation and Sub Saharan Africa).

Chart 13: World meat production by type, 1998–2022



Source: FAO-OECD.

Global meat production growth is expected to slow to 1.6 percent per annum in the period from 2014 to 2022 compared with an average 2.1 percent in the previous decade (see Chart 13). This will largely be due to a slower growth in Latin America, particularly Brazil and Argentina, which had experienced a strong growth in the previous decade. According to FAO–OECD, developing countries will increase their share of global production in all meat categories and by 2022 will account respectively for 60 percent, 65 percent, 62 percent and 78 percent of bovine, pork, poultry and sheepmeat production. Generally, developing countries are projected to capture 80 percent of the additional meat output growth over the outlook period.

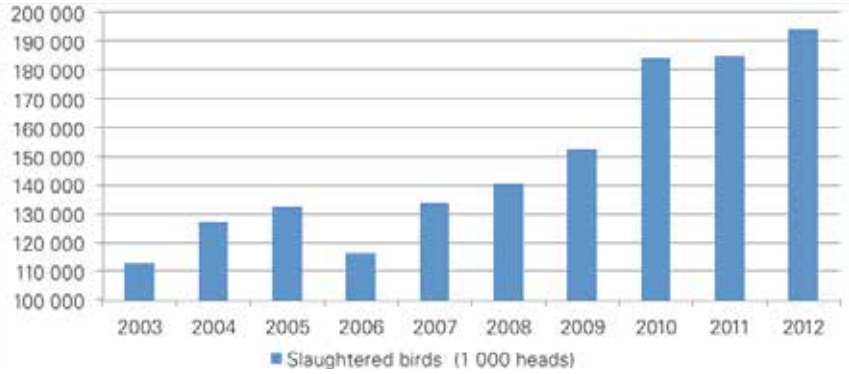
In terms of production quantity, Jordan cannot be considered as a big player on a global level as it covers only 0.18 percent of the world's chicken meat production. Much more importantly though, the country is at the regional level (among Western Asian countries), where it contributes to chicken meat production by almost 5 percent. Due to good levels of self-sufficiency, the country also has very limited trade flows (both import and export) and can be neglected as a trade partner at the international level.

Broiler meat sector in Jordan: value chain analysis

Sector overview. The schematic description of the chicken meat supply chain in Jordan is represented in the Figure 6 (next page).

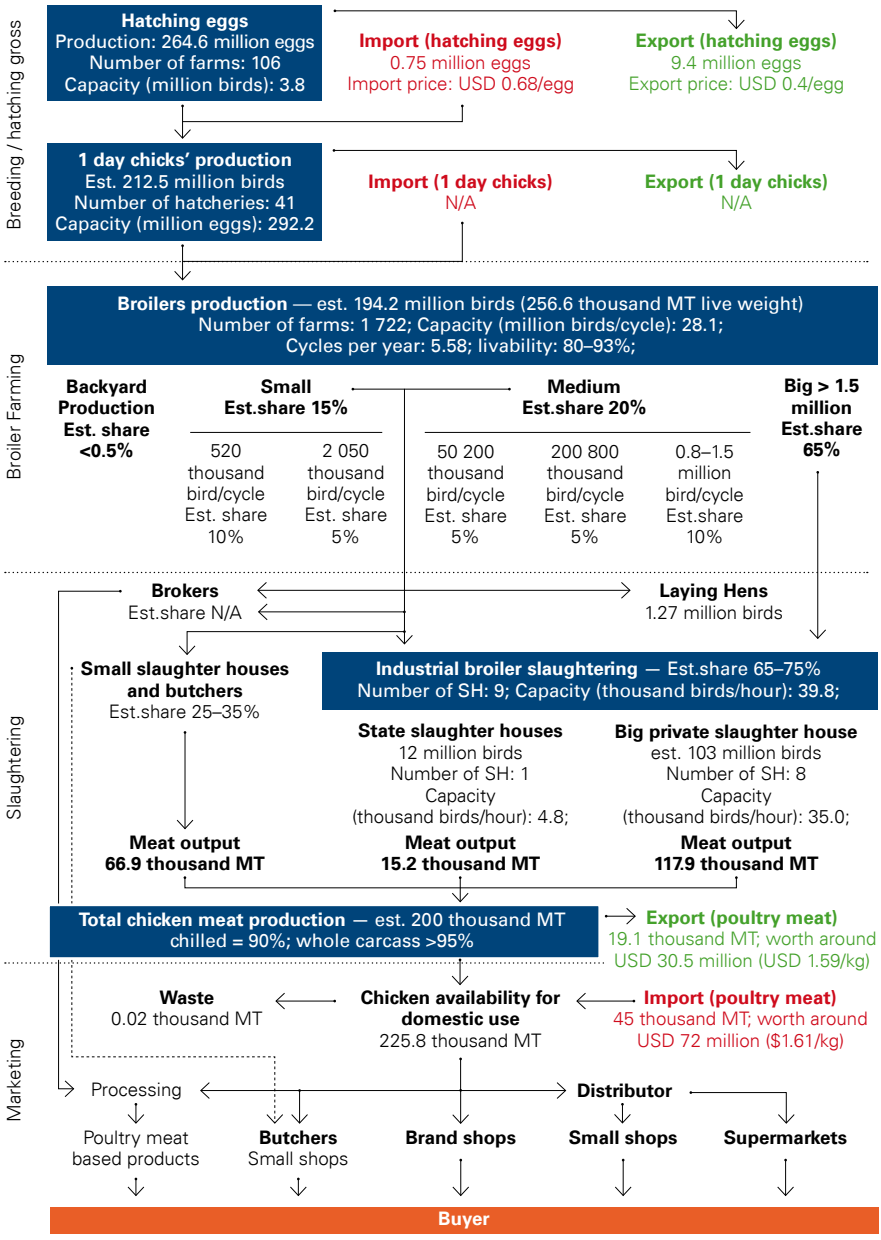
The total capacity of the Jordanian broiler units is in the range of 28 million birds per cycle (on average 6.9 cycles per year). Production in 2012 was around 194.2 million birds (see Chart 14), equaling 256.6 thousand tonnes in terms of live weight.

Chart 14: Birds slaughtered and meat production, 2003–2012



Source: FaoStat, MoA.

Figure 6: Schematic description of the chicken meat supply chain in Jordan, 2012



Source: Authors' compilation.

As we can see from the Table below, total chicken meat production in 2012 is estimated at 200 thousand tonnes: a 50 percent increase compared with the levels in 2005.[48]

Table 26: Poultry meat supply and demand balance in Jordan

Item	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 (est.)
Population, million people	5.2	5.3	5.4	5.5	5.7	5.8	5.9	6	6.2	6.3	6.5
											Thousand tonnes
Production	123.7	128	133.2	117.5	133.9	140.5	152.9	187.7	190.7	200	215
Import	2.8	12.1	12.3	14.6	25.1	43.7	40.7	48.2	54.3	45	41
Total supply	126.5	140.1	145.5	132.1	158.9	184.2	193.5	235.9	245	245	256
Export	2	1.8	2.3	1.4	2.8	20.2	22	21.6	18.7	19.1	25
Waste	0	0	0.02	0.05	0.12	0.02	0.04	0.02	0.03	0.04	0.04
Food consumption	124.5	138.3	143.2	130.6	156	164	171.5	214.3	226.3	225.8	231
Per capita, kg	24.1	26.1	26.5	23.6	27.6	28.3	29	35.4	36.6	35.7	35.7
Total Distribution	126.5	140.1	145.5	132.1	158.9	184.2	193.5	235.9	245	245	256

Source: Authors' estimates based on MoA, DoS, FAO, USDA and GTIS data.

Following WTO membership, large producers have established integrated production systems with sophisticated modern farms and marketing facilities. The broiler meat production companies have their own breeding farms, hatcheries, broiler farms, feed factories, slaughter houses and marketing facilities. Large producers encompass up to 60 percent of the broiler market.

In fully integrated systems, the final product is either frozen or chilled chicken meat. In this case, department stores and large retailers are the buyers.

In parallel, big distributors buy the chicken from the producers and sell them to the retailers and the slaughterhouses.

[48] A first review of the poultry sector in Jordan was made by FAO in 2008 (FAO. 2008. Poultry Sector Country Review).

Between 65 percent and 75 percent of the total sold meat is serviced by slaughterhouses. Thus, distributors are the main actors in the poultry meat chain.

There are nine slaughterhouses with a total capacity of 39.8 thousand birds per hour. These slaughterhouses are located in the Amman, Zarka, Karak and Aqaba governorates. The largest slaughterhouse is in Karak and is owned by the National Company for Poultry with a capacity of 6 000 birds per hour.

In the case of small producers, the marketing system depends on direct sales to middlemen/commission agents who market the whole flock within a short period of time, typically in 1–3 days. In this case, the marketed product is live chicken and the destination of the product is the small slaughter houses scattered across Jordan.

The meat sector was analysed in detail in 2007 by the Ministry of Planning and International Cooperation (MoPIC).[49] According to this report, operational costs were characterized by high growing rates driven mainly by increasing cost for inputs other than the working force. In fact employee wages increased slower than overall operational costs. The increasing electricity and water costs (primarily those related with its quality improvement) were just a few of the operational costs decreasing the sector's competitiveness. Sector players, however, have managed to increase the gross value added from year to year. For this main reason, most producers are increasing their current production capacities and planning for further expansion.

Demand, however, increases only up to a certain income level, after which meat consumption tends to level off or even slightly decline. As the economy grows, meat consumption patterns shift. An increase in local consumption is likely to be affected by the growth of Jordan's average household expenditure. As the process will still take some time, the meat processing sector should focus on filling the existing gap between domestic consumption and production, and on increasing exports to developed countries — at least in the short-term — by complying to their strict import regulations.

Breeder farms and hatching eggs production. The main broiler cross in Jordan is Hubbard Cross, with parent flock grown

[49] 2008–2009. MoPIC. Jordan Competiveness Report.

domestically (thanks to an exclusivity contract by a local company). Overall, only two grandparent farms are working in Jordan. In 2012, 106 parent stock (breeder) farms were operating in Jordan with a total annual capacity of 3.7 million birds (Table 27). Official numbers from the MoA show that the total capacity of the breeding farms should be around 250 million eggs per year. We assume that this number should be around 10 percent higher. As shown in Annex 2, in terms of total capacity of birds, about 56 percent is shared among four regions (Jezzah, Zarqa, Mafraq and North West Badia). A higher capacity is reached instead by the Northern Badia farms.

Over the last six years, the overall capacity and the number of breeding farms in Jordan has fluctuated significantly (particularly in 2010). The breeding segment, however, has recently recovered a growing trend. Such fluctuations are typical of an industry which is growing and aiming at aligning itself to market dynamics.

Table 27: Number and capacity of breeding farms in Jordan, 2007–2012

	2007	2008	2009	2010	2011	2012
Capacity, million birds	3.4	3.1	3.7	2.6	3.9	3.7
Number of farms	114	117	105	87	103	106

Source: MoA.

In 2012, the total production of hatching eggs amounted to 264.6 million eggs. According to the DoS (see Table 28 below; for detailed information refer to Annex 2), the total value of produced eggs was JOD 61.1 million (around JOD 0.23 per egg). This is 73 percent higher compared with 2008 when the value of a single egg was estimated at 0.17 JOD/egg. In 2012, the total costs of inputs (excluding work, administration and overhead costs) required to produce one egg totalled JOD 0.16.

Table 28: Production of hatching eggs in Jordan, 2008–2012

	2008	2009	2010	2011	2012
Hatching eggs (million eggs)	211.3	257.9	256.2	251.6	264.6
Hatching eggs (JOD million)	35.8	40.3	51.5	53.0	61.1

Source: DoS.

Our analysis, based on data collected directly from industry informants, shows that the market price and production costs of hatching eggs has increased over the years. In 2012, as indicated in Table 29, the total production cost was estimated at 0.25 JOD/egg, while the average market price reached 0.30 JOD/egg. At this price, the total value of hatching eggs produced in Jordan that year equaled almost JOD 80 million. The added value of this segment is estimated at around JOD 13 million.

Table 29: Hatching eggs production budget, 2012

Total hatching eggs production cost	0.25	JOD/egg
Including feed	0.075	JOD/egg
Average market price of hatching eggs	0.30	JOD/egg
Net profit of breeding segment	0.05	JOD/egg
Return on costs (%)	20	%

Source: Authors' calculations based on industry data.

In 2012, Jordan was a net exporter of hatching eggs. According to official statistics, exports amounted to a total value of USD 6.88 million (JOD 4.82 million) for 18.74 million hatching eggs at an average price of 0.37 USD/egg (0.26 JOD/egg), and were mainly directed at Qatar, Saudi Arabia and Iraq. The country managed to maintain this position in 2013 even if it imported significant amounts of eggs from Yemen (1.64 million eggs) and from Kuwait (0.68 million eggs). According to import statistics, the average import price of hatching eggs equalled the production cost in Jordan. In fact, hatching eggs from Yemen were imported in Jordan at a price of 0.35 USD/egg (0.25 JOD/egg). This may show a competitiveness issue in this particular segment of the chain, whereas imported hatching eggs are at the edge of being of higher convenience with respect to those domestically produced. However, the need to maintain a reliable position with export customers coupled at the same time with that of responding to the growing demand of domestic hatcheries/broiler farms, is another possible explanation of the export/import dynamics for hatching eggs.

In 2012, there were 41 hatcheries in Jordan with a total hatching capacity of over 290 million eggs per year (Table 30). This capacity would allow them to produce around 234 million[50] one day old chicks per year. According to our estimates, in order to supply the demand of local broiler farms, hatcheries had to produce in 2012 no less than 213 million chicks.

Following a considerable drop in 2009 (-10 percent compared with the previous year), hatching capacity in Jordan has recovered significantly over the last three years.

Table 30: Number of hatcheries and their capacity in Jordan, 2007–2012

Year	2007	2008	2009	2010	2011	2012
Capacity, million eggs	280.4	283.8	254.4	261.6	288.4	292.2
Number of hatcheries	45	42	44	46	43	41

Source: MoA.

Hatcheries are largely integrated in large broiler farms or cooperatives of medium-sized farms. Survey data show that the efficiency level of hatcheries in Jordan is average with scope for improvement, whereas even the most efficient hatcheries report a hatchability level of only 80 percent.

The total production cost of one day old chick is JOD 0.41 and its market price is JOD 0.45; the return on costs (RoC) for a hatchery is estimated at 9.1 percent (see Table 31). The main cost component of one day old chick production is the hatching cost, which is considered somewhat high due to the less than average hatchability levels. The hatching (operational) costs are estimated at 0.03 JOD/chick.

[50] At a maximum hatchability rate of 80 percent.

Table 31: One day old chicks production budget, 2012

Cost of 1 hatching egg	0.30	JOD/1 day chick
Hatchability	80	%
Total raising costs of 1 day chick	0.03	JOD/1 day chick
Total production cost of 1 day chick	0.41	JOD/1 day chick
Average market price of 1 day chick	0.45	JOD/1 day chick
Net profit of hatching segment	0.04	JOD/1 day chick
Return on costs	9.1	%

Source: Authors' calculations based on industry data.

At the national level, the hatchery segment gross output was estimated at over JOD 96 million, in 2012, with an added value of over JOD 8 million.

Broiler farming. Official MoA data show that in 2012 the total number of broiler farms operating in Jordan amounted to 1 722 units with a total capacity of over 28.1 million birds per cycle (see Table 33). The average capacity of each farm was around 16 thousand broilers per cycle. The estimated total production capacity of the broiler farming segment in Jordan is estimated at 220 thousand tonnes broilers (live weight equivalent). According to our analysis, the production capacity of broiler farms in Jordan could be significantly higher. In all cases, production estimates from the DoS are considerably above (roughly 16 percent) the production level that can be calculated from the MoA's data:[51] 256.6 thousand tonnes of produced broiler (live weight equivalent).

In 2012, the total value of broilers produced was JOD 342.3 million (see Table 32) and the added value of this segment amounts to JOD 27 million.

[51] Such discrepancies often occur in Jordan but eventually MoA data tends to realign with those of the DoS.

Table 32: Broilers production in Jordan, 2008–2012

	2008	2009	2010	2011	2012
Production quantity, MT	187 822	203 432	248 098	256 847	256 616
Total value, JOD million	261.5	238.6	307.1	325.9	342.3
Unit value, JOD/kg	1.39	1.17	1.24	1.27	1.33

Source: DoS.

Sixteen percent of broiler farms in Jordan — 276 farms — were reported in the official statistics as unlicensed (for more detailed information refer to Annex 2). They contributed to 10 percent of the total capacity of broiler farms in Jordan. The average capacity of unlicensed farms was lower (32 percent less) compared with the average national capacity of a 'formal' broiler farm in Jordan. The governorates with the highest capacity broiler farms are Mafraq with 6.4 million birds, Amman with 5.0 million birds and Irbid with 4.9 million birds per cycle.

Over the last decade, the broiler farming segment of the poultry supply chain in Jordan has experienced a significant consolidation trend. Along with the decreasing number of farms, their capacity increased from 26.8 million birds per cycle in 2006 to 28.1 million birds in 2012. In the same period, the average capacity of broiler farms in Jordan increased by 25 percent, from 13.1 to 16.3 thousand birds per cycle per farm. An indicator which would call for efficiency improvements of this segment.

Table 33: Number of broiler farms and their capacity in Jordan, 2007–2012

	2006	2007	2008	2009	2010	2011	2012
Capacity, million birds per cycle	26.75	26.36	22.03	27.28	28.12	27.36	28.14
Number of farms	2 039	1 940	1 887	1 866	1 909	1 866	1 722

Source: MoA.

According to the below (Table 34), almost 65 percent of the broilers in Jordan are currently produced by a few vertically integrated large companies, each having a broiler production capacity of at least 1.5 million birds per cycle.

Table 34: Market share of broiler farms by capacity, 2012

	Capacity	Market share (contribution to total broilers production)
Small	5 000–20 000	10%
	20 000–50 000	5%
Medium	50 000–200 000	5%
	200 000–800 000	5%
	800 000–1 500 000	10%
Big	>1 500 000	65%
Backyard production		<0.5%

Source: MoA.

For the sake of analyzing the broiler farming segment of the supply chain, two broad categories are taken into account: broiler production using modern technologies (defined as new farms) and broiler production using obsolete technologies (defined as old farms).

These two types of farms have different capacities, costs and margins. Their efficiency also differs significantly. At the same time, their share of the overall broiler production market in the country is consistently different. For this analysis, we assume that all small farms apply obsolete technology in broiler production and are thus categorized as old farms, while all the big farms have been able to invest and switch over to modern technology and thus be accordingly categorized as new farms. Little information is available on how many medium-sized farms have invested in new technologies. It is, however, assumed here that the majority of these would be of low efficiency levels, similar to that of the small farms.

New farms are able to work with 78 broiler production cycles per year compared with an average of 5–6 cycles per year of old farms. The average duration of the cycle in new farms is 43–47 days (32–36 raising days and 11 sanitation days). The smaller amount of cycles in old farms is due to longer sanitation breaks and their technological inability to operate during cold winter months. Compared with the best international practices, the cycle duration in new farms can be shortened by speeding up their operations,

hence reducing the amount of days required for sanitation. This will help increase farm efficiency and will reduce the impact of fixed cost components of the broiler production costs.

Indeed sanitary conditions are superior in new farms, which record a high livability level of 93 percent; while in the old farms, it can be even lower than 80 percent. The latter are more vulnerable to bird disease outbreaks. Livability levels have an obvious, inherent impact on production costs. The cost of a one day old chick is JOD 0.48 per broiler in a new farm, which is significantly lower compared with JOD 0.56 per broiler in old farms.

Optimization of production cycles and high livability rates are crucial but are not the exclusive factors of efficient broiler farming. The most important cost element in broiler meat production is the feed component, accounting for over 67 percent of live broiler production costs in modern farms and up to 55 percent of chicken meat production costs. That is why the feed conversion rate (amount of feed needed to produce 1 kg of live weight) plays a key role in determining industrial competitiveness.

