The agricultural knowledge and innovation system of Jordan's horticultural sector

Current state and suggestions for improvement

Gregory Sixt and Krijn Poppe

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De tuinbouw in Jordanië gaat gebukt onder een crisis als gevolg van weggevallen export. Innovatie kan de positie van de sector verbeteren. Daartoe dient de Jordaanse overheid innovatiebeleid te voeren met het agrarisch kennis- en innovatiesysteem (AKIS) als object van sturing. Op basis van een review van het Jordaanse AKIS wordt voorgesteld in een Living Lab ervaring op te doen met het managen van een aantal innovatieprojecten en capaciteitsopbouwprojecten.

The horticultural sector in Jordan is undergoing a crisis, due to a decline in export. Innovation can improve the performance of the sector. To this end, the government of Jordan should pursue an innovation policy with the Agricultural Knowledge and Innovation System (AKIS) as object of the governance. Based on a review of the AKIS in Jordan it is proposed that a Living Lab setting be used to gain experience with the management of a number of innovation projects and capacity building projects.

Key words: Jordan, AKIS, innovation, horticulture

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Preface

The Kingdom of Jordan, and especially its horticultural sector, faces challenging times. The political instability in neighbouring countries has not only resulted in a large flow of refugees, especially from Syria, but also a loss of markets. The war in Syria has blocked the export of fruit and vegetables to the east of Europe, including Russia, as road traffic has become impossible. This has led to a collapse of prices in the home market.

The Dutch government is investigating how it could assist Jordan in general as well as with the horticultural sector. A mission in the summer of 2018 (reported in De Groot et al., 2018) identified the Agricultural Knowledge and Innovation System (AKIS) as an important focus area for support. This line of thinking has been pursued by two subsequent missions, commissioned by RVO Nederland, the Dutch government agency responsible for contracting these activities on behalf of the Ministry of Foreign Affairs. This report is based on those two missions.

A first mission was undertaken during the first week of September 2018 under the leadership of Mr Geert Westenbrink, policy coordinator at the Netherlands Ministry of Agriculture, Nature and Food Quality and advisor to the embassy in Amman, with Dr Gregory Sixt as independent expert with previous experience in Jordan and on assessing AKIS. Dr Sixt is a consultant contracted by Wageningen Economic Research and based in Boston, USA. During this mission barriers and opportunities to revive the horticultural sector were identified. Chapter 2 and 3 report the outcomes. Prior to the mission, Mr Hisham Rawashdeh, a local consultant to the Dutch embassy in Amman, prepared a very useful fact finding report on technical and vocational training that is included as appendix 2 to this report.
A second mission, also under the leadership of Mr Geert Westenbrink and with Krijn Poppe (Wageningen Economic Research) as AKIS expert, was undertaken at the end of September with the objective of reviewing the outcomes of the first meeting and drawing up a plan to take the AKIS in Jordan to a higher level. This plan, reported in chapter 4, was discussed with important stakeholders and presented to the former Minister of Agriculture, His Excellency Khaled Hnaifat and the Ministry of Agriculture's Directors of Departments. The response was very positive; the main stakeholders in Jordan welcome an intensive collaboration with the Netherlands. This was very positively reiterated during a visit of the current Minister of Agriculture and Environment, His Excellency Ibrahim al Shahahdeh to the Netherlands in November.

The authors thank all the interviewees in Jordan for their collaboration and openness. They also thank the ambassador and staff of the embassy for all the technical support. Special thanks goes to Mr Geert Westenbrink, Mrs Jemma Grayburn, Mr Hesham Rawashdeh, Mr Cornelis (Coen) van Kessel and Mrs Jasmin Beverwijk (Nuffic) for stimulating discussions and sharing their insights. In The Hague, Floor Geerling-Eiff and Peter Ravensbergen (Wageningen Economic Research) provided information on AKIS policies in Europe and projects in Jordan. Feedback on our advice in a workshop at the embassy in which Mr. Nizar Haddad, National Agriculture Centre for Research, Mr. Basil El Deek Board Member of Jordan Exporters and Producers Association (JEPA), Naser Al Manaseer of Balqa Applied University, among others participated was also much appreciated.

We hope the advice in this report