New farms in Jordan are characterized by good levels of feed conversion rates, ranging from 1.5 to 1.6 kg of feed per 1 kg of live broiler weight. In these farms, feed contributes on average JOD 0.78 to the production costs of 1 kg of live broiler and JOD 1.00 to the production costs of 1 kg of chicken meat. Otherwise, feed conversion rates are worse in old farms requiring up to 1.7 kg of feed per one kg of live broiler weight. In these farms, feed contributes on average JOD 0.85 to the production costs of 1 kg of live broiler and JOD 1.08 to the production costs of 1 kg of chicken meat.

Eventually, adding up all of the production costs, including: one day chick, feed and operational costs, the total production costs per 1 kg of live broiler in new and old farms amount respectively to: JOD 1.16 and JOD 1.39 (for a detailed broiler production budget see Table 35). At the average market price of live broiler at 1.30 JOD/kg, the RoC are 11.9 percent for new farms and - 6.4 percent for old farms.

Table 35: Broilers production budget, 2012

	New farms		Old farms	
1 day chick cost	0.45	JOD/1 day chick	0.45	JOD/1 day chick
Livability	93	%	80	%
Cost of 1 day chick per broiler	0.48	JOD/broiler	0.56	JOD/broiler
Feed price	450	JOD/MT	450	JOD/MT
Feed conversion rate	1.55	feed/meat	1.67	feed/meat
Expected weight of a broiler	1.5	kg/broiler	1.8	kg/broiler
Cost of feed per broiler	1.05	JOD/broiler	1.35	JOD/kg live weight
Labour cost	0.018	JOD/broiler	n.a.	JOD/broiler
Energy cost	0.004	JOD/broiler	n.a.	JOD/broiler
Vaccination cost	0.15	JOD/broiler	n.a.	JOD/broiler
Water cost	0.007	JOD/broiler	0.012	JOD/broiler
Overhead costs	0.03	JOD/broiler	n.a.	JOD/broiler
Operational costs	0.21	JOD/broiler	0.58	JOD/broiler
Total prod cost of broiler	1.74	JOD/broiler	2.50	JOD/broiler
Total prod cost per kg of live broiler	1.16	JOD/kg of live broiler	1.39	JOD/kg of live broiler
Average market price per kg of live broiler	1.30	JOD/kg of live broiler	1.30	JOD/kg of live broiler
Net profit of broiler farming segment	0.14	JOD/ kg of live broiler	-0.09	JOD/ kg of live broiler
Return on costs	11.9	%	-6.4	%

Source: Authors' calculations based on industry data.

Feeding. Jordan relies entirely on imported feed components for the production of its compound feed. Feed component imports to Jordan are characterized by low market competition levels. Only three companies import feed components, of which the market share of imported corn by the largest company amounts to about 60 percent.

The segment is characterized by significant infrastructural and organizational bottlenecks. All imports of feed components are managed through the Aqaba Port, distant almost 350–400 km

from the northern districts of the country where the majority of the broiler farms are concentrated. The port of Aqaba is not equipped with storage facilities to yield an efficient handling of feed grains. None of the private feed grain importers have silos at the port area or in its surroundings; all of their silos are located in the northern districts. Vessels arriving to the Aqaba port need to be unloaded directly on trucks, which then transport the produce to the silos storages. The only operational silos in the Aqaba port are state-owned grains silos.

In 2013, Ukrainian corn price at silo gate was 240 JOD/tonnes, while the higher quality Argentinean corn was sold at 320 JOD/tonne. The same year, Ukrainian corn was imported at 185–200 JOD/MT CIF. Low market competition and inefficient infrastructure make the procurement price of feed components by compound feed mills quite expensive. This inevitably impacts the cost of compound feed where the feed ingredients component is 75 percent (see the feed production budget below).

Table 36: Compound feed production budget, 2012

Feed ingredients	315	JOD/MT
Fixed costs	25	JOD/MT
Variable costs	17	JOD/MT
Overhead costs	63	JOD/MT
Total feed production cost	420	JOD/MT
Average market price of compound feed	450	JOD/MT
Net profit of feed production segment	30	JOD/MT
Return on costs	7.1	%

Source: Authors' calculations based on industry data.

This segment of the economy is characterized by relatively low, but stable profits. All large integrated producers have their own feed mills producing for their own farms, but also for others (smaller farms and for export). In 2012, Jordan exported 37.7 thousand tonnes of different compound feeds, mainly to Iraq. Some of the interviewed companies involved in table eggs production stated that they procure compound feed at a price of 800 JOD/tonne. The average market price of compound feed

in Jordan in 2012/13 was 450 JOD/tonne (The compound feed production budget is available in Table 36.).

Slaughtering. In Jordan, around 25–35 percent of broilers are slaughtered by small-scale slaughter houses and individual butchers. These operators purchase live animals from small and medium farms, directly or through brokers. According to this analysis, the meat output of this segment is estimated to amount to 66.9 thousand tonnes of domestic fresh poultry meat. The remaining and major share of the market (65–75 percent) is covered by 9 big industrialised slaughter houses, most of them vertically integrated.

Table 37: Industrial slaughterhouses capacity and production

	2008	2009	2010	2011	2012
Processing capacity (birds per hour)	27 000	27 000	36 500	36 500	39 800
Production (thousand MT of meat per year)	102	106	133	140	133

Source: MoA.

Out of the nine big slaughter houses, eight are private with an overall capacity of 35 thousand birds/hr and a meat output of 117.9 thousand tonnes per year, in 2012. In addition to these, the Amman Municipality Slaughter House, the only big operator that is state-owned, has a reported capacity of 4.8 thousand birds/hr and a meat output of 15.2 thousand tonnes per year (in 2012). Over the last year, the total slaughtering capacity of the country has increased significantly, from 27 thousand birds/hr in 2008 to almost 40 thousand birds/hr in 2012 (Table 37).

Our analysis shows that the average slaughtering cost, including packaging, in all industrial slaughter houses is about JOD 0.17 per broiler (detailed slaughtering segment budget available in Table 38). Assuming that on average 1.5 kg live broiler is delivered to the slaughter house at a market price of around JOD 1.95, the total resulting cost of a processed broiler is around JOD 2.12. At an average meat yield of 78 percent, the total production cost of one whole, chilled chicken is calculated at 1.81 JOD/kg. At an average market price of 2.10 JOD/kg of whole, chilled chicken, the RoC at slaughter house levels is equal to 16.1 percent.

Table 38: Broilers slaughtering and packaging budget, 2012

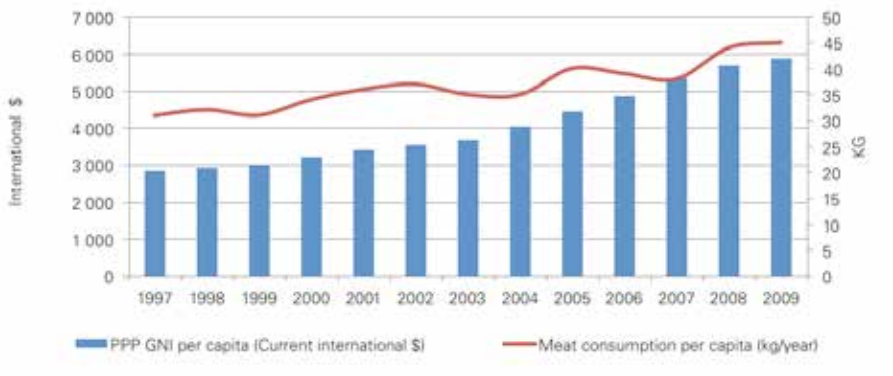
Cost of broiler	1.95	JOD/broiler
Electricity cost	0.02	JOD/boiler
Labour	0.08	JOD/boiler
Fuel	0.03	JOD/boiler
Water cost	0.01	JOD/broiler
Sanitation cost	0.002	JOD/broiler
Packing consumables cost	0.01	JOD/broiler
Overhead cost	0.01	JOD/broiler
Slaughtering and packing cost per broiler	0.17	JOD/broiler
Total cost of a processed broiler	2.12	JOD/broiler
Expected weight of a broiler	1.5	kg/broiler
Output of meat per broiler	78	%
Total production cost of whole chicken	1.81	JOD/kg
Market price of whole chicken (SH gate)	2.10	JOD/kg
Net profit of slaughtering and packing segment	0.29	JOD/kg
Return on costs	16.1	%

Source: Authors' calculations based on industry data.

Markets. Over the last years, the country has gained high levels of self-sufficiency. In 2012, Jordan internally produced 89 percent of its domestically consumed poultry meat and is expecting to further increase this indicator in 2013.

Jordan's population has steadily increased over the last decades, at an average rate of 2.3 percent annually. The per capita consumption of poultry meat, driven by increasing income and changes in consumer preferences, has also shown increasing trends. Over the last decade it has increased by an average of 4 percent per year (historical data on per capita Gross National Income (GNI) and per capita meat consumption available in Chart below).

Chart 15: Per capita GNI elasticity of per capita meat consumption in Jordan, 1997–2009



Source: FAOstat and World Bank data.

If the trend continues, the country could expect domestic poultry meat consumption to increase up to 345 thousand tonnes in 2020. Over 50 more than 2012 levels, when domestic consumption of poultry amounted to an estimated 226 thousand tonnes (and at an estimated value of JOD 440 million).

Almost 80 percent of the domestically consumed poultry meat is chilled whole carcass. According to the information provided by slaughter houses, only 5 percent of the supplied poultry meat is in the form of cuts, mainly to hotels and restaurants.

In 2012, Jordan exported 19.1 tonnes of frozen poultry meat — at an average unit price of 1.10 JOD/kg — worth around JOD 21 million.

In 2012, the total supply of poultry meat in the country amounted to 245 thousand tonnes, of which Jordan produced domestically almost 200 thousand tonnes. The total market value of the domestically produced poultry meat is estimated at around JOD 413 million.[52] Around 90 percent of the domestic production is chilled poultry meat, mainly whole carcass.

[52] Slaughter house gate price of chilled poultry meat: 2.1 JOD/kg; slaughter house gate price of frozen poultry meat: 1.75 JOD/kg.

The frozen poultry meat is predominantly for export, mainly deriving from unsold chilled meat.[53] In addition, an estimated 45 thousand tonnes of poultry meat was imported to Jordan in 2012. The value of poultry meat imports amounts to an estimated JOD 5 055 million.

Water budget and productivity. Consumption of water in poultry meat production varies significantly from farm to farm and from slaughterhouse to slaughterhouse. It mainly depends on the technology that is used at each stage of the supply chain: by the level of modernization of main assets and by the levels of managerial and technical skills of the administrators. According to our estimates, along the entire poultry meat chain in Jordan, water consumption ranges from about 7 litres (6.85) of water per kg of meat produced in facilities equipped with modern technology to almost 13 litres (12.9) in facilities that are using obsolete technology.

At an international comparison level, the poultry water-use efficiency in Jordan appears to be interestingly high. The country stands in line with the most performing EU and Danish companies and results as more efficient compared with the United States and Finnish companies (see below the benchmark Table on water-use efficiency in slaughtering).

Table 39: Water-use in slaughtering in selected countries (litres per processed carcass)

Jordan	Finland*	EU*	Denmark*	USA**
3.6410	12.8–14.0	5.07–67.4	8.6	11.30

* IFC Environmental, Health, and Safety Guidelines for poultry processing, 2007.

** Department of Poultry Science, University of Georgia, 2011.

For the provision of feed, Jordan relies completely on imports of corn and soya mill (and formula additives); thus the water usage related to their production does not impact directly the water budget of the country. Accordingly, the above numbers of our calculations are not inclusive of water used for feed crop production. The following analysis concentrates mainly on processes that take place in Jordan and that require water sourced

[53] The shelf life of a chilled chicken is 3 (and up to 5) days. Should the carcass not be sold within 12 days in brand shops of large integrated companies, it returns to the company plant to be frozen.

from the Jordanian territory. The analysis takes into account two scenarios: under the first scenario, we analyze the water usage of each poultry meat supply segment by efficient fully-integrated companies; the second scenario considers non-integrated process companies characterized by inefficient water utilisation.

At the farming segment, there are three pathways of water consumption: through feed, through direct animal intake of water, and water used for cleaning and sanitation. Highly efficient farms have higher feed conversion rates (up to 1.55) and shorter raising cycles of a broiler (around 36 days). This allows them to consume less feed and consequently, less water. Due to better environmental control and more advanced measures of hygiene management, highly efficient farms require less time for cleaning and sanitation and use considerably less water compared with old style open broiler farms.

Table 40: Broiler farm water budget

	New farm	Old Farm	
Water used in feed processing	0.15	0.15	litre/kg
Feed used to produce a hatching egg	0.17	0.17	kg
Hatchability of eggs	0.80	0.80	%
Livability of chicks	0.93	0.93	%
Feed used to raise a 1 day chick	0.23	0.23	kg
Expected weight of broiler at farm gate	1.5	1.8	kg
Feed conversion rate	1.55	1.67	Feed unit/meat unit
Total feed used to grow a broiler (broiler intake + feed used to raise a 1 day chick)	2.55	3.23	kg
Water per broiler through feed	0.38	0.49	litre/ broiler
Average cycle duration (raising)	36	42	days
Water intake per broiler per day	0.11	0.12	litre/day
Water intake per broiler per cycle	3.89	5.18	litre/cycle
Other uses per broiler	0.10	2.50	litre/ broiler
Total water used per broiler	4.38	8.17	litre/broiler
Water used per kg of live chick	2.92	4.54	litre/kg

Source: Authors' calculations based on industry data.

Other than water used for feed crop production, feed mills consume water in the process of compound feed making. This consumption of water by feed mills is estimated at 0.15 litre/kg of feed.

Considering that 0.23 kg of feed are required to produce 1 hatching egg, a feed conversion rate in new farms (check in brackets values for old farms) is 1.5 kg (1.67 kg) of feed per live weight of broiler; the amount of feed used to raise a 1.5 kg (1.8 kg) broiler is 2.55 kg (3.23 kg), which results, in a water consumption through feed of 0.38 litre (0.49 litre) per broiler. Although there is large individual variability, generally water intake in birds is double the amount of feed consumed (ratio of 2:1).

Table 41: Broiler water intake at different ages

Age (weeks)	ml of water/ week/bird
1	225
2	480
3	725
4	1 000
5	1 250
6	1 500
7	1 750
8	2 000

Source: Schlink et al., 2010 Water requirements for livestock production: a global perspective. Rev. sci. tech. Off. int. Epiz., 29 (3), 603–619.

With modern technology, during the 36-day cycle of (new) poultry farms, the total water intake of a broiler chicken with expected final weight of 1.5 kg amounts to 3.9 litres; while during the 42-day cycle in open (old) poultry farms, ,the total water intake of a broiler chicken with expected final weight of 1.8 kg amounts to 5.2 litres. Water consumption in a single farm cycle also includes farm operations such as, the cleaning/sanitation at the end of every cycle and the cooling system during warmer months; these operations require very limited quantities of water in new farms (around 0.1 litres per broiler), but are very demanding in old poultry farms (up to 2.5 litres per bird).

Eventually, at the very end of the farming segment (at farm gate), the total amount of water consumed to produce 1 kg of live weight broiler is 2.92 litres in new farms compared with 4.54 litres in old farms (see detailed water budget of broiler farms in Table 40).

Slaughter houses report water consumption in the range of 3.64–10 litres per processed bird. In fully integrated and highly efficient industries, which result in: a broiler live weight of 1.5 kg, a meat output per broiler of 78 percent and final carcass weight of 1.17 kg, the total amount of water used to process 1 kg of meat amounts to 3.11 litres (Table 42). However, for old and less efficient slaughter houses, with the live weight of a broiler of 1.8 kg, a meat output per broiler of 78 percent and final carcass weight of 1.4 kg, the total amount of water used to process 1 kg of meat amounts to 7.12 litres.

Table 42: Slaughterhouse water budget

	"New"	"Old"	
Average weight of live broiler	1.5	1.8	
Water used to slaughter a bird	3.64	10	litre/carcass
Meat output per broiler	0.78	0.78	%
Carcass weight	1.17	1.40	kg
Water used to process 1 kg of poultry meat	3.11	7.12	litre/kg

Source: Authors' calculations based on industry data.

Accordingly, the total amount of water used to produce 1 kg of meat (including water used along the whole supply chain from farmer to final consumer) is 6.85 litres in highly efficient, integrated systems and over 12.94 litres in less efficient, non-integrated systems (Table 43).

Table 43: Broiler meat production water budget

	"New"	"Old"	
Total water used to raise a broiler	4.38	8.17	litre/broiler
Total water used to slaughter a broiler	3.64	10.00	litre/broiler
Total water used to produce one carcase	8.01	18.17	litre/carcass
Av. carcass weight	1.17	1.404	kg
Total water used to produce 1 kg of poultry meat	6.85	12.94	litre/kg
Consumer price of poultry meat	2.37	2.37	JOD/kg
Gross value per litre of water	0.35	0.18	JOD/litre
Total added value of the chain	0.62	0.18	JOD/kg
Total added value of the chain per litre of water	0.09	0.01	JOD/litre

Source: Authors' calculations based on industry data.

As a result, along the entire broiler meat supply chain in a fully integrated company, one litre of water generates a gross value of JOD 0.35 (at a market price of 1 kg of poultry meat for JOD 2.37) and a total accumulated added value of JOD 0.09 (the total accumulated profit along the supply chain was estimated at 0.62 JOD/kg of meat). Non-integrated and less efficient production systems in Jordan produce with one litre of water only JOD 0.180 of gross value and a total accumulated added value of JOD 0.01.

It is worth mentioning again that the detailed water budget analysis we performed above does not account for water used in primary feed crop production. Although, in order to provide a broader picture on water-use efficiency in poultry meat production, in the following Table, we provide information on the average virtual water content of poultry meat in production systems in developed countries and compare it with the virtual water content of poultry meat, beef, pork, goat meat and sheepmeat.

Table 44: Average virtual water content of different types of meat produced in production systems in developed countries

Beef (litre/kg)	Sheep meat (litre/kg)	Pork (litre/kg)	Goat meat (litre/kg)	Chicken meat (litre/kg)
15 497	6 143	4 856	4 043	3 918

Source: A.C. Schlink, M., L. Nguyen & G.J. Viljoen. 2010. Water requirements for livestock production: a global perspective, FAO/IAEA, Vienna. (http://web.oie.int/boutique/extrait/14schlink603619.pdf).

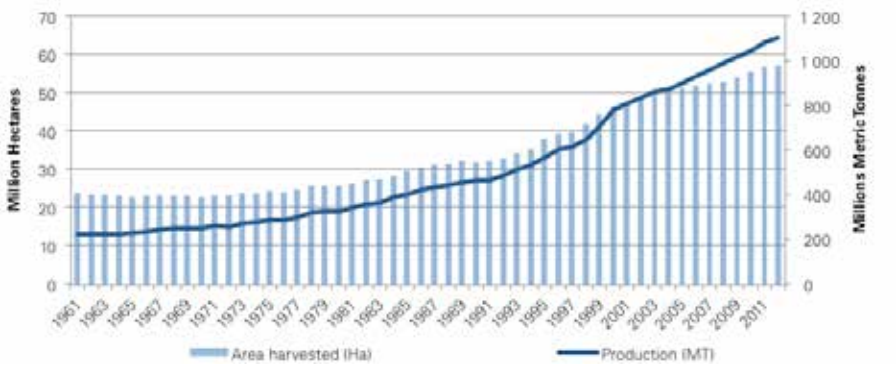
As we can notice from Table 44, poultry is the most efficient among other types of meat in terms of total amount of water used to produce 1 kg of meat.

Selected vegetables

Global overview

Over the last four decades, worldwide vegetable production has increased five-fold from 220 million tonnes in 1961 to over 1 106 million tonnes in 2012 (Chart 16). The average growth rate of the vegetable supply over the period was 3.2 percent per year. Alongside with production increases, the harvested area for vegetables expanded from around 24 million hectares in 1961 to around 57 million hectares in 2012, at an average rate of +1.8 percent per year. This suggests that the efficiency and productivity of the sector has improved remarkably over time.

Chart 16: World production of vegetables and harvested area, 1961–2012

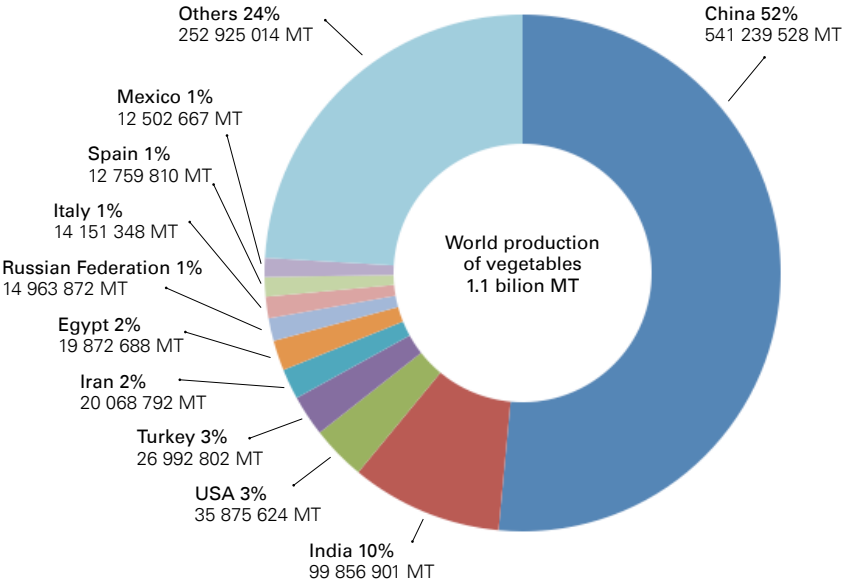


Source: FAOStat.

The average annual global production of vegetables during 2008–2012 amounted to around 1.11 billion tonnes. Over the same period the top five world producers (China, India, USA, Turkey and Iran) contributed 69 percent to of the world vegetables production, while the top 10 ten producer countries accounted for 76 percent (Chart 17).

With its 1.5 million tonnes of average annual vegetable production in 2008–12, Jordan ranks 62nd among the world's largest vegetable producers.

Chart 17: World top 10 vegetable producers in 2008–2012



Source: FAOStat.

The quantity of vegetables traded on international markets has constantly increased over the last decades. During the 2008–2012 period, the amount of vegetables internationally traded each year was 6 percent (about 65–70 million tonnes) of the global production. The leading vegetable exporters in terms of volume are China, the Netherlands (actually, re-exporter), Mexico, Thailand and Spain (Table 45).

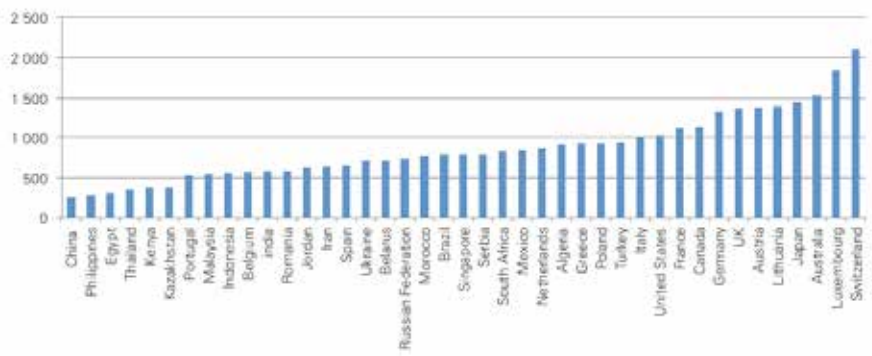
Despite its small production base, in 2012, in terms of volumes of exported vegetables, Jordan had a commendable position (20th) among the world exporters; while in terms of export value, the country ranked lower (23rd place) on the list.

The average export price of vegetables varies significantly from country to country with a range between 500[54] to over 2 500 USD/tonne.

The leading importers in terms of volume of vegetables are the following: China, the United States, Germany, India and Egypt (see Table 46).

The highest value markets are in: Switzerland, Luxemburg, Australia and Japan.

Chart 18: Average vegetables import prices in 2008–2012



Source:GTIS.

Vegetables sector in Jordan: value chain analysis

Sector overview. Vegetable crops are the backbone of the JV, which line up on a production area of around 200 000 dunums

[54] Should the average vegetable export price (~500 USD/tonne) from Jordan be applied to the entire physical corresponding output of the JV (876 thousand tonnes in 2011), it would generate a gross economic output in the range of USD 450 million. This would be the result of the entire vegetable cropped area in the JV, i.e. about 200 000 dunums. An indicative comparison is possible with the gross output from the West Bank, which crops only 16–17 percent the vegetable area used in the East Bank but generates an estimated value of USD 150 million from the same (http://www.israellandfund.com/en-us/info/regions/judea-samaria-and-the-jordan-valley.htm). This is likely only because Israeli products are provided with more value added, being of a type that enable these to be directed towards high-value markets.

Table 45: Main exporters of vegetables, 2008–2012

		Million MT						USD Million				
		2008	2009	2010	2011	2012		2008	2009	2010	2011	2012
	Reporting Total	57.51	61.23	64.88	65.9	67.12	Reporting Total	47 371.9	46 625.2	53 610.6	58 180.0	55 322.2
1	China	6.54	6.58	6.58	7.55	7.17	Netherlands	7 801.2	6 750.1	7 741.7	7 607.5	7 114.2
2	Netherlands	6.26	6.33	6.84	6.98	6.5	China	4 223.1	4 845.3	7 477.8	8 721.3	6 913.3
3	Mexico	4.23	4.26	4.8	4.93	5.17	Spain	5 467.1	5 424.2	5 371.1	5 520.1	5 737.0
4	Thailand	3.16	4.61	4.5	4	4.94	Mexico	3 869.0	3 840.5	4 309.8	4 947.1	5 012.5
5	Spain	4.34	4.35	4.55	4.79	4.79	USA	3 465.7	3 401.3	3 784.5	3 937.7	4 044.4
6	Canada	4.46	5.35	5.57	5.71	4.56	Canada	3 001.8	3 035.5	3 365.4	3 670.2	3 171.5
7	USA	3.62	3.62	3.9	3.82	4.04	France	2 489.1	2 176.5	2 431.4	2 607.3	2 396.0
8	France	3.68	3.72	4.12	3.89	3.8	Belgium	2 511.5	2 296.1	2 321.4	2 311.9	2 328.0
9	Belgium	2.71	2.65	2.71	2.82	2.89	Italy	1 577.3	1 411.3	1 773.2	1 688.8	1 597.0
10	India	2.27	2.53	2.17	2.09	2.61	Thailand	749.3	854.1	1 070.2	1 265.7	1 365.8

11	Germany	2.23	2.4	2.35	2.22	2.59	Australia	488.7	547.9	716.3	987.9	1 289.4
12	Australia	0.75	1.05	1.23	1.64	2.08	Germany	1 237.6	1 105.0	1 174.7	1 257.6	1 151.6
13	Iran	0.74	1.08	1.1	0.9	1.4	Poland	1 097.3	889.4	1 009.9	1 050.7	1 116.7
14	Egypt	1.06	0.91	1.23	1.57	1.37	Turkey	952.8	1 020.5	1 100.6	1 070.8	966.1
15	Turkey	1.23	1.34	1.37	1.41	1.37	India	681.8	825.1	964.4	994.8	915.7
16	Poland	1.11	0.99	1.04	1.06	1.23	Iran	254.4	614.3	664.5	541.4	806.9
17	Italy	1.08	0.93	1.14	1.04	1.03	Egypt	659.2	798.5	831.2	986.4	800.4
18	Argentina	0.62	0.68	0.83	0.86	0.84	Argentina	504.5	426.7	640.8	740.6	696.0
19	RF	0.15	0.43	0.25	0.62	0.81	Peru	379.8	386.0	467.0	499.7	573.8
20	Jordan	0.68	0.75	0.68	0.76	0.7	Israel	-	525.6	554.2	560.0	530.6
21	UK	0.63	0.81	0.82	0.84	0.68	UK	463.8	464.2	488.4	535.8	513.6
22	Israel*	0.3	0.4	0.4	0.7	0.6	Lithuania	282.4	181.9	273.4	382.8	473.3
23	Morocco	0.47	0.45	0.51	0.64	0.51	Jordan	391.5	375.2	437.8	478.0	470.3
	Others	5.1	5	6.2	5.1	5.5	Others	4 823.0	4 430.0	4 640.9	5 815.9	5 338.1

* The Central Bureau of Statistics, Statistic abstract of Israel 2013.
Source: GTIS.

Table 46: Main importers of vegetables, 2008–2012

		Million MT						USD Million				
		2008	2009	2010	2011	2012		2008	2009	2010	2011	2012
	Reporting Total	54.77	59.4	60.01	63.36	69.38	Reporting Total	47 928.8	44 912.6	51 614.2	56 302.4	55 841.8
1	China	2.36	6.56	6.48	5.85	7.91	China	5 632.9	5 391.3	6 486.0	7 248.8	7 416.8
2	United States	5.7	5.7	6.49	6.8	6.92	United States	6 292.0	5 654.4	6 349.5	6 335.3	6 176.4
3	Germany	4.58	4.49	4.69	4.76	4.86	Germany	4 491.4	3 562.8	3 876.8	4 018.0	4 009.8
4	India	2.63	3.81	3.01	3.24	3.83	India	3 317.1	2 933.4	3 194.9	3 153.4	3 148.7
5	Egypt	0.4	2.19	0.42	0.6	3.8	Egypt	1 691.9	1 707.5	2 152.5	2 526.2	2 695.7
6	Belgium	3.17	2.99	2.89	2.97	3.31	Belgium	2 701.9	2 216.9	2 544.7	2 738.7	2 655.0
7	Netherlands	3.33	2.45	2.66	3.05	3.31	Netherlands	2 136.5	2 119.7	2 395.0	2 618.1	2 489.8
8	UK	3.19	2.72	2.74	2.86	3.11	UK	1 764.3	1 632.2	2 210.2	3 062.8	2 433.6
9	France	2.97	2.7	2.76	2.79	2.92	France	583.0	1 052.6	1 513.1	1 823.8	2 407.8
10	RF	2.81	2.47	3.17	4.1	2.65	RF	1 452.2	2 104.1	1 874.4	1 847.8	2 268.9

11	Canada	1.91	1.98	2.09	2.2	2.24	Canada	1 808.7	1 616.8	1 607.4	1 833.9	1 805.7
12	Spain	2.11	1.84	1.89	1.73	1.91	Spain	1 686.6	1 710.5	1 812.9	1 896.6	1 702.1
13	Italy	1.62	1.82	1.89	1.77	1.79	Italy	1 330.0	1 123.6	1 215.0	1 269.8	1 277.1
14	Japan	1.29	1.27	1.5	1.68	1.73	Japan	435.9	532.0	720.8	737.1	709.5
15	South Korea	1.44	1.03	0.91	1.07	1.29	South Korea	712.9	604.2	696.0	694.5	700.9
16	Thailand	0.37	0.64	0.51	0.75	1.28	Thailand	535.2	394.8	568.4	682.0	700.4
17	Malaysia	1.01	1.17	1.16	1.19	1.21	Malaysia	460.0	307.0	620.8	614.7	635.5
18	Hong Kong	0.68	0.68	0.68	0.74	0.88	Hong Kong	614.1	505.3	676.3	730.3	609.7
19	Indonesia	0.7	0.65	0.66	0.95	0.83	Indonesia	605.1	554.2	605.9	617.0	608.2
20	Brazil	0.64	0.53	0.72	0.7	0.77	Brazil	591.4	568.3	646.8	635.5	596.9
21	Others	11.86	11.71	12.69	13.56	12.84	Others	9 085.6	8 620.8	9 846.8	11 218.2	10 793.3

Source: FaoStat.

(20 000 hectares, for detailed structure see Table below). Vegetable production has over time grown in significance mainly as a result of cropped area expansion. Aggregate productivity levels have improved compared with those in 2000 (even more so when compared with the levels in the mid-1990s) but have been quite stable during the last six years.

Interviews with lead vegetable producing companies in Jordan confirmed the assumption that not all winter vegetables have good prospects for future development. Jordan is a big producer of tomatoes, cucumbers and potatoes. A recent study has shown that at current market conditions and prevailing farm gate prices both tomato and cucumber production in greenhouses (worse in open fields) is not profitable (while the potato shows positive profit margins). However, when applying farm-gate prices reported by the DoS, tomato and potato production is unprofitable, while the cucumber shows high margins of profit.

At best market prices, which are attainable only in high-value end markets, the return of all crops display profitability. Unfortunately, the local market is capable of guaranteeing this level of prices only for a limited spectrum and volume of vegetables that are traded through the high-niche distributors (retailed in urban elite supermarkets). This is explained by the fact that the local market is small-sized and lacks proper infrastructure, and that the local consumer is largely not in a position to afford the price premium for quality.

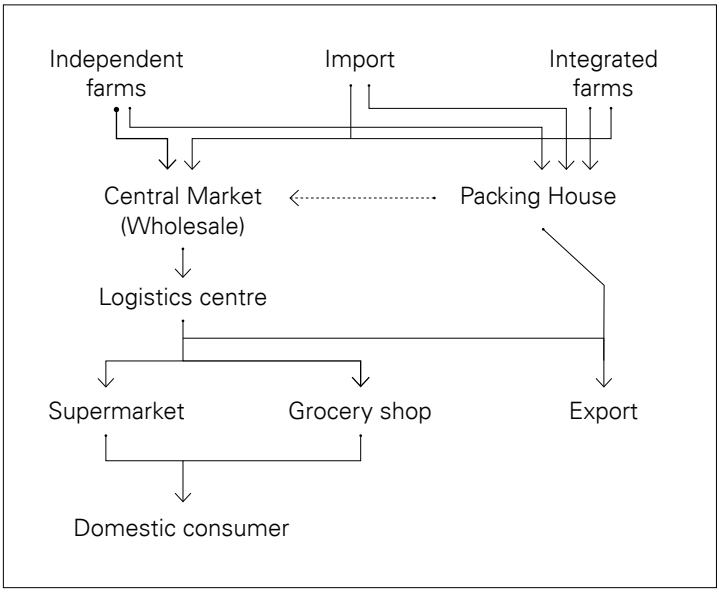
This analysis focuses on three vegetable crops produced in the JV, which — at current market and demand conditions — are considered by local producers as best options, allowing them to access export markets with the highest added value. Such crops are coloured bell peppers, cucumbers and cherry tomatoes. These three crops have in the recent years been successfully exported from the JV to Central and Eastern Europe.

Table 47: Area, average yield and production of vegetables in 2011 in the Jordan Valley

Crop	Total			Autumn			Summer		
	Area (dunum)	Average Yield (MT/dunum)	Production (MT)	Area (dunum)	Average Yield (MT/dunum)	Production (MT)	Area (dunum)	Average Yield (MT/dunum)	Production (MT)
Total	183 672			144 144			39 528		
Tomatoes	67 803	5.4	368 095	60 837	5.5	336 771	6 966	4.5	31 324
Squash	19 796	2.7	53 559	16 685	2.7	45 303	3 111	2.7	8 256
Eggplants	20 388	5	101 703	18 128	5	90 890	2 260	4.8	10 814
Cucumber	12 376	12.2	151 161	12 120	12.2	148 382	256	10.9	2 779
Potato	14 884	3.1	46 253	12 265	3.2	39 123	2 619	2.7	7 131
Cabbage	1 217	4.9	5 913	853	5.1	4 324	365	4.4	1 589
Cauliflower	2 119	3.4	7 255	1 803	3.4	6 153	316	3.5	1 102
Hot pepper	3 664	3	11 055	3 031	3.2	9 796	633	2	1 259
Sweet pepper	6 094	6.7	40 520	5 722	6.7	38 207	372	6.2	2 314
Others	35 331	2.6	90 626	12 700	2.2	28 316	22 632	2.8	62 310

Note: values in the table are averages for all cropping techniques used in the Jordan Valley.
Source: DoS.

Figure 7: Vegetables supply chain in Jordan



Source: Authors' compilation.

Production. The analysis on access, availability and costs of inputs; materials; and that of routine crop operations shows that these are in the norm (in line with international standards of vegetable growing, without particular bottlenecks/shortcomings) and are comparable among all producers in the JV. Special consideration is provided in other sections of this report to specific issues that are related to labour and access to land.

Out of the three selected crops, the production of cherry tomatoes — a relatively new crop for the country with an acreage that is still small — is quite costly. Due to higher labour costs during picking, the total production cost of cherry tomatoes is 0.53 JOD/kg (and may be even higher depending on post-harvest losses/waste). In the case of cucumbers and coloured bell peppers, which have more consolidated production practices among the JV producers, the average production costs are respectively: 0.19 JOD/kg and 0.49 JOD/kg. As shown in the detailed budget Table below, for all crops, labour and input materials represent the main production costs.

Table 48: Selected vegetables production budget

Primary production	Peppers (coloured)		Cucumbers		Cherry tomatoes	
Labour cost	0.19	JOD/kg	0.09	JOD/kg	0.3	JOD/kg
Plant prod. & protect. Inputs cost	0.17	JOD/kg	0.05	JOD/kg	0.13	JOD/kg
Management cost	0.03	JOD/kg	0.01	JOD/kg	0.02	JOD/kg
Water cost	0.002	JOD/kg	0.001	JOD/kg	0.001	JOD/kg
Other costs	0.03	JOD/kg	0.02	JOD/kg	0.02	JOD/kg
Investment depreciation and maintenance	0.06	JOD/kg	0.03	JOD/kg	0.06	JOD/kg
Total production costs	0.48	JOD/kg	0.19	JOD/kg	0.53	JOD/kg
Best market price (farm gate)	0.6	JOD/kg	0.25	JOD/kg	1	JOD/kg
Net profit of primary production segment	0.12	JOD/kg	0.06	JOD/kg	0.47	JOD/kg
Return on costs	26.1	%	32.5	%	89.9	%

Source: Authors' calculations based on industry data.

At current market conditions, the best performing crop in terms of profit and RoC is the cherry tomato. With a farm-gate price averaging 1 JOD/kg, a farmer can earn a net profit up to 0.47 JOD/kg with a RoC of almost 90 percent. Despite high returns, the reduced capacity to access demand (mainly towards high-end export markets and because of the small demand in the local markets) rank this crop as a low opportunity among JV producers.

Sweet peppers allow a net profit of 0.12 JOD/kg (26 percent RoC) to producers. The net profit of primary production of cucumbers is much lower — around 0.06 JOD/kg — but due to lower production costs, the RoC of this crop is a significant 32 percent.

According to producer and dealer reporting, vegetable production is a high-risk activity and subject to considerable price volatility. Our survey data in fact confirms that companies, involved in packing and trading, purchase from farmers ordinary tomatoes of comparable quality at prices ranging widely from 0.1–1 JOD/kg.

Domestic market. In Jordan, packaging is a value addition which is provided almost exclusively to vegetables directed at export markets. Vegetables that are marketed locally are handled through central markets, supermarkets and grocery shops in bulk. Only a small amount of vegetables (including cherry tomatoes) are packaged and sold through the (few) elite supermarkets.

Figure 8: Marketing of bulk and packed vegetables at supermarkets in Amman

Bulk produce

Packed produce (elite supermarket)

Source: Authors' photos.

Before being placed on supermarket and grocery shop shelves, the overwhelming amount of vegetables produced by Jordanian farmers and a significant part of imported vegetables transit through one of the three central markets of Jordan in: Amman, Irbid and Zarqa.

The following typical interaction scheme takes place among JV (and non) producers, dealers and retailers:

- The farmer entrusts his production directly to dealers at the farm-gate;
- The transaction takes place through a commission agreement. In fact, the dealer generally does not buy the produce from the farmer, he receives and markets the produce on behalf of the producer;

- The intermediation fee is on average 30 percent the value of the produces;
- Retailers buy agricultural products at the central markets at DAP (Delivered at Place) conditions;
- The delivery (transportation) is handled mainly by dealers or third service providers.

Table 49 shows the quantities of main vegetables traded through the Central Amman Market — the biggest central market in Jordan.

In 2011, over 173 thousand tonnes of tomatoes, 84 thousand tonnes of cucumbers and 18 thousand tonnes of sweet peppers, were traded through central markets (Table below).

As mentioned earlier, our calculations show that if sold through central markets, vegetables are largely unprofitable at the production segment level. In particular and based on the above interaction scheme, we made an attempt to estimate what would be the net profit to the production (farmers) and intermediation (dealers) of sweet peppers, cucumbers and cherry tomatoes.

Based on production costs, the intermediation fees mentioned earlier and on central market wholesale prices officially reported by the MoA, sweet pepper production often results unprofitable for farmers who can lose up to JOD 0.24 per kg of produce. Profitable, even if very close to the breakeven point is the production of cucumbers, where the farmer can expect to receive a net profit of 0.04 JOD/kg. The only produce that would show profitability is the cherry tomato. It should be noted though that official wholesale prices are not available for cherry tomatoes. The price we used in our analysis is the farm-gate purchase price reported by a few packing companies.

On the other hand, profits drawn by dealers are constantly positive as costs of intermediation are by far inferior to incomes recouped from the intermediation fee.

Table 49: Monthly trade of vegetables through Amman central market in 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total 2011
Tomato (MT)	7 454	8 270	9 128	10 146	12 262	11 437	11 930	8 719	9 661	11 380	8 034	7 620	116 043
Potato (MT)	7 898	6 614	5 942	7 185	8 822	7 985	9 243	7 569	9 453	9 435	7 668	8 948	96 762
Cucumber (MT)	3 398	3 262	4 209	5 772	6 622	6 318	6 707	5 971	5 640	5 451	3 919	4 227	61 496
Dried onion (MT)	3 838	4 964	4 339	5 463	3 799	4 154	4 291	3 649	4 862	4 586	4 019	4 550	52 515
White cauliflower (MT)	3 225	2 240	2 543	2 805	2 924	1 680	1 650	2 114	1 577	2 894	2 590	1 974	28 216
Squash (MT)	1 633	1 634	2 084	2 866	2 837	2 169	1 863	1 815	1 482	2 097	1 639	1 498	23 617
Cabbage (MT)	1 598	1 419	1 148	1 461	1 527	1 470	1 712	1 235	1 846	2 533	2 609	2 370	20 928
Eggplant (MT)	1 117	909	614	557	1 765	2 185	2 668	2 333	3 025	2 522	1 889	1 303	20 888
Carrot (MT)	1 502	1 066	1 178	1 300	1 531	1 263	1 435	1 292	1 007	1 296	997	1 465	15 332
Sweet pepper (MT)	795	824	861	1 251	1 480	959	1 228	1 230	1 475	1 611	1 248	812	13 774
Other recorded products (MT)	7 888	7 698	8 681	12 454	14 769	11 004	9 521	7 002	6 804	9 322	8 118	8 309	111 569
Total	40 345	38 899	40 727	51 262	58 339	50 625	52 248	42 929	46 832	53 127	42 731	43 075	561 139

Source: MoA.

Table 50: Selected vegetables traded through central markets in Jordan in 2011

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total 2011
Tomatoes (MT)	13 100	13 361	13 854	14 471	17 508	16 831	17 332	12 862	13 607	17 401	11 491	11 937	173 755
Amman	7 454	8 270	9 128	10 146	12 262	11 437	11 930	8 719	9 661	11 380	8 034	7 620	116 041
Irbid	4 958	4 409	4 242	3 928	4 799	4 730	4 517	3 479	3 396	5 068	2 996	3 955	50 477
Zarqa	688	682	484	397	447	664	885	664	550	953	461	362	7 237
Cucumbers (MT)	4 523	4 377	5 878	7 872	9 076	9 008	9 100	8 142	7 438	7 306	5 082	5 807	83 609
Amman	3 398	3 262	4 209	5 772	6 622	6 318	6 707	5 971	5 640	5 451	3 919	4 227	61 496
Irbid	963	945	1 427	1 858	2 179	2 421	2 140	1 912	1 624	1 623	997	1 404	19 493
Zarqa	162	170	242	242	275	269	253	259	174	232	166	176	2 620
Peppers (MT)	1 027	1 030	1 132	1 554	1 941	1 292	1 557	1 658	1 958	2 225	1 641	1 040	18 055
Amman	795	824	861	1 251	1 480	959	1 228	1 230	1 475	1 611	1 248	812	13 774
Irbid	174	159	216	253	387	265	263	362	415	539	350	199	3 582
Zarqa	58	47	55	50	74	68	66	66	68	75	43	29	699

Source: MoA.

Table 51: Intermediation of selected vegetables at central market and farmers profit

Central Market	Peppers (coloured)	Cucumbers	Cherry tomatoes
Production cost	0.48 JOD/kg	0.19 JOD/kg	0.4 JOD/kg
Intermediation fee	0.30 %	0.30 %	0.30 %
Price after intermediation	0.58 JOD/kg	0.29 JOD/kg	0.68 JOD/kg
Municipality tax	0.01 JOD/kg	0.01 JOD/kg	0.01 JOD/kg
Other (labour, rent of shop)	0.01 JOD/kg	0.01 JOD/kg	0.01 JOD/kg
Total intermediation cost	0.02 JOD/kg	0.02 JOD/kg	0.02 JOD/kg
Intermediation income	0.10 JOD/kg	0.10 JOD/kg	0.30 JOD/kg
Net profit of dealer	0.08 JOD/kg	0.08 JOD/kg	0.28 JOD/kg
Procurement price from dealer	0.34 JOD/kg	0.33 JOD/kg	1.00 JOD/kg
Commission to the farmer	0.24 JOD/kg	0.23 JOD/kg	0.70 JOD/kg
Net profit of farmer	-0.24 JOD/kg	0.04 JOD/kg	0.32 JOD/kg

Source: Authors' calculations based on industry data.

Central markets in Jordan do not impose restrictions of minimum quantity to be purchased; this makes them accessible also to final consumers of fruits and vegetables. Despite this fact, the main clients at central markets are retailers (supermarket and grocery shops).

The analysis confirms that the retail segment of the vegetable value chain in Jordan is also characterized by high margins. Randomly, in different supermarkets of the capital city, Amman, we collected information on consumer prices of selected products. For most of the produce (except cucumbers), consumer prices resulted significantly higher than official, wholesale prices reported by the MoA. It should be noted that in our approach, we did not perform a detailed analysis of marketing costs related to retail distribution chains (labour, real estate costs, losses of produce and other costs). Due to this, high margins should not necessarily be interpreted as high net profits for retailers.

Table 52: Retail of selected vegetables

Supermarket	Peppers (sweet)	Cucumbers	Cherry tomatoes
Procurement price from dealer	0.34 JOD/kg	0.33 JOD/kg	1.00 JOD/kg
Local transportation cost	0.05 JOD/kg	0.05 JOD/kg	0.05 JOD/kg
Other log costs	0.02 JOD/kg	0.02 JOD/kg	0.02 JOD/kg
Waste	0.03 JOD/kg	0.02 JOD/kg	0.15 JOD/kg
Packaging	0.00 JOD/kg	0.00 JOD/kg	0.30 JOD/kg
Marketing	0.05 JOD/kg	0.05 JOD/kg	0.05 JOD/kg
Packaging			0.30 JOD/kg
Total cost at supermarket	0.49 JOD/kg	0.47 JOD/kg	1.87 JOD/kg
Supermarket price	2.5 JOD/kg	0.49 JOD/kg	14.4 JOD/kg
Margins of marketing segment	2.01 JOD/kg	0.02 JOD/kg	12.53 JOD/kg

Source: Authors' calculation based on industry data.

Packaging. Few companies in Jordan are equipped with proper materials and sorting and packaging equipment. All of them are traders; though a small number have their own production sources and none are capable to fully load existing packaging capacity with their own production. Information collected confirms that more than 50 percent of the produce handled by a company is procured — mainly from farmer contractors.

Table 53: Packaging costs and returns

Packaging for exporting	Peppers (coloured)	Cucumbers	Cherry tomatoes
Packaging			
Farm gate price	0.6 JOD/kg	0.25 JOD/kg	1 JOD/kg
Packing materials cost	0.18 JOD/kg	0.18 JOD/kg	0.18 JOD/kg
Other costs	0.12 JOD/kg	0.12 JOD/kg	0.12 JOD/kg
Total processing and packing cost	0.3 JOD/kg	0.3 JOD/kg	0.3 JOD/kg
Pack house gate cost	0.9 JOD/kg	0.55 JOD/kg	1.3 JOD/kg
Av. market price (pack house gate)	0.9 JOD/kg	0.55 JOD/kg	1.3 JOD/kg
Net profit of packing segment	0 JOD/kg	0 JOD/kg	0 JOD/kg
Return on costs	0 %	0 %	0 %

Source: Authors' calculation based on industry data.

On average, a company spends around 0.3 JOD to pack 1 kg of produce (Table above). Around 60 percent of this cost is the cost of packaging materials, 20 percent is the cost of labour and the rest is shared between energy and overhead costs. Since packaging is done exclusively for export purposes, the accounting of net profit of the packaging segment at pack house gate prices is avoided.

Table 54: Exporting costs and returns to EU markets

	Peppers (coloured)		Cucumbers		Cherry tomatoes	
Exporting via plane						
Price pack house gate	0.9	JOD/kg	0.55	JOD/kg	1.3	JOD/kg
Local transportation cost	0.1	JOD/kg	0.1	JOD/kg	0.1	JOD/kg
Air freight cost	0.85	JOD/kg	0.85	JOD/kg	0.85	JOD/kg
Total CIF cost	1.85	JOD/kg	1.5	JOD/kg	2.25	JOD/kg
Total CIF price	1.7	JOD/kg	1.1	JOD/kg	2	JOD/kg
Net profit of exporting segment	-0.15	JOD/kg	-0.4	JOD/kg	-0.25	JOD/kg
Return on costs	-8.1	%	-26.7	%	-11.1	%
Exporting via sea (Haifa)						
Price pack house gate	0.9	JOD/kg	0.6	JOD/kg	1.3	JOD/kg
Local transportation cost	0.1	JOD/kg	0.1	JOD/kg	0.1	JOD/kg
Sea freight cost	0.35	JOD/kg	0.35	JOD/kg	0.35	JOD/kg
Total CIF cost	1.4	JOD/kg	1	JOD/kg	1.75	JOD/kg
Total CIF price	1.7	JOD/kg	1.1	JOD/kg	2	JOD/kg
Net profit of exporting segment	0.35	JOD/kg	0.1	JOD/kg	0.25	JOD/kg
Return on costs	25.9	%	10	%	14.3	%

Source: Authors' calculations based on industry data.

Foreign markets. In terms of value, vegetables contribute significantly to the export share of the country. According to the GTA in 2010–2012 vegetables accounted for over 6 percent of total exports and contributed annually to the national balance of payments with over USD 450 million (Table 55).

Table 55: Share of vegetables in total export from Jordan

Description	USD Million		
	2010	2011	2012
All commodity chapters	6 998.6	7 945.5	7 924.5
Including edible vegetables & certain roots & tubers	437.8	478.0	470.3
Including			
Tomatoes, fresh or chilled	231.4	224.3	249.8
Cucumbers and gherkins, fresh or chilled	86.6	121.1	83.0
Fruits of genus capsicum or pimento, fresh/chilled	30.2	33.3	35.8

Source: GTIS.

The top three crops leading the vegetable exports list are tomatoes, cucumbers and peppers. In 2010–2012 the three crops formed almost 80 percent of the total vegetable exports from Jordan.

Table 56: Destination of Jordan vegetables export

	2011	2012	2013 (01–07)
Tomatoes (MT)	434 829	418 517	275 326
Gulf Countries	420 661	414 082	274 743
Non Gulf Countries	14 168	4 435	583
Peppers (MT)	32 239	28 848	22 049
Gulf Countries	26 296	25 256	15 581
Non Gulf Countries	5 943	3 592	6 468
Cucumbers (MT)	147 864	104 744	30 296
Gulf Countries	131 344	83 975	28 526
Non Gulf Countries	16 520	20 769	1 770

Source: GTIS.

As shown in the Table above, the main destination of Jordan's vegetable exports are the Gulf countries, which have absorbed over the last three years, on average: 98 percent of the tomato, 74 percent of the sweet pepper and 85 percent of the cucumber exports of the country. By and large, such markets require lower standards, which also yield inferior prices. Non-Gulf Countries (mainly high-value European markets) have until now played a marginal role.

Unfortunately, official statistics do not show the share of vegetable and fruit exports coming from the JV. However, based on official export data from the MoA and DoS and on calculations done together with marketing specialists of the MoA, an assumed volume has been computed. Considering the clearly distinguished, seasonal production patterns of the Highlands and the JV, the specific share of the two regions in monthly exports can be separated with a reasonable approximation. The Chart below assumes that 100 percent of vegetables exported during January-March and November-December, and around 80 percent of vegetables exported during April-May and October, come from the JV (see Chart 19).

Chart 19: Share of the Jordan Valley and Upland in Jordan's export of vegetables

Source: Authors' calculations.

Table 57: Export of selected vegetables from the Jordan Valley and the Highlands

	2011	2012	2013
Tomatoes (MT)	434 829	418 517	275 326
from JV	312 083	284 087	181 535
From HL	122 746	134 430	93 791
Peppers (MT)	32 239	28 848	22 049
from JV	22 424	18 286	14 510
From HL	9 815	10 562	7 539
Cucumbers (MT)	147 864	104 744	30 296
from JV	132 413	90 488	23 657
From HL	15 451	14 256	6 639

Source: Authors' calculations based on GTIS Data.

If the above postulation is compared with available data from the GTA on monthly exports from Jordan, we can consequently compute the exports of selected vegetables, taking into account: 72 percent of exported tomatoes, 70 percent of exported bell peppers and 90 percent of exported cucumbers produced in the JV.

Prior to the Syrian conflict, fruits and vegetables exported from Jordan were transported by road through Syria and Turkey to Europe. The truck shipment cost used to be 6 000–7 000 USD (0.27–0.32 USD/kg) with a 6-day delivery time. Due to the current insecurity situation, the cost has escalated to 16 000–20 000 USD (0.73–0.91 USD/kg), while the delivery time exceeds 14 days. Alternatively, transiting cost through Iraq is 15 000–19 000 USD (0.68–0.86 USD/kg) but the delivery time is longer.

In the current situation, Jordan has two alternative channels that can be used to export its produce: air and sea freight. The cost of air transport of 1 kg of produce from the JV to any European destination ranges from JOD 0.8–0.85. High shipment costs are indeed compensated by a particularly short delivery time (1–2 days) but very few food produces can maintain competitiveness levels at these conditions.

Longer but undoubtedly less expensive is the second channel of export — the sea.

Table 58: Sea freight costs and delivery time (through Haifa port)

To	Port of Arrival	Duration (Days)	20 foot (22 tonnes)	40 foot (25 tonnes)
Germany	Hamburg	15	7 500	8 100
Ukraine	Odessa	8	6 800	7 300
RF	Pittsburgh	10	7 000	7 550
Romania	Costanza	6	6 500	7 050
UK	Felixstowe	12	7 200	7 650

Source: industry data.

Depending on the destination port, it takes from 6 to 15 days to deliver a container to Europe with a cost of up to 0.35 USD/kg. The cost of sea freight is not fixed and can change depending on seasonal demand. In addition, the via-Haifa channel is new to Jordanian export companies and yet to be codified on pure commercial grounds.[55] Until client-to-service provider relationships are well consolidated, the Jordanian exporter will suffer the syndrome imposed by an occasional rapport.

The analysis shows that at current market conditions none of the three selected vegetables can be profitably exported via air freight to Europe. Contrarily, the three crops have all shown positive margins if exported by sea.

Despite the fact that the gulf market is of lower value compared with the EU, due to proximity and consequently lower transportation costs and due to better market accessibility in this region, Gulf countries remain important trade partners for Jordanian vegetable exporters.

[55] Regular lines from Haifa to many European destinations are available even though Jordanian traders have low priority in accessing them.

Table 59: Exporting costs and returns to Gulf markets

	Peppers (coloured)	Cucumbers	Cherry tomatoes
Price pack house gate	0.9 JOD/kg	0.6 JOD/kg	1.3 JOD/kg
Local transportation cost	0.1 JOD/kg	0.1 JOD/kg	0.1 JOD/kg
Sea freight cost	0.1 JOD/kg	0.1 JOD/kg	0.1 JOD/kg
Total CIF cost	1.1 JOD/kg	0.8 JOD/kg	1.5 JOD/kg
Total CIF price	1.2 JOD/kg	1 JOD/kg	2 JOD/kg
Net profit of exporting segment	0.1 JOD/kg	0.2 JOD/kg	0.5 JOD/kg
Return on costs	9%	25%	33%

Source: Authors' calculations.

According to our calculations, the profit margins exporting to Gulf countries appear similar to those generated by exports to European markets. This is certainly the case when high-end Gulf markets are targeted, which seems to be a new niche that has potential for growth.

Water budget and productivity. The off-season production of vegetables in the JV carried out during winter is an undertaking that, especially through exports, generates a higher added value compared with that of the summer period, which is mainly produced in the Highlands.

Based on JVA data on irrigation water allocation for crop production and on information made available by producers and 'processors' of vegetables in the JV, an estimate can be made of the water cubic meter added value along the entire vegetable supply chain.

Irrigation water distribution in the JV is regulated by an allocation system of strict quotas. Quotas are specific per type of crops and period of the year. On average, around 180 m^3 of water are used to irrigate one greenhouse of 0.5 dunum during the whole production cycle of around 7 months.

Table 60: Allocation of water for vegetables

360	m^3/du/year
180	m^3/0.5 du/year

Source: Authors' calculations.

As per JVA rules, the allocation of water for all vegetables is the same, while irrigation scheduling is left to the farmer's decision (via the on farm reservoirs). On average, cucumbers, cherry tomatoes and sweet peppers yield 6, 8 and 7 tonnes per half dunum and use respectively: 30, 22.5 and 25.7 m^3 of water to produce 1 tonne of produce (see Table below).

Table 61: Yields of selected crops and water-use for their production

Crop	Yield tonne/0.5 du	Water-use m^3/tonne
Cucumber	6	30
Cherry tomato	8	22.5
Sweet Pepper	7	25.7

Produce marketed at central markets entail exclusive water consumption related to the shop's cleaning operations, as no processing occurs in this case. Data from Amman Central market indicate that a single shop of 75 m^2 consumes 0.04 m^3 of water per day and has a produce turnover of 5 tonnes. This results in a water usage per kg of product of 0.008 litres (which may be considered irrelevant). Cherry tomatoes produce the highest added value per m^3 of water — 0.59 JOD/litre. The high water productivity is in line with the high consumer price of the produce. Should more conservative calculations be considered, taking into account the likely post-harvest and marketing losses, water productivity would be halved to around 0.3–0.35 JOD/litre. The use of water is less productive for other crops: 0.005 JOD/litre for cucumbers and 0.07 JOD/litre for sweet pepper production.

Table 62: Water budget of vegetables at local marketing (through supermarkets)

	Cucumbers	Cherry Tomatoes	Sweet Peppers	
Water-use for production	30	22.5	25.7	litre/kg
Water-use for handling	0.008	0.008	0.008	litre/kg
Total water-use	30	22.5	25.7	litre/kg
Total profit from production, intermediation and retail	0.14	13.3	1.85	JOD/kg
Consumer price	0.49	14.4	2.5	JOD/kg
Gross value per litre of water	0.02	0.64	0.10	JOD/litre
Added value per litre of water	0.005	0.59	0.07	JOD/litre

Source: Authors' calculations.

A typical Jordanian packing house[56] with an annual processing capacity of 4 000 tonnes of fruits and vegetables (123 tonnes per day), the daily amount of water consumed for all of the packing operations is 50 m^3 (20 tonnes for cooling operations, 10 tonnes for sorting and 20 tonnes for the cleaning and maintenance of the plant). Therefore, an amount of 400 litres per tonne of product packed is consumed.

Table 63: Water budget of vegetables for export

	Cucumbers	Cherry Tomatoes	Sweet Peppers	
Water-use for production	30	22.5	25.7	litre/kg
Water-use for packing	0.4	0.4	0.4	litre /kg
Total water used for production and packing	30.4	22.9	26.1	litre /kg
Cumulated profits of production, packing and exporting segments	0.16	0.72	0.47	JOD/ litre
Export price	1.1	2	1.7	JOD/ litre
Added value per litre of water	0.005	0.031	0.018	JOD/ litre
Gross value per litre of water	0.036	0.087	0.065	JOD/ litre

Source: Authors' calculations.

[56] Information provided by industry operators.

The packaged produce are for export. The total added value generated by selected export vegetables per unit of water used along the chain is shown in the above Table (respectively, 0.005, 0.031 and 0.018 JOD/litre for cucumbers, cherry tomatoes and sweet peppers).

As a result, for instance, the water productivity of the entire coloured peppers chain (for the known volumes of export quantities and values) result to be in the range of 18 JOD/m^3 of water consumed.

Table 64: Actual water productivity of exported (high-end markets) coloured peppers from the JV.

	Export (thousand MT)	Water used (m^3)	Net value from export (JOD milion)	Water productivity per m^3 (JOD)
Peppers	4	93,960	1.7	18.01

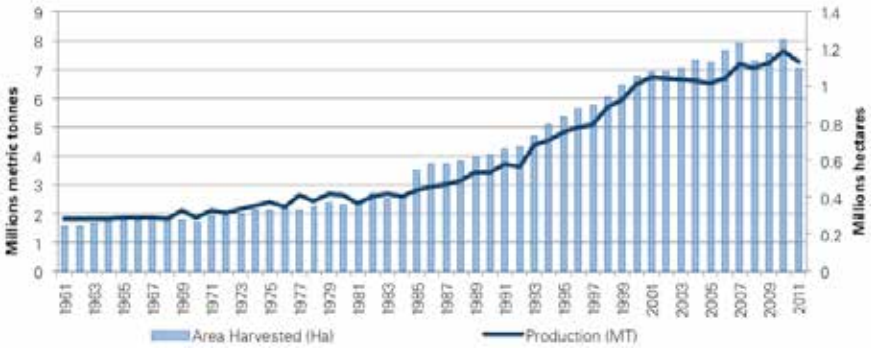
Source: Authors' calculations.

Dates

Global overview

Over the last four decades worldwide date production has significantly increased, from about 1.85 million tonnes in 1965 to over 7.3 million tonnes in 2011. Alongside with increased trends in production, the area harvested with dates expanded exponentially from around 0.2 million hectares in 1961 to around 1.1 million hectares in 2011 (see Chart 20). This would show an annual average production growth rate of 3 percent, while the actual expansion starts in the mid-1980s.

Chart 20: World production of dates and harvested area, 1961–2011

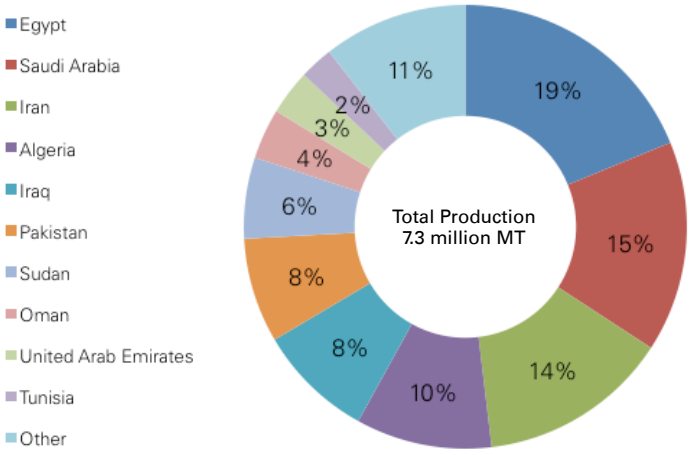


Source: FAOStat.

According to USAID, the Iraq-Iran conflict of the 1980s disrupted the worldwide date supply, creating shortages for the lucrative EU market and the fast growing Asian markets. In this context, the global market date price increased significantly, inducing producer countries in the region to allocate significant investments in date palm growing.

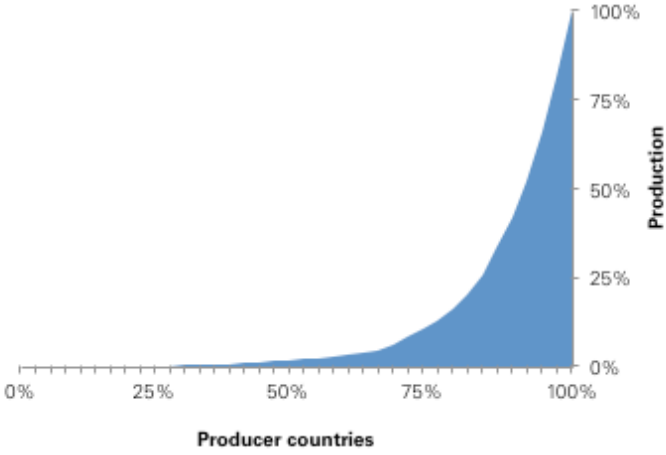
Few countries consistently rank among the top date producers in the world. Dates are produced in around 39 countries worldwide. In 2011, the top four producers (Egypt, Saudi Arabia, Iran and Algeria) provided 50 percent of the world date production, while the top 10 producer countries accounted for up to 73 percent of the world date production (see charts below). Jordan ranked 26th with its 11 213 tonnes of date production in 2011.

Chart 21: World top 10 date producers in 2011



Source: FAOStat.

Chart 22: Concentration of date production



Source: FAOStat.

In 2011, of the total quantity of dates produced globally, only 10 percent were traded internationally (see Table 65). Date exports have, however, steadily increased over the past twenty years.

Table 65: Main exporters of dates, 2007–2011

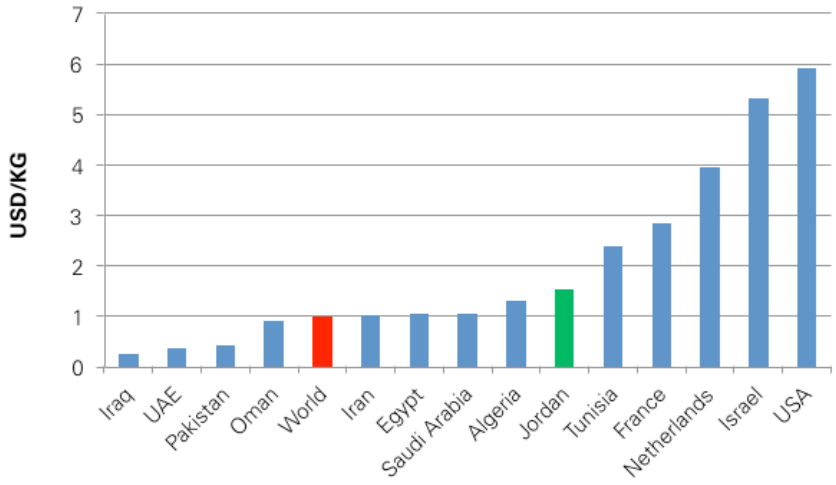
	Quantity (thousand MT)						Value (USD million)				
	2007	2008	2009	2010	2011		2007	2008	2009	2010	2011
World	687.1	906.6	598.8	660.1	710.4	World	588.9	686.1	571.3	775.6	902.2
Iraq	37.1	264.6	183.7	120.1	138.4	Tunisia	164.8	170.4	176.3	200.1	211.5
Pakistan	104.1	93.1	111.7	121.7	113.4	Iran	91	101.8	55.8	134	160.3
Iran	123.3	113.5	68.8	106.8	112	Saudi Arabia	40.5	56.5	1.7	78.1	86.3
Tunisia	68.9	69.5	77.3	84.3	86.9	Israel	52.6	50.8	59.2	63.4	85.9
Saudi Arabia	48.8	50.9	1.6	73.4	77.8	Pakistan	38.3	32.5	42.7	48.7	64.1
UAE	233.8	237.9	56.2	50.1	51.2	Iraq	9.5	59.5	46.9	35.9	46.9
Algeria	13.4	10.1	12	10.4	28.1	USA	18.9	21.2	22.3	25.3	33.4
Egypt	4.7	9	14.7	19.6	23.8	France	29.5	28.5	27.1	32.1	33.1
Israel	9.5	9.4	12.4	12.7	14.6	UAE	63.4	69.1	32.3	33.3	31
France	10.5	8	11.3	11.5	11.3	Egypt	3	7.3	17.5	18.5	28.2
Oman	9.4	7	7.3	6.8	7.2	Algeria	23.1	20	12	16.9	25.4
USA	3.3	3.4	3.8	4.4	5.6	Netherlands	7.9	7.5	9.3	9.8	12.5
Niger	1.8	1.1	1.1	6.7	5.4	Oman	5.7	6.5	5.9	7	9
Malaysia	0.9	1.9	2.9	4.3	3.9	Germany	10.2	12.3	7.6	7.1	8.8
Netherlands	1.8	1.6	2.2	2.8	3.4	Jordan	2.9	4.1	3.2	4.4	6.2
Jordan	2.8	3	1.9	2.6	3.2	South Africa	4.4	4.9	3.9	5.1	5.6

Source: FaoStat.

Historically, except for the period from 1991 to 2007, the indisputable leader of the global dates export market both in terms of volumes and value is Iraq. In 2011, the country exported over 138 thousand tonnes of dates worth over USD 211 million with an average unit price of 1 530 USD/tonne. In the same year, significant quantities were exported also from Pakistan, Iran, Tunisia and others. Jordan ranked 11th in terms of export quantity.

During 2007–2011, dates were exported at an average price of 0.99 USD/KG. As may be noted from the Chart below, the world's top five exporters of dates (except Tunisia), exported primarily low-price date varieties. The main exporters of premium quality dates are the United States and Israel (France and Netherlands are actually re-exporters). Jordan, with an average export price of 1 530 USD/tonne, ranked above the world average (see Chart 23).

Chart 23: Dates export prices, average 2007–2011



Source: FAOStat.

The lead importing countries are India followed by Morocco, Yemen, France and the United States (see Table 66).

Table 66: Main importers of dates, 2007–2011

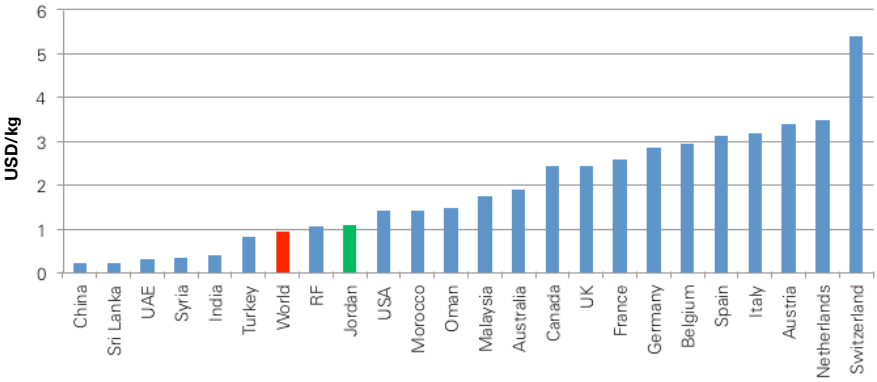
	Import Quantity (tonnes)						Import Value (USD thousand)				
	2007	2008	2009	2010	2011		2007	2008	2009	2010	2011
World	870.6	850.9	675.2	605.9	677.8	World	593.5	663.1	635.2	724.9	796.5
India	253.3	230.9	298.4	193.5	256.3	India	72.4	81.3	99.1	95	141.7
Morocco	50.5	41.1	50.5	51.4	33.1	Morocco	43.5	63.9	64.7	77.9	75.2
Yemen	21.3	25.2	23.9	23.9	30.4	France	66.7	67.5	63.2	72	69.2
France	27.4	24.9	24.1	28.2	25.9	UK	34.6	31	29.5	33.2	35.6
USA	8.6	6	15.8	11.8	21.4	Malaysia	21	19.9	27.1	36.1	34.4
China	3.8	7.7	4.4	7.9	20.3	Germany	29.8	32.3	30.4	27.4	34
Indonesia	15.5	13.9	16.4	17	20.1	USA	12.6	10	18.7	18.5	30.4
RF	22.4	22.4	16.2	20.8	19.8	RF	13.6	18	21.3	29.2	27.6
Niger	11	10.6	10.6	11.6	19	Canada	16.4	17.9	17.7	24.4	26.6
Malaysia	15.3	14.1	15.8	18	16.2	Italy	20.3	18.5	28.1	30.3	24.8
Turkey	13.1	12.3	10.4	13.2	15.4	Indonesia	12.1	13.8	16.3	18.1	20.5
UK	14.4	13	12.8	12.8	14	Spain	21.8	22	20.9	22.3	18.7
Pakistan	19.8	10.2	9.9	2.3	13.2	Netherlands	10.3	11	14.7	16.4	16.5
Germany	10.8	10.9	10.7	9.5	11.7	Australia	10.4	7.9	8.4	13.1	16.3
Jordan	8.5	9.9	9.8	8	9.6	Turkey	6.9	8.6	9.6	13.1	14.8

Canada	8.6	7.5	7.6	9.4	9.2	Yemen	8.9	11.7	11.2	11.2	14.1
Oman	2.2	6.2	11.7	11.5	8.9	Switzerland	10	11.6	10.2	10.3	13.2
Sri Lanka	0.4	5.8	5.5	6.2	8.4	Jordan	7.2	9.5	10.7	10.4	12.4
Italy	7.2	6.1	8.3	9	7.6	Lebanon	4.7	7	7.2	9.7	9.1
Lebanon	5.1	6	6.3	6.4	6.9	Belgium	9.7	9.8	7.6	6.5	8.4

Source: FaoStat.

India is the number one world date importer also in terms of total value, yet with an average import price of dates at 0.4 USD/kg, the country can be considered a low-value market — far below the world average (see Chart 24).

Chart 24: Date import prices, 2007–2011 average



Source: FaoStat.

On the other hand, the European market is particularly important in terms of value. The average import price of dates in the European countries is about three times higher than the average world import price. The USAID study indicates that Tunisia and Israel, despite producing less than 2 percent of the global date supply, are the top two exporters to the EU through high-quality and high-priced dates.

Jordan is also a large importer of dates. From 2007–2011, the country imported some 9.2 thousand tonnes of dates per year at an average price of 1.1 USD/kg (about 30 percent lower than the export price). It is important to notice that Jordan imports low-quality and low-value dates for domestic consumption, while best quality dates are mainly directed to export.

The dates export market has two main segments: dates consumed fresh and dates that are subject to further processing. The first segment mainly comprises dates of the highest quality, which is mainly retail packaged in Western markets. The second segment places on the market lower quality dates that are used as ingredients in bakery, confectionary and other products.

Iraq, Pakistan and Iran are currently capable of producing very large quantities of premium, industrial grade dates at a relatively low price. Jordan, with its costly and low-scale production has little to no room to compete internationally in this specific segment of the market.

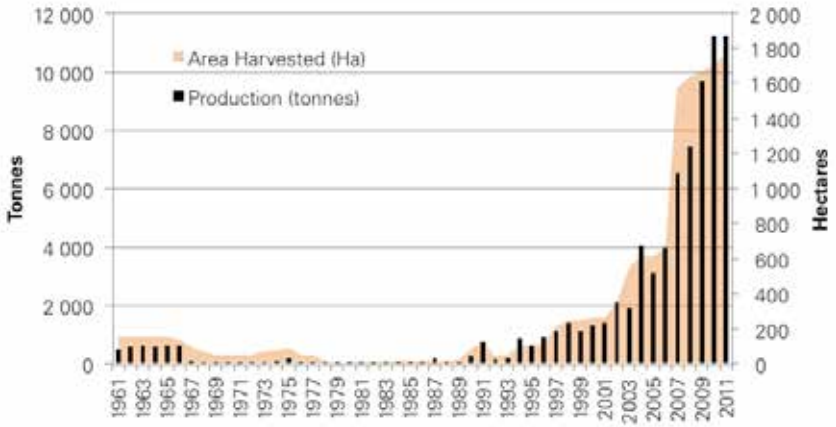
The United States (California), Tunisia, Algeria and Egypt mainly produce varieties suitable for the fresh market. Fresh-variety dates are table fruit and packed accordingly for retail sale. This segment includes also premium-quality dates (such as Medjool dates) that are mainly exported to European high-value markets.

Medjool dates represent an important niche share of the global dates market. According to market experts, around 22 thousand tonnes of Medjool dates are produced annually. Of this, 53 percent are produced by the United States (California) and 40 percent by Israel. The whole market of fresh dates and particularly premium quality dates, offers good opportunities for date producers — for Jordanian producers as well — especially in terms of expected returns.

Dates sector in Jordan: value chain analysis of Medjool dates

Sector overview. The date production activity in Jordan is relatively new. As can be seen from the historical data, until the mid-1990s, the area planted with date palms and date production was very low — almost inexistent during the 1970s and 1980s.

Chart 25: Production of dates and cultivated areas in Jordan, 1961–2011



Source: FAOStat.

Starting from 1994, the sector started its progressive expansion which is still continuing now (see Chart above). Along with the expansion, the sector also started undergoing concentration processes.

As outlined in the table below, the total date production area expanded to an area of 18.4 thousand dunums in 2012 (corresponding to 2.14 percent of the total country's fruit tree area), with an overall volume of production of 10.4 thousand tonnes. In terms of value of production, the gross output in 2012 is valued at JOD 16.6 million (around 1 600 JOD/ tonne of produce).

Table 67: Dates production, planted area, yields and trees availability in Jordan, 1994–2012

	1994	1999	2004	2005	2006	2007	2008	2009	2010	2011	2012
Area (thousand dunum)	1.1	2.5	6.1	6.1	6.6	15.7	16.4	16.7	17.1	17.7	18.4
Jordan Valley	754	1.3	4.3	5.0	5.3	8.7	9.4	9.7	10.1	10.7	n.a.
Total number of trees (thousand)	20.6	42.7	93.2	93.2	98.7	250.6	259.2	264.4	269.5	285.6	297.1
Number of bearing trees (thousand)	14.9	28.6	66.0	65.6	69.4	139.7	149.6	190.5	232.6	234.0	220.1
Number of non-bearing trees (thousand)	5.7	14.1	27.2	27.6	29.3	110.9	109.6	73.9	36.9	51.6	77.0
Share of non-bearing trees (thousand)	28%	33%	29%	30%	30%	44%	42%	28%	14%	18%	26%
Production (thousand MT)	0.9	1.1	4.1	3.1	4.0	6.5	7.4	9.7	11.2	11.2	10.4
Yield per bearing tree (kg/tree)	60.1	38.6	61.7	47.5	57.2	46.8	49.7	50.8	48.3	47.9	47.3
Trees per dunum	19.0	17.0	15.2	15.2	15.0	15.9	15.8	15.9	15.8	16.1	16.1

Source: DoS.

In 2012, the total number of date palms reached almost 300 thousand trees (26 percent non-bearing).

Almost 68 percent of the date palm production is in the JV (2011), given its optimal agro-climatic conditions. The JV is in fact liable for a further increase in production share of dates as 83 percent of the non-bearing date palms are located there.

Even though date palms can withstand long periods of drought under high temperatures, irrigation water is required for high yield and high-quality fruit. Thus, date palm plantations are an irrigated undertaking of the JV (see Table below).

Table 68: Census of date palms, 2007

Number of trees (thousand)			Area (thousand dunum)		
Non-irrigated	Irrigated	Total	Non-irrigated	Irrigated	Total
0	250 576	250 576	0	15 727	15 727

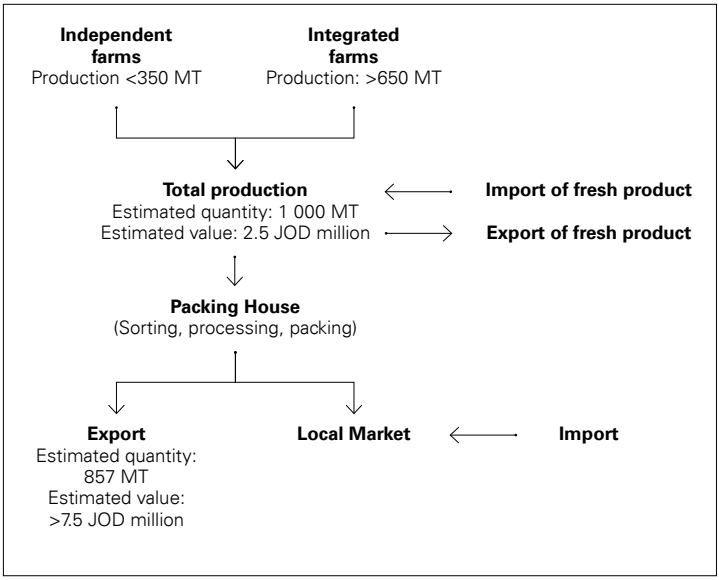
Source: DoS.

A typical advantage of date palms is that this tree can withstand saline water with higher levels of total dissolved solids (TDS) content (up to 1 500–1 700 ppm) before yield is effectively affected. Thus, the plantations make best use of the low-quality irrigation water from the middle of the valley and can also withstand the use of brackish well water, which is often used for supplementary irrigation when the JVA system distributes water below the foreseen allocation to farm units.

Date bearing palms start their economic production at 5–6 years of age and reach full production after the 10th year. Therefore during the first 5 years of cultivation, there is a negative RoC that is balanced progressively over the years. The financial losses the company incurs during the first five years can be accounted as operational losses, or otherwise, can be allocated as investments and depreciated throughout the years (estimated at around 50 years of productive life).

According to the information provided by date sector operators, the Medjool date palm has become very popular in Jordan over the past decade and its plantations have expanded exponentially. There are no official national statistics which specifically regard the variety. According to our estimates, around 10 percent of dates currently produced in Jordan are of the Medjool variety. This is of considerable importance for the sector as the Medjool represents the main variety for export with the highest added value.

Figure 9: Schematic description of Medjool dates supply chain in Jordan, 2012



Source: Authors' analysis.

Medjool dates production. In 2012, over 650 tonnes of Medjool dates were produced in integrated farms (farms owned by companies with their own packing houses). The remainder was produced by independent farms and sold at a market farm gate price of at least 2.5 JOD/kg.

Table 69: Medjool dates primary production budget, 2012

Labour cost	0.20	JOD /kg
Plant production & protection inputs cost	0.26	JOD /kg
Machinery cost	0.05	JOD /kg
Management cost	0.20	JOD /kg
Other costs	0.14	JOD /kg
Investment related costs	0.18	JOD /kg
Total production costs	1.02	JOD /kg
Market price (farm gate)	2.50	JOD /kg
Net profit of primary production segment	1.48	JOD/kg
Return on costs	144.1	%

Source: Authors' calculations based on industry data.

As can be seen from the Table above, the total production costs for 1 kg of dates amounts to 1.02 JOD/kg — far below the farm gate market price of Medjool date (see Table above).

Further investment in this segment will regard an accelerated expansion of the growing area (with a mechanization of the harvesting operations — hydraulic lifts).

Processing and packing. Harvested at or near to maturity, fresh or semi-dried dates are sold in bulk directly to local markets or are packed and exported. Almost 100 percent of the Medjool dates in 2012 went to processing and packaging.

The processing and packaging phase in Jordan is mostly integrated in a closed, production-for-export system. The Medjool date packhouses are owned by large, Medjool date exporters, who also own the plantations. Such Medjool exporters are also, typically the main (if not the only) buyers of farm-picked Medjool dates in Jordan.

Packhouses use a grading standard for Medjool dates, classifying them in four grades based on fruit size and defect exempt: jumbo (approximately 23–27 grams), large (approximately 18–22 grams), medium (approximately 13–17 grams) and small (less than 12 grams), which are all considered 1st class. The 2nd class dates, on the other hand, are an unclassified collection, containing a mix

of all sizes. Current packhouse gate prices per kilo of 1st class Medjools range from 3 JOD/kg to 7 JOD/kg (small to jumbo). After grading, dates are packed in carton and plastic boxes, mainly of a size ranging from 0.5–1 kg.

Table 70: Dates processing and packing budget, 2012

Average cost of dates (farm gate)	2.50	JOD/kg
Operational costs	0.20	JOD /kg
Packing materials cost	0.50	JOD /kg
Other costs	0.25	JOD /kg
Total Processing and packing cost	0.95	JOD/kg
Packhouse gate cost	3.45	JOD/kg
Average market price of dates (packhouse gate)	5.00	JOD/kg
Net profit of primary production segment	1.55	JOD/kg
Return on costs	44.9	%

Source: Authors' calculations based on industry data.

At the processing and packaging stage, the total costs per kg of dates amount to around JOD 0.95, mainly due to packaging materials (see Table above). Added to the farm gate price of dates at 2.50 JOD/kg, the total cost of packed Medjool dates at the packhouse gate reaches 3.45 JOD/kg. We estimate that with a packhouse gate market price of 5.0 JOD/kg, the processing and packing segment can generate RoC equal to about 45 percent.

Investment areas of this segment mainly regard the expansion of packing capacity (likely automated) in line and at the pace of production increases and in energy saving technology (solar power).

Markets. Regarding marketing costs, the costs for 1 kg of dates at supermarkets in the local market reach 5.50 JOD/kg with a revenue on costs of 41.8 percent at a supermarket price of 7.80 JOD/kg.

Table 71: Dates marketing budget for local market, 2012

Average cost of dates (packhouse gate)	5.00	JOD/kg
Marketing price	0.50	JOD/kg
Total cost of dates at the supermaket	5.50	JOD/kg
Supermarket price of finest dates	7.80	JOD/kg
Net profit of primary production segment	2.30	JOD/kg
Return on costs	41.8	%

Source: Authors' calculation based on industry data.

The export of Medjool dates, especially in terms of value, is significant. From an estimated production of 1 000 tonnes, the estimated exported quantity accounted for 857 tonnes in 2012. According to our estimates the total value of Medjool dates from Jordan can amount to over JOD 6 million.[57] Currently, three large processing and packaging companies control over 70 percent of the share of total exports.

Table 72: Date marketing budget for export markets, 2012

	Exporting via aeroplane	Exporting via sea (Haifa)	
Average cost of dates (packhouse gate)	5.00	5.00	JOD/kg
Local transportation cost	0.10	0.10	JOD/kg
Freight cost	1.50	0.35	JOD/kg
Total CIF cost of dates	6.60	5.45	JOD/kg
CIF price	7.50	7.50	JOD/kg
Net profit of primary production segment	0.90	2.05	JOD/kg
Return on costs	13.6	37.6	%

Source: Authors' calculations based on industry data.

[57] For the sake of a theoretical projection, by extending the cropping area under Medjool dates to 6 percent of the overall cropped area in the JV (i.e. to around 20 000 dunums) this would increase date production to over 15 thousand tonnes, worth JOD 120 million in terms of export value.

The export market has different costs depending on shipping means: exporting by air entails a total CIF of 6.60 JOD/kg of dates, while by sea the cost totals to 5.45 JOD/kg. The returns are respectively, 13.6 percent and 37.6 percent at a CIF price of 7.50 JOD/kg (Table 72).

While not analysed in depth by this study, it should be mentioned that other date varieties can also be profitably produced in Jordan. According to industry data procured during our survey, Barhi variety dates show good prospects for future development. Unlike Medjool, Barhi has lower production costs (the producer spends less than 0.7 JOD to produce 1 kg of Barhi dates) and has a larger market, which includes the domestic market.

The internal demand of dates in Jordan exceeds by far the domestic supply. The market of the country is flooded by dates from neighbouring countries that competitively produce dates at a much larger scale than Jordan. Based also on earlier research conducted,[58] we however assume that Jordanian producers have acquired the capacity to compete in the local as well as in the international markets.

In 2012, the amount of imported dates amounted to 10.85 thousand tonnes, worth USD 17.55 million (Table 73). In the same year, the export of dates (of all types) amounted to 2.7 thousand tonnes worth USD 5.54 million.

[58] FAO/World Bank Study: Irrigation Water Pricing for the Jordan Valley, 2012.

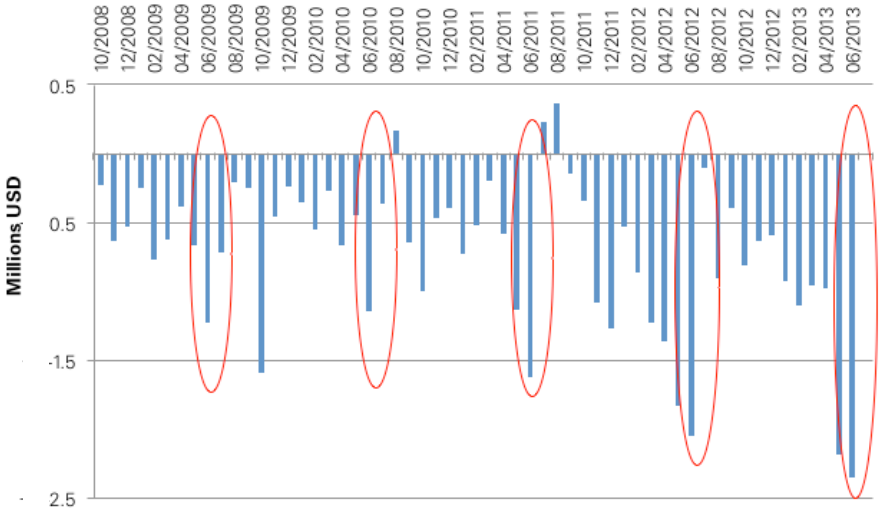
Table 73: Dates foreign trade in Jordan, 2000–2012

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Import													
Quantity (thousand MT)	4.25	3.45	7.06	7.71	9.56	9.56	10.7	8.53	9.93	9.75	8.05	9.61	10.85
Value (USD million)	4.22	2.84	3.68	4.77	5.79	6.37	7.71	7.2	9.49	10.84	10.36	12.33	17.55
Price (USD thousand/MT)	0.99	0.82	0.52	0.62	0.61	0.67	0.72	0.84	0.96	1.11	1.29	1.28	1.62
Export													
Quantity (thousand MT)	0.63	0.72	1.45	1.84	2.36	2.29	2.21	2.81	3.01	1.94	2.59	3.23	2.7
Value (USD million)	0.44	0.47	0.77	1.09	1.75	2.15	3.63	2.91	4.06	3.15	4.37	6.15	5.54
Price (USD thousand/MT)	0.7	0.65	0.53	0.59	0.74	0.94	1.64	1.04	1.35	1.63	1.68	1.9	2.05
Trade balance (thousand MT)	-3.62	-2.73	-5.61	-5.87	-7.2	-7.27	-8.49	-5.73	-6.92	-7.82	-5.45	-6.38	-8.15
Trade balance (USD million)	-3.77	-2.37	-2.91	-3.68	-4.04	-4.22	-4.08	-4.29	-5.43	-7.68	-5.99	-6.18	-12.01

Source: GTA.

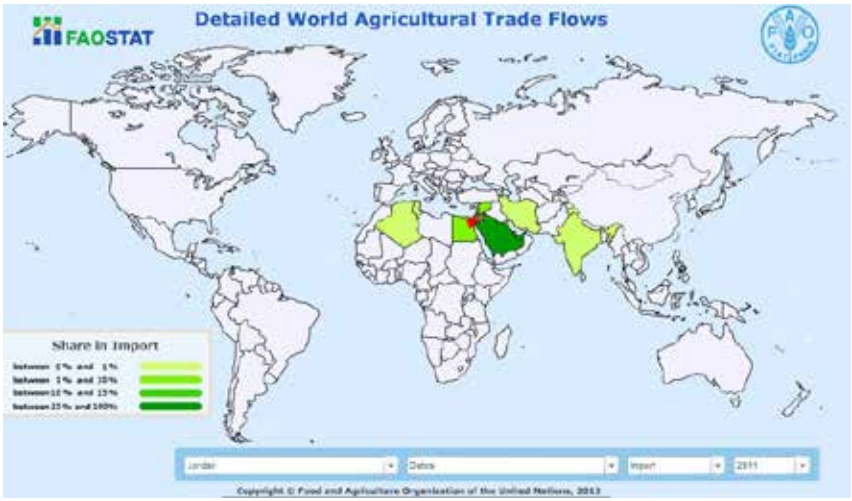
The trade balance of dates, in 2012, was JOD -8.15 million (equivalent to USD -12.01 million). The deficit in the dates trade balance is particularly evident during certain periods of the year, starting a month before Ramadan when dates are high in demand (see Chart below).

Chart 26: Monthly trade balance of dates



Source: GTA.

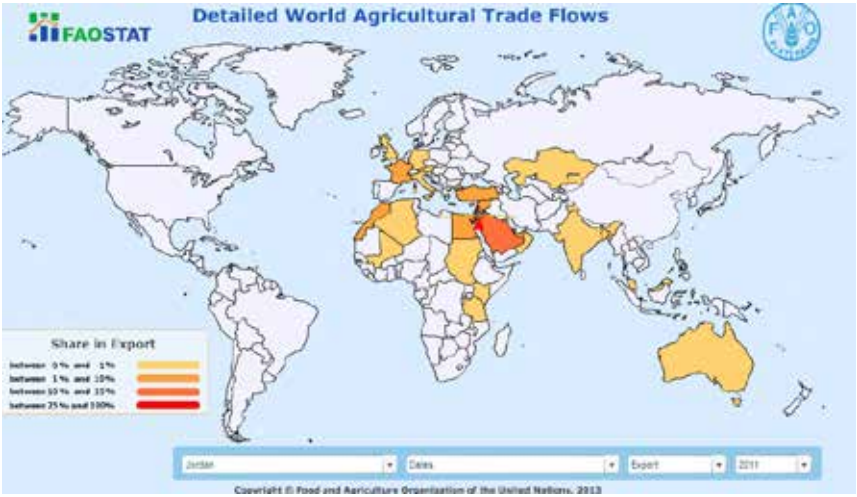
Figure 10: Main origin of Jordanian dates import in 2011



Source: FAOStat.

Export destinations for Jordanian dates are primarily sought in the neighbouring Arab countries, in European markets and in some far eastern markets. According to the GTA, dates were exported at an average price of 2.05 JOD/kg as compared with the import price of 1.6 JOD/kg.

Figure 11: Main destinations of Jordanian dates export in 2011



Source: FAOStat.

Water budget and productivity. Based on 50-year average output data for first class Medjool dates and on current JV water allocations (see Table below), the estimated water consumption per tonne of dates produced is 72.51 m^3.

Table 74: Water-use in primary dates production

Water allocation per year (same as vegetables)	180	m^3/dunum/year
Output 1st class Medjool	2.48	tonne/du
Water consumption	72.51	m^3/tonne (litre/kg)

Source: Authors' calculations.

At the packing house level, the water consumption per kg of packed dates, owing to packaging operations, amounts to around 6 litres.

Assuming that the packed produce will be traded locally through supermarkets and considering that 78.5 m^3 of water are required per each tonne of packed product, the overall water productivity compared with the added value the whole supply chain generates JOD 67.8. If the produce is exported by sea or by air, the water productivity corresponds respectively to JOD 64.7/m^3 and JOD 50/m^3.

Table 75: Water budget at the marketing level

	Export via sea	Export via air	Local	
Net profit of whole supply chain	5.08	3.93	5.33	JOD/kg
Return on costs	209.4	109.8	215.3	%
Total water used in production			72.5	m^3/MT
Total water used in packing			6	m^3/MT
Total water used to produce 1 MT of dates (ready to consume)			78.5	m^3/MT
Net productivity per 1 m^3 of water	64.7	50.0	67.8	JOD/m^3

Source: Authors' calculations.

CONCLUDING REMARKS AND RECOMMENDATIONS

Concluding remarks on selected food chain analysis

Poultry meat

The prospects of the poultry meat industry are by and large positive. The continued increase in domestic consumption is a positive sign for the sector, which is likely to experience in the upcoming years a further demand driven expansion. Population in Jordan has increased over the last decades at an average rate of 2.3 percent annually. The per capita consumption of poultry meat, driven by increasing income and changes in consumer preferences, has also shown increasing trends. Over the last decade, it increased by an average of 4 percent per year. If this trend continues, the country could expect an increase of domestic poultry meat consumption of up to 345 thousand tonnes by 2020. Moreover, current export levels to preferential regional markets are also likely to grow, together with an increased supply for the domestic market.

Modern, vertically-integrated production systems have the highest profitability rates and are more sustainable. The chain is overall profitable and quite balanced along its key segments. Each segment of the chain, at the market price of its specific output, is profitable (Chart 27).

Chart 27: Profit and production cost distribution along the chicken meat production chain

Source: Authors' calculations based on industry data.

At the same time, the prospects of the industry pose serious issues, which refer to an important 35 percent of the industry share. This is the case of broiler farms that are implementing old farming technologies. Their productivity level is extremely low and their margins of profit are often negative. Production systems, even those that use modern and up-to-date technology but are not integrated, have limited profitability and often incur losses (production efficiency comparison between integrated and non-integrated farms available in Table 76).

Table 76: Production efficiency comparison — integrated vs. non-integrated production systems (scenario analysis without distribution of margins along the chain)

	Fully-integrated, highly efficient production	Not-integrated, low efficient production	
Hatching egg cost	0.25		JOD/egg
Hatchability	84		%
Raising cost of 1 day chick	0.03		JOD/egg
Total production cost of 1 day chick	0.33	0.45	JOD/1 day chick
Livability	93	80	%
Cost of 1 day chick per broiler	0.36	0.56	JOD/broiler
Feed price	420	450	JOD/MT
Feed conversion rate	1.5	1.67	feed/meat
Expected weight of a broiler	1.5	1.8	kg/broiler
Cost of feed per broiler	0.95	1.35	JOD/broiler
Farm operational costs per broiler	0.21	0.58	JOD/broiler
Total production cost of broiler	1.85	2.95	JOD/broiler
Slaughtering and packing cost per broiler	0.17	0.17	JOD/broiler
Total cost of a processed broiler	2.02	3.12	JOD/broiler
Expected weight of a broiler	1.5	1.8	kg/broiler
Output of meat per broiler	78	80	%
Total production cost of chicken meat	1.72	2.16	JOD/kg
Logistics and marketing cost	0.03	0.03	
Total cost of chicken meat production and distribution	1.75	2.19	JOD/kg
Consumer price of chicken meat	2.37	2.37	JOD/kg
Net profit	0.62	0.18	JOD/kg
Profitability level	35.4	8.1	%

Source: Authors' calculations based on industry data.

The most dominant problems facing the non-integrated poultry meat production system in Jordan are the following: the high cost of feed; technological and organizational deficiencies that, among other aspects, impede proper disease management and significantly lower livability; high transport costs and an inefficient marketing system (that is over-skewed on the side of the middlemen/commission agents' segment of the chain). These encompass those systems defined as small (old farms) and medium farms and include, for the latter, even those that may have invested in modernization (thus those considered new farms) but have not stretched out the investment to complete the virtualization of the production cycle.

International water efficiency benchmarks show that Jordan has achieved remarkable levels of water-use efficiency, especially in the slaughtering segment of the supply chain. High efficiency levels are not extended to all companies operating in the sector. The sector has strong internal discrepancies as water-use efficiency changes dramatically from farm-to-farm and from slaughter house-to-slaughter house. Our analysis shows that fully-integrated and highly efficient systems manage to consume half the water (6.86 litre/kg of produced meat) consumed by non-integrated and less efficient market players (12.9 litre/kg of produced meat). Investments in modernizing and up-scaling the sector will definitely have a strong positive impact on water-use efficiency and the water productivity of the sector. Regarding water productivity, the average value of the entire chain — including all players at all segments — is currently and at present mixed technological conditions, low at about 25 JOD/m^3 consumed. Our analysis indicates that best performers at present are able to generate a water productivity of about 90 JOD/m^3. Conversely, the worst performers of the industry have a water productivity around 14 JOD/m^3.

Table 77: Poultry chain water-use and average water productivity in the sector

	Heads (million)	Water-use (litre/ head)	Total water used (m^3)
Live broilers production	194.0		1 143 136
Integrated	116.4	4.4	509 519
Other	77.6	8.2	633 618
Carcass production — slaughtering	194.0		2 343 520
Industrial	116.4	6.8	791 520
Other (traditional butchers)	77.6	20*	1 552 000
Total water used			3 486 656
Meat produced (MT)			200 000
Water-use (m^3/MT of meat)			17
Total net profit (60% integrated and 40% non-integrated), JOD			88 800 000
Water productivity per m^3, JOD			25
*Estimation			

Source: Authors' calculations.

Fruit and vegetables

The JV is the actual agribusiness centre of the country but its prospects will remain dim unless targeted and concerted investment is made soon. The prevailing primary production activities in the JV are by and large unprofitable with few and discrete exceptions. At current prevailing price levels, very few production systems generate positive net returns, i.e. bananas, melons grown under greenhouse conditions and dates. The case of the banana is, however, distorted and unsustainable as long as protection tariffs on imported produce that enters Jordan continue. Open field potatoes and drip irrigated citrus provide positive although marginal benefits. By applying DoS average farm gate prices, only tomatoes and cucumbers produced under greenhouse conditions and drip-irrigated citrus provide interesting results. Other than in such cases, losses (even heavy) occur, as is witnessed by the majority of the producers in the JRV.

As shown by this analysis, positive economic returns along the chain are, however, noted at the packaging, trading and retailing segments. This is evident for all produce traded in the broader domestic market, as well as (and with even higher gains) in the domestic, high-end outlets (elite supermarkets) and in the case of export. Nevertheless, the gains of these segments do not or seldom have a fall-back effect at the isolated primary production level. The situation may change in the future. The domestic market in Jordan, especially for high-quality products, is expected to grow driven by the increasing population and per capita incomes.

The past two to three consecutive years of economic losses have worsened the indebtedness status of the majority of the farmers. Should present conditions and prevailing fragmented production systems be further maintained, the JRV and its producers are condemned to a likely failure in the near future. In all cases, the failure of the primary sector would have severe repercussions along the entire chain and would also impede any growth of the agribusiness industry.

The only instance of actual profitability regarding the entire chain, occurs when production and trade are integrated within a coordinated agribusiness undertaking and, of course, when this targets high-value products for high-end domestic and export markets. Unfortunately, for the time being, only a small portion of the JV F&V output (ranging annually around 30 000–40 000 tonnes) ends up displayed in the high-value markets. An upgrading is certainly feasible, as is evident by comparing with the West Bank's agribusiness economic indicators on the other side of the JV. In the West Bank, only 33 000 dunums (equal to only 16.5 percent of the vegetable area of the Jordanian JRV) are cropped, producing a gross output estimated at USD 150 million annually. This corresponds to one-third of the estimated annual gross output of Jordanian JRV vegetables should the average export price be applied to its entire physical vegetable output (thus totalling some USD 450 million). This is only because Israeli products have more value added and are of a type that enables them to be directed to high-value markets.

At the primary production level, a paradigm shift is thus required targeting more and more, and eventually in an exclusive manner, high-end, market-demanded produces (including organic food).

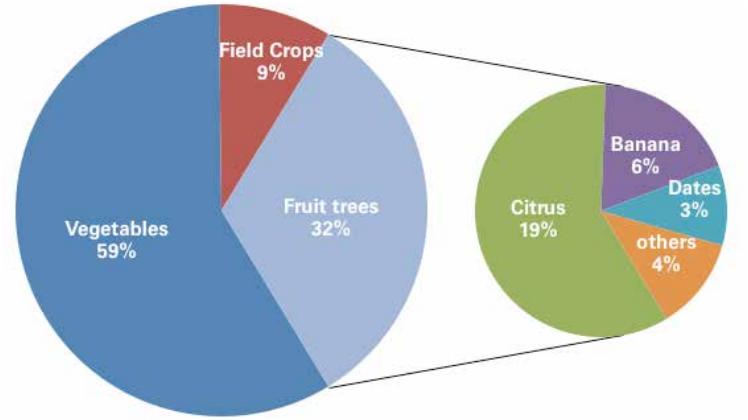
The current cultivated area in the JV (2012) amounts to about 339 000 dunums.

Table 78: Cropping pattern of the JV (dunum)

Crops	2005	2006	2007	2008	2009	2010	2011	2012
Vegetables	156 420	180 141	187 967	207 141	188,64	196 946	183 672	200 313
Field Crops	36 395	31 440	29 195	33 451	30,47	33 337	21 315	30 416
Fruit Trees	93 825	95 688	100 510	102 386	104 594	106 592	109 052	111 625
of which:								
Citrus	6 838	65 298	65 195	65 274	65 620	65 849	65 989	66 137
Banana	12 637	14 265	15 325	16 242	17 344	18 434	19 617	20 811
Dates	4 949	5 361	8 749	9 395	9 703	10 101	10 712	11 416
others	11 401	10 764	11 241	11 476	11 927	12 208	12 734	13 258
Total JRV:								
Area	285 727	307 269	309 845	342 978	342 978	336 875	314 039	342 354
Planted	286 640	307 269	317 671	342 978	323 704	336 875	314 039	342 354
Irrigated	282 827	304 740	304 968	338 533	338 533	333 630	311 581	339 237
Not-irrigated	2 900	2 529	4 877	4 444	4 444	3 245	2 457	3 117

Source: Jordan Department of Statistics.

Chart 28: Share of representative crops in the Jordan Valley, 2012



Source: DoS.

A trend analysis shows that:

- Vegetable crops form the backbone of the JV cropping activities but expansion beyond 200 000 dunums appears unlikely and would only be possible (to a limited extent) if market or policy shocks occur to other crops (e.g. removal of banana import tariffs);
- Citrus cropping maintains a stable area share of around 65 000 dunums; further expansion is limited by JVA water policies and by unsuitable conditions elsewhere to the crop's current preferred areas (i.e. bad water quality in the middle of the valley and agro-ecological constraints in the southern part of the valley);
- Banana cropping holds a strong position around 16–17 000 dunums of cropped area, in line with its (artificial) competitive advantage (imposed tariffs on imported bananas);
- Date palm is the only crop which has had a relatively remarkable area expansion; further upscaling of the crop is likely but is slowed down by the high, on-farm and off-farm (marketing infrastructure) investments that are required.

Recent calculations have been made[59] to project the economics of the prevailing production systems to the entire JRV, based on their respective assumed frequency and proportion. Two scenarios are drawn using: a) current (DoS) market prices and b) best market prices.

Table 79: JRV economics at current market prices

	Vegetables OF	Vegetables GH	Vegetables mix (OF & GH)	Dates open field	Citrus (surface)	Citrus (drip)	Banana
Planted area, du	85 449	30 303	28 938	8 190	24 570	24 570	16 380
Analysis of financial performance on planted area							
	+	+	+	+	+	+	+
Revenue, JOD/du of planted area	144 750 606	95 353 440	51 914 772	29 213 150	13 267 800	22 604 400	35 912 250
Total costs, JOD/du of planted area	163 275 949	94 290 815	68 753 794	26 172 783	16 139 902	21 100 102	21 549 119
Net revenue, JOD/du of planted area	-18 525 343	1 062 625	-16 839 022	3 040 367	-2 869 102	1 504 298	13 463 132
Net revenue	11%	1%	-24%	12%	-18%	7%	62%
Summary financial performance on total planted area							
Total revenue, JOD		392 116 418					
Total costs, JOD		411 279 523					
Net returns, JOD		-19 163 105					
Net returns		-4.7%					

Note: Open field (OF) and greenhouse (GH).

Source: FAO. 2012. The Jordan Valley's agro-economic perspectives: a way forward. Discussion paper. Rome.

[59] FAO. 2012. The Jordan Valley's agro-economic perspectives: a way forward. Discussion paper. Rome.

Table 80: JRV economics at best market prices

	Vegetables OF	Vegetables GH	Vegetables mix (OF & GH)	Dates open field	Citrus (surface)	Citrus (drip)	Banana
Planted area, du	85 449	30 303	28 938	8 196	24 570	24 570	16 380
Analysis of financial performance on planted area							
Revenue, JOD/du of planted area	161 970 071	109 359 770	167 505 139	71 602 509	28 571 225	57 142 449	35 912 250
Total costs, JOD/du of planted area	163 275 949	94 290 815	68 753 794	26 172 783	16 136 962	21 100 102	21 549 119
Net revenue, JOD/du of planted area	16 694 122	75 068 955	38 751 345	45 489 717	12 434 263	36 042 347	13 463 132
Net revenue, %	11%	83%	56%	174%	77%	171%	62%
Summary financial performance on total planted area							
Total revenue, JOD		691 223 404					
Total costs, JOD		411 279 523					
Net returns, JOD		**239 943 880**					
Net returns, %		**58.3%**					

Note: Open field (OF) and greenhouse (GH).

Source: FAO. 2012. The Jordan Valley's agro-economic perspectives: a way forward. Discussion paper. Rome.

In terms of area, only that which has been or is being organized under the WUA system is considered (273 000 dunums). In the first case, the JV would suffer losses in the order of -19 million JOD/year. Otherwise, should producers be able to fetch best market prices and conditions, the consolidated gain would be about +240 million JOD/year.

Key sector investment and policy recommendations

The poultry sector and VCA shows that Jordan requires mainly structural, medium-long term reforms. Most of them (except the establishment of a proper national food quality and safety control system) are in the domain of private initiatives and require commitments from private companies. Basically, local producers, on the high-level industrial scale in particular, will need to upscale their production base in order to meet growing domestic demand for fresh poultry meat.

In particular, the following topics are critical for the sector's future development:

- Consolidation or specialization of smallholders (primary production in particular) — Fragmented production systems need to improve efficiency or specialize (e.g. on niche markets) through modernization and integration (e.g. creating consortium arrangements, specialized contract farming, etc.); otherwise those unable to upgrade, will need to work out an exit strategy (total diversification). Each of these instances

would require significant investment and programming of development efforts. In the absence of or pending the implementation of investment projects that would address such issues it is likely that many small-to-medium and by definition old farms would, in a not very distant future, need to cease their activities with a consequent output gap imposition on the national production level. This supply gap can be filled only by an increased share of poultry meat imports or by an improved production capacity of the bigger domestic players or through a mix of the two.

- Expand production and processing capacities — At a time of demand expansion and in the likely coming event that considerable market shares of minor producers will be left vacant, a window of opportunity is opened to the most progressive portion of the poultry industry. This chance however doesn't come at zero-cost. Important investments must be made by the poultry industry. There is scope for production expansion, which should increase at the same pace of poultry meat consumption growth rates. The current slaughtering capacity is amply higher than current broiler production levels, which is under-used (on average slaughter houses work less than 10 hours per day). In addition, efforts should be dedicated to increase the number of broiler production cycles per year by reducing the long sanitation break between cycles. All such instances inevitably impact the fixed portion of poultry meat production costs.
- Efficiency improvements of specific production chain segments — At the feed segment level, low market competition and inefficient infrastructure make the procurement price of feed components by compound feed mills expensive. Further investigations are needed to understand the actual scope and dimension of interventions at this level. The breeding segment of the production chain also requires improvements. Over the last few years, the production costs of hatching eggs has increased significantly. As a result, in 2013, the country imported significant amounts of eggs (1.64 million eggs from Yemen, 0.68 million from Kuwait). According to import statistics, the average import price of hatching eggs equalled the production cost in Jordan. In fact, hatching eggs from Yemen were imported to Jordan at the price of 0.25 JOD/egg. Investments towards resource efficiency, upgrading and increasing the hatching eggs production capacity are required to satisfy an expanding domestic market.

- Establishment of a proper national food quality and safety control system — Investment through Public-Private-Partnership solutions, may also regard the establishment of a proper national food quality and safety control system through the application of quality control standards for local food items and for exported commodities.

The F&V sector is in a very different situation compared with the poultry sector. The sector is very fragmented and dependant on irrigation. Due to high competition in the horticulture market — also with imported produces — primary horticulture production is an activity that generates low-profit margins. The situation is not the same all over the country. In fact, the main regions of the country, the Highlands and the JV, perform differently both in terms of economic returns and resource-use efficiency. The analysis shows that in a long term prospective horticulture in the Highlands is not sustainable, while a sustainable economic future in the JV is still possible. However, a number of long-term conditions can also prevail, thus related short-to-medium term priority actions would need to be taken.

Backstopped by the public sectors, the following options need to be taken into consideration at the industry level:

- Reduction of cropped areas — Based on actual water availability, the overall cropped area has to be reduced. Also it's worth reducing the length of the cropping season (max until April) to enhance off-season produce market opportunities.
- Efficiency improvements — High productivity should be pursued through precision agronomic technologies. In terms of investment areas, the agribusiness industry will need to further enhance its agricultural productivity (e.g. water efficiency, desalinisation and in discrete cases in mechanized aided harvesting, for example in mechanical lifts for Medjool dates harvesting) and enlarge its production base either directly (e.g. high-tech greenhouses and large multi-span protected units) or through improved contractual arrangements (showing equitable reciprocal value) with primary producers. This may be possible by upgrading the current "untied" contract farming arrangements with more organized and better structured "outgrowers *cum nucleus* scheme" agreements. Existing best practices worldwide may be analysed for benchmarking purposes. Investment is also required here to improve and expand value added capacity in terms of: modern packhouses with integrated cold chains (including storage both refrigerated

and non-packing automation, energy-saving investments — e.g. in solar power); efficient trading (advantageous and reliable freight contracts including refrigerated transportation); food losses and waste control management systems and marketing organization (ensuring trustworthy market outlets).

- Export oriented approach — The production of export vegetables grown under high-tech greenhouses (computerized with temperature/humidity control systems of over some 25 percent of the current vegetable area or rather some 50 000 dunums) should be maximized. A technical and organizational upgrading of the producers is also required, who will need to re-orient their production targets towards high-value products of the "right" quality and quantity; and who will need to align themselves in a timely manner to the demand (and to its changing patterns). This shift entails a number of investments at the production level which mainly regard: optimising cropping systems/practices (quality input level, e.g. seed and seedlings); technology improvements of protected agricultural gears and means (greenhouses); broader, more widespread capacity development for compliance to international GAPs/SPSs standards (encompassing "soft" and "hard" investments). A continued and sustainable expansion of the WUA organization is also needed in order to responsibly empower the users to obtain water of reliable quantity and quality.
- Shift towards more efficient cropping patters — The date palm area (with the Medjool dates variety) should be expanded to the extent possible (doubling the current date area to some 20 000 dunums) in the middle-southern valley, and contextually reduce the banana area. It should also optimize citrus orchards (in the north) gradually diversifying (over some 50 percent of the current citrus area or about 30 000 dunums) with other high-value fruit trees, including dates and table grapes.

The public sector will have to play an important role in the development of the fruits and vegetable sector. Not less important is the role of the country in fostering the development of the poultry sector.

Special policy and institutional attention would need to focus on the following:

- Land — Acknowledged amendments to the land ownership regime could facilitate an effective and modern agribusiness transformation in the JV. Currently, only individuals can own

lands. It is recommended to enable land titles in the name of companies and cooperatives.

- Labour — Immigration quotas should be increased for the valley that are well-regulated and extended to the Asian countries.
- Jordan Valley — It is highly important to acknowledge the JRV as a country priority area by declaring it the "Agribusiness Hub" of the country. A public sector sponsor would have to champion this process.
- Water supply — Long-term certainty of irrigation water availability (of good agronomic quality) needs to be ensured. In terms of hard investment, public sector responsibilities and related investment endeavours should regard JVA system interventions for improved irrigation water management and distribution to guarantee the JRV producers long-term certainty on set amounts of good-quality water. Eventually, there is scope to accelerate pipelined investments to increase the availability of TWW for irrigation purposes. Importantly, the public sector will need to invest (through partnership solutions with the private sector) to upgrade the national infrastructure for food safety assurance purposes.
- Develop a cooperative legal framework — A modern and efficient cooperative framework needs to be facilitated that would enhance the organization of the smaller producers.
- Public-private partnership in R&D, food quality and safety control systems and market information systems — R&D needs to be concentrated on the following: addressing the major issues concerning the producers (through Public-Private Partnership programs between Agribusinesses and e.g. NCARE, Universities, etc.); establishing Public-Private Partnerships to create a proper national food quality and safety control system through the application of quality control standards (including an efficient and internationally acknowledged certification system) for local food items and especially for exported commodities; upgrading business-specific capacity development of producers (for compliance on GAP/SPS and other volunteer international standards); working on ad hoc and improved inter-governmental trade agreements in discussion with the private sector; setting up modern and efficient market information systems (through for example an empowered JEPA) with the related infrastructure at all chain segment levels, which can actually aid producers' planting and marketing strategies.

- Engagements with IFIs — Area-specific engagements with donors and IFIs need to be made to source required funding and facilitate concrete credit opportunities for the private sector.

There are a few pre-conditions needed to set the grounds for action. The private sector needs to show interest and a demonstrated commitment to invest in the direction of a renaissance of the JV agribusiness. Champions of the private sector can emerge among agribusinesses,[60] who would in turn self-organize themselves and take on the responsibility of preparing a sector investment work plan. The plan will need to include the analyses and planning of a first-priority line of interventions. A starting point of the work plan may foresee the contextual investment plan upgrade their own production units and facilitate investment interventions in contracted farming units for outsourced production (which would require access to financial means by smaller producers with the agribusiness partners acting as guarantors).

In parallel, a number of smaller but progressive producers in the JV (particularly but not exclusively in the southern part of the valley), who are already organizing themselves under a cooperative form of arrangement (institutionally emerging in Jordan), could possibly scale up their economic and organizational status and become eligible to access ad hoc credit lines for investment financing.

[60] Currently, there are about 8–10 large agribusiness operators in the JV, each with its own production base, which is further enhanced through contractual arrangements with 20–30 small producers.

ANNEXES

Annex 1

Water related policies and institutions

Policies. Water is highly evidenced in the National Agenda 2020,[61] which calls for the availability of adequate water sources, effective water-use and the need for leveraging non-conventional water sources; all as means to achieve sustainable development.

The agenda promotes employment and socio-economic development through the growth of labour-intensive and export-oriented industries and trade services. It prioritizes the food industry and agriculture as important thematic areas for investment development. The agriculture sector-specific initiatives will need to aim to improve the quality of agricultural produce and direct production towards high-yield/revenue crops, which optimise water-use efficiency. The current performance of the different sectors is substantially aligned with the agenda's targets but with some discrepancies due to the global financial crisis.

The thematic area of the agenda regarding infrastructure upgrading includes initiatives aimed at the following: developing the water supply and new resources; improving the efficiency of the water distribution networks; restructuring tariffs and progressively reducing subsidies; developing and upgrading wastewater treatment facilities by using state-of-the art technology and re-using treated water for agriculture and industry; and encouraging the involvement of the private sector in developing the water sector and creating an investment-friendly environment.

The lead water-related policy document for Jordan is the"Water for Life — Jordan Water Strategy 2008–2022".[62] It recognizes that despite the huge improvements in infrastructure to supply water, Jordan faces a critical and serious supply-demand imbalance. It

[61] The National Agenda is the common policy framework for all institutions of the Government of Jordan. It specifies Jordan's priorities. The aim of the National Agenda is to achieve consistent policies and ensure that they will not be subject to government changes, while taking into account the need to regularly develop and update these policies.

[62] http://www.joriew.eu/uploads/private/joriew_org_jordan_national_water_strategy.pdf.

also indicates that more pressure will be put on water resources due to changes in population and lifestyles. At the time of the strategy publication (2009), the water imbalance[63] was 565 million m^3. The document predicts that a deficit condition cannot be overcome, although it is projected to halve by 2022 to 284 million m^3. In order to achieve this objective, as well as effective governance reform and efficient use of water resources, the following implementation targets need to be achieved:

- drastic reduction in groundwater exploitation;
- implementation of major water conveyance investments (Disi and Red-Dead, see Table below);
- irrigated agriculture in the Highlands capped, regulated and enforced;[64]
- appropriate water tariffs and incentives introduced to promote irrigation water efficiency and economic productivity.

Disi-Amman conveyance project:

A billion-dollar project to extract 100 million m^3 of water a year from the fossil Disi aquifer in the Mudawwara area, 325 kilometers south of Amman. The Disi aquifer is non-renewable. It is expected to provide 125 million m^3/year for 50 years, when it will be used up.

Red Sea-Dead Sea Canal:

The Red Sea-Dead Sea Canal is a multi-billion dollar plan to build a canal from the Red Sea to the slowly evaporating Dead Sea. The project also incorporates the construction of a desalination plant. It is expected to provide Jordan with 500 million m^3 of water annually.

[63] Measured as Current Abstraction — Safe Yields.

[64] Enforcing efficacy is paramount. The former 1997 Water Strategy fell short on this as its follow-up bylaw no. 85 of 2002, which deemed to assist in controlling agricultural groundwater abstraction taking the abstraction rate close to the annual recharge, proved impossible to apply.

Major water conveyance investments in Jordan

In all cases and before other uses, the first priority set by this strategy is to have an adequate, safe and secure drinking water supply.

The National Climate Change Policy (2013–2020), recently released,[65] indicates that the long-term goal of Jordan is to achieve a pro-active, climate risk-resilient Jordan, maintaining a low-carbon impact but growing economy, with: healthy, sustainable and resilient communities; sustainable water and agricultural resources; and thriving and productive ecosystems in the path towards sustainable development. To this end, wastewater policies, strategies and action plans need to be integrated with a climate change mitigation perspective. Adaptation actions also need to be pursued to deflect negative impacts on: natural ecosystems; river basins and watersheds; biodiversity — with cascading effects on agriculture and food security/production; water resources; human health; public infrastructure; human settlements and the socio-economic framework.

The Government of Jordan is working hard to improve the quantity and the quality of TWW. The effluent quality of the largest plant (Samra) has improved thanks to upgrading[66] and BOD5 and TSS levels that are now below the design value (30 mg/litre). Improvements have had a great impact on the water quality of the KTD as well as the water quality for irrigation in the middle and north JV. This upgrading made it feasible to expand the use of TWW for irrigation in a trade against the reallocation of freshwater for domestic use. In 2009, MWI expanded the TWW conveyor with a total length of 35 km from KTD to reach the boundaries of the middle and north JV (Al Mashara area). TWW already contributes to nearly 60 percent of the total water resources used for irrigation in the north and middle JV and this percentage is increasing on an annual basis due to the increasing amounts of TWW from the As-Samra Plant, as well as from other plants discharging water towards the JV. By the year 2015, TWW is expected to add an additional 76 MCM/yr making the total available and usable water to be about 180 MCM/yr, mainly allocated for irrigated agriculture within the JV. Over 60 percent (46 MCM) of the TWW used in the valley will come from the As-Samra.[67]

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65 MOE. 2013. http://www.undp.org/content/dam/jordan/docs/News/Climate%20change%20policy_JO.pdf.

66 USAID, 2006.

67 Water Resources Group 2030.

Institutions. The main public sector institutions in charge of the water sector include the MWI in cooperation with the JVA and the Water Authority of Jordan (WAJ). The MWI was established in 1988 with the JVA and the WAJ under its umbrella. The MWI is in fact the Chair of the Board of Directors of both the WAJ and the JVA. The institution governing the main users of water resources — the farmers who irrigate their crops — is the MoA. In addition, the MoPIC, oversees the setting of effective policies, the identification of sectoral priorities, the implementation of local development programs and the strengthening of international cooperation, including revising and updating the national agenda for the year 2020.

The main concerns of the MWI are: formulating and implementing an irrigation policy and strategy; planning and developing water resources and controlling water allocation and use; preparing a water master plan and the annual water balance budget; establishing a water data centre; human resources development and training programmes for the water sector; and public awareness programmes.

The JVA is in charge of the integrated development plan of the JRV. Its main tasks are: construction, operation and maintenance of dams in the Side Wadis and in the JRV; delivering and distributing irrigation water to farmers and collecting irrigation water charges; encouraging farmers to adopt modern irrigation methods and to save water and improve farm irrigation efficiency; working with international donors and farmers on farm irrigation practices and scheduling; implementing emergency plans to face water shortage in dry years and seasons; implementing public awareness and water conservation programmes in irrigation.

The WAJ oversees the development and protection of water sources, the provision of water and sewerage services and the improvement of infrastructure to preserve environmental and public health. It is also responsible for: providing licenses to farmers to utilise groundwater for irrigated agriculture; checking the drilling of tube wells and carrying out the testing of the yield of the wells; and checking the abstraction from the tube well in the groundwater basins, pursuant to Law no. 83 (2003), to reduce overexploitation of renewable groundwater resources practiced by farmers.

The MOA is primarily responsible for designing and implementing agricultural sector policies and for providing technical assistance

and extension services (through The National Centre for Agricultural Research and Extension — NCARE) and rural financing (through the Agricultural Credit Corporation — ACC). The National Strategy for Agriculture Development (2000–2010) has completed its timeframe but has not been substituted yet by a new instrument. An agriculture sector review has been undertaken and commissioned by the European Commission, which is still to be released.

The MoPIC is supporting and directing development initiatives aimed at raising the standards of living and improving the national economy. Its mission is to strengthen and enhance technical, financial and economic cooperation with donors, international organizations and financing institutions, while steering foreign assistance in line with socioeconomic priorities within the framework of the National Agenda. The Jordan Aid Information Management System (JAIMS)[68] provides information on ongoing development projects and programs being implemented, in Jordan, and funded via foreign assistance through committed donors, as well as financing institutions and international organizations in various sectors. MoPIC also maintains the Jordan National Competitiveness Observatory (JNCO) website.[69] This tool is tracking the main economic sectors' competitive performance, serving as a reference database at both the macro- and micro-levels and acting as an early warning, signaling system.

The donor community is assisting the country on its sustainable water management issues. In particular, important partners in this endeavor, are: FAO, the World Bank, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and USAID. The European Bank for Reconstruction and Development (EBRD) has recently joined the supporting group.

FAO leads a Regional Water Scarcity Initiative, which also focuses on Jordan. The overall goal of the initiative is to support member countries in identifying and streamlining policies and best practices in agricultural water management and beyond, which can significantly contribute to boosting agriculture productivity, improving food security and sustaining water resources. The initiative will identify critical areas that require action, assist in the formulation of a regional, collaborative strategy and build broad partnerships to support its implementation.

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68 http://www.MoPIC-jaims.gov.jo/Home.aspx.

69 http://www.jnco.gov.jo/static/welcome.shtm.

The World Bank, following its "Evaluation of Bank Assistance for Water Development and Management" (2004),[70] has recently presented in a public workshop (June 2013) the findings of its "Pricing of Irrigation Water in the Jordan Valley" study, conducted with the objective to determine the cost per m^3 of water allocated to the agricultural sector in the valley. The increase in irrigation water tariffs is considered necessary in an environment where the average irrigation water tariff has remained unchanged since 1995, while the government budget allocated to the JVA has been drastically reduced in the past decade. Two scenarios are used to identify the cost of water: the first scenario includes only the coverage of operation and maintenance, whereas a second scenario extends to cover also part of the capital costs to allow for a minimum rehabilitation and replacement of an aging infrastructure in the valley. The analytical work provides the basis for the government to announce its support, for the first time in almost 20 years, to increase the irrigation water tariff. The study includes indications of water productivity that are based on an agro-economic analysis of crop production systems in the valley done by FAO. Currently and as a result of this initiative, MWI started to increase water tariffs in 2014, with a phased plan that will stabilize by 2017. In addition, The Word Bank Institute's (WBI) Private Sector Engagement for Good Governance program (PSSG) has supported the Government of Jordan in implementing a multi-stakeholder engagement platform — the Jordan Valley Water Forum (JVWF).[71] This platform tries to resolve some of the most pressing issues of the valley's water sector by addressing critical water issues through better coordination and engagement between public and private stakeholders. A second JVWF was held in January 2013. Attendants assessed progress on the issues raised during the first JVWF and whether the government had acted upon the requests made by the farmers. They also tried to improve the JVWF process and discussed ways to strengthen the forum secretariat as well as align donors' assistance with the issues raised by the farmers and identify new issues for government consideration.

GIZ has assisted MOWI with the formulation of the National Water Master Plans (the first in 1977; and the current one elaborated in 2004), following the United Nations guidelines. The latest plan

[70] http://www.oecd.org/countries/jordan/36489193.pdf.

[71] http://www.youtube.com/watch?v=W8JXvs70q_o; http://wbi.worldbank.org/wbi/stories/coordinating-stakeholders-jordan-crucial-water-issues.

is not a static instrument but a digital plan based on a Water Information System (WIS) with software tools that are applied to do the following: assess the present availability, withdrawals, losses and uses of the water resources; formulate alternative development scenarios for water resources and demand/use at various planning horizons; perform the balancing of resources versus demands for the recent past as well as for the alternative development options; and identify technical and operational options in order to bridge the gap between resources and demands.

In 2001, GIZ supported JVA for the launch of a participatory water resources management project in the JV with the aim of sharing the responsibility between the authority and the farmers. WUAs have been established through a democratic process, including the definition of responsibilities, duties and the management structure. Contracts with the WUAs regulate tasks transfer, in which the associations are responsible for the distribution of the water for irrigation. The program currently encompasses 75 percent of the irrigated area but eventually, a full coverage of the valley is expected. By and large, the WUA system is acknowledged as a positive achievement by the majority of the farmers that have been involved in the program. A recent GIZ report, "Analysis of Water Efficiency in the Agricultural Sector in the Jordan Valley" (2013), presents the analysis of the economic water value in agriculture in the JV. The cost and revenue analysis of the water supply by the JVA showed that it is necessary to take measures to improve revenues and cut on expenses. It is also recommended that WUAs take on the full task of water management in the JV, including fees collections.

USAID during the past decade has focused its assistance more on developing and conserving water in Jordan than on any other non-cash assistance sector. Programs focus on: supporting the reform of water policies, institutions and practices; expanding the water supply/wastewater treatment facilities for major population centres; promoting the use of innovative technology; and creating greater awareness and involvement at the community and decision-making levels in water demand management. Its current focus is on the following: supporting the implementation of Jordan's National Water Strategy; providing wide-ranging capacity building to restructure and strengthen water sector institutions/frameworks, focusing on human resources and financial and facilities management; contributing to improved planning and management information systems;

supporting policy development/law enforcement; restructuring tariffs and encouraging best commercial practices in water utilities; increasing private sector participation; promoting needed infrastructure investments; and improving water-use efficiency. Major assistance activities include the Institutional Support and Strengthening Program (ISSP), a technical assistance and capacity building program to enhance financial management within the water sector, optimize water-use and reduce over-exploitation of resources. This includes issues such as water valuation and restructuring and strengthening water sector institutions with a focus on human resources and financial and facility management. In addition, the Water Reuse and Environmental Conservation (WREC) is a water conservation program for industry, agriculture and landscaping. It includes demonstrations of industrial water management and pollution prevention, site rehabilitation and institutional capacity building. Two major study reports from USAID include the "Review of water policies and recommendations for strategic priorities" (2012) and the "Disaggregated economic value of water in industry and irrigated agriculture in Jordan" (2012).

EBRD started its program in Jordan in 2012, when the country became a member of the institution. Among other areas, its focus is on water and wastewater treatment municipal services and providing direct finance to private businesses, particularly in the agribusiness sector. Under the Deauville Partnership, the EBRD, along with the Government of Jordan, is managing a technical cooperation fund of USD 1.5 million to help the country improve the quality and reliability of drinking water provisions to Jordan. In addition, EBRD has selected Jordan as one of the four water scarce countries[72] for its "Water along the Food Chain" study, which is being undertaken in partnership with FAO.

Regarding the private sector, the 2030 Water Resource Group[73] provided in 2011 (through McKinsey and Co.) its views on the

[72] The three other countries are Kyrgyzstan, Turkey and Ukraine.

[73] WRG is a public-private-civil society partnership that targets government water officials and other water sector specialists to foster reforms on sustainable water resource management for long-term development and economic growth. It was established as an informal collaboration between the International Finance Corporation (IFC), the World Economic Forum and a number of bilateral development agencies (notably the Swiss Agency for Development and Cooperation and USAID Jordan), private sector companies (notably Nestlé, PepsiCo, SABMiller, The Coca-Cola Company and Veolia Environment) and other organizations. See: http://www.2030wrg.org/wp-content/uploads/2012/06/WRG_Brochure_2012-.pdf; http://www3.weforum.org/docs/WEF/WRG_Background_Impact_and_Way_Forward.pdf.

productive use of Jordan's scarce water resources based on the targets set in the National Agenda. It recommended shifts on outputs that generate higher economic and social value per unit of water input. Considering an estimated, accessible safe supply (~900 million m^3) and a projected 2030 demand for all sectors (~1 550 million m^3), the assessment provides a number of recommendations and assumed priority investments in order to ensure or reduce the additional requirements (~650 million m^3). The study advocates improved water efficiency use for all sectors (municipal, industry, energy and mining) and higher flexibility and productivity for the JRV and Highland agricultural economic choices (including highly reduced groundwater abstraction, focusing on the use of TWW and an overall cap of 510 million m^3 of irrigation water). On the supply side, it confirms the implementation of capital-efficient mega projects (Disi/Red-Dead, Kufranja dam, etc.).

Annex 2

Poultry sector structure

Table 81: Parent stock farms number and capacity by governorate region, 2012

Governorate	Region	Production capacity, million eggs per year	Capacity, 1 000 birds	Number of farms	Av. Farm capacity, 1 000 birds per farm	Av. Production capacity, million eggs per year per farm
Amman	Naour	8.75	121.5	2	60.75	4.37
	Jezzah	36.00	500	15	33.33	2.40
	Wadi Alseer	0.59	8.25	1	8.25	0.59
	Mmouqer	1.44	20	1	20.00	1.44
	Total	46.78	649.75	19	34.20	2.46
Madab	Madaba	4.30	59.75	2	29.88	2.15
	Zeban	14.33	199.07	6	33.18	2.39
	Total	18.64	258.82	8	32.35	2.33
Zarqa	Zarqa	53.45	742.4	21	35.35	2.55
	Total	53.45	742.4	21	35.35	2.55
Irbid	Irbid	7.52	104.5	6	17.42	1.25
	Taybeh	0.97	13.5	1	13.50	0.97
	Banykenanah	1.73	24	2	12.00	0.86
	Koora	0.47	6.5	2	3.25	0.23
	Ramtha	3.60	50	3	16.67	1.20
	Total	14.29	198.5	14	14.18	1.02
Jarash	Jarash	12.46	173	5	34.60	2.49
	Total	12.46	173	5	34.60	2.49
Salt	Salt	4.75	66	2	33.00	2.38
	Aen basha	8.09	112.4	3	37.47	2.70
	Total	12.84	198.4	5	39.68	2.57

Karak	Karak	6.30	87.5	1	87.50	6.30
	South Mazar	1.08	15	1	15.00	1.08
	Total	7.38	479.3	2	239.65	3.69
Mafraq	Mafraq	31.34	435.37	16	27.21	1.96
	Badia north	22.84	317.24	3	105.75	7.61
	North west Badia	29.12	404.42	13	31.11	2.24
	Total	83.30	1 156.93	32	36.15	2.60
Sum totals		249.14	3 658.74	106	345.16	2.35

Source: MOA.

Table 82: Hatcheries number and capacity by governorate region, 2012

Governorate	Region	Production capacity: million 1 day chicks per year	Number of hatcheries
Amman	Capital	40.5	1
	Naour	50	3
	Jezzah	45	4
	Total	135.5	8
Zarqa	Zarqa	45.18	7
	Total	45.18	7
Irbid	Irbid	9.3	4
	Banykenanah	3.5	2
	Koora	5.3	2
	Ramtha	10.3	3
	Total	28.4	11
Jarash	Jarash	3	1
	Total	3	1
Salt	Salt	17	3
	Total	17	3

Karak	Karak	5	1
	Total	5	1
Mafraq	Mafraq	58.13	1
	Total	58.13	1
Sum Totals		292.21	32

Source: MoA.

Table 83: Broiler farms number and capacity by governorate region, 2012

			All farms			Unlicensed farms			Licensed farms		
Governorate	Region	Production capacity: 1 000 tonnes meat per year	Total Capacity: 1 000 birds per cycle per area	Average capacity. 1 000 birds per cycle per farm	Number of farms	Total Capacity: 1 000 birds per cycle per area	Average capacity. 1 000 birds per cycle per farm	Number of farms	Total Capacity: 1 000 birds per cycle per area	Average capacity. 1 000 birds per cycle per farm	Number of farms
Amman	Capital	4	571	16	36	501	16	32	70	18	4
	Wadi Al sir	4	541	12	44	21	11	2	520	12	42
	Sahab	3	366	17	22	15	8	2	351	18	20
	Jeza	13	1.7	24	70	-	-	-	1.7	24	70
	Na'our	6	801	16	49	357	14	26	445	19	23
	Mouqer	8	1 069	13	84	230	10	24	840	14	60
	Total	39	5 048	17	305	1 123	13	86	3 925	18	219
Madaba	Madaba	5	647	17	37	6	6	1	641	18	36
	Zeban	7	858	13	65	119	8	15	739	15	50
	Total	12	1 504	15	102	125	8	16	1.38	16	86

Zarqa	Zarqa	27	3 493	44	79	10	5	2	3 483	45	77
	Total	27	3 493	44	79	10	5	2	3 483	45	77
Balqa	Salt	5	671	13	50	-	-	-	671	13	50
	Faheies and Mahes	-	29	10	3	-	-	-	29	10	3
	Ean Basah	4	473	18	26	-	-	-	473	18	26
	Total	9	1 173	15	79	-	-	-	1 173	15	79
Irbid	Irbid	13	1 633	11	151	333	9	37	1.3	11	114
	Ramtha	6	750	13	60	-	-	0	750	13	60
	Bani Kananeh	8	1.04	9	119	667	11	59	373	6	60
	Kura	4	506	7	69	-	-	-	506	7	69
	Mazar	1	168	9	19	-	-	-	168	9	19
	Taybeh	4	565	10	58	200	10	20	365	10	38
	Alwastyeh	2	206	10	21	16	5	3	190	11	18
	Total	38	4 868	10	497	1 216	10	119	3 652	10	378
Jordan Valley	Jordan Valley	3	407	12	34	37	9	4	370	12	30
	Total	3	407	12	34	37	9	4	370	12	30

Jarash	Jarash	8	987	10	96	45	45	1	942	10	95
	Total	8	987	10	96	45	45	1	942	10	95
Mafraq	Mafraq	21	2 745	16	173	214	14	15	2 531	16	158
	South Badia	18	2 339	292	8	-	-	-	2 339	292	8
	North Badia	10	1 295	32	41	82	14	6	1 214	35	35
	Total	50	6 378	29	222	296	14	21	6 083	30	201
Ajloun	Ajlon	4	562	8	72	34	6	6	528	8	66
	Total	4	562	8	72	34	6	6	528	8	66
Karak	Karak	3	414	9	45	10	10	1	404	9	44
	South Jordan Valley	10	1 258	140	9	0	-	0	1 276	142	9
	Qasser	4	563	17	33	68	11	6	495	18	27
	Mazar	3	346	7	52	52	5	10	294	7	42
	Faqu'	1	145	10	14	0	-	0	145	10	14
	A'yy	2	270	9	30	0	-	0	270	9	30
	Total	23	2 996	16	183	130	8	17	2 884	17	166

Tafelieh	Tafeleh	3	430	14	31	-	-	-	430	14	31
	Total	3	430	14	31	-	-	-	430	14	31
Ma'an	Ma'an	1	68	14	5	0	-	-	68	14	5
	Total	1	68	14	5	0	-	-	68	14	5
Aqaba	Aqaba	2	225	13	17	67	17	4	158	12	13
	Total	2	225	13	17	67	17	4	158	12	13
Jordan	Total	220	28 139	16	1 722	3 064	11	276	25 075	17	1 446

Source: MoA.

Table 84: Slaughterhouses in Jordan, 2008–2012

		Processing capacity (thousand birds per hour)					Production (thousand tonnes of meat per year)				
Location	Slaughterhouse	2008	2009	2010	2011	2012	2008	2009	2010	2011	2012
Mafraq	Al Jazzera	8.0	8.0	8.0	8.0	8.0	14.5	16.0	19.3	20.2	20.4
Karak	National poultry company	4.0	4.0	6.0	6.0	6.0	26.3	27.0	27.0	28.2	28.5
Al Dulail	Al- Dulail	4.0	4.0	8.0	8.0	8.0	23.2	23.3	29.2	30.8	30.0
Amman	Amman municipality	2.0	2.0	2.5	2.5	4.8	12.5	12.0	13.2	14.3	15.2
Zarqa	Al Tahuneh	3.0	3.0	3.0	3.0	4.0	16.6	18.5	25.7	26.5	26.3
Zarqa	International company /Tamam	3.0	3.0	3.0	3.0	3.0	8.5	8.5	9.0	9.5	9.3
Jarash	Shaban quail slaughterhouse	3.0	3.0	3.0	3.0	3.0	0.5	0.4	0.4	0.3	0.2
Mafraq	Shdefat	0	0	1.5	1.5	1.5	0.0	0.0	6.5	8.2	0.0
Salt	Wadi shueib	0	0	1.5	1.5	1.5	0.0	0.0	2.5	2.5	3.2
Total		27.0	27.0	36.5	36.5	39.8	102.1	105.7	132.8	140.5	133.1

Source: MoA.

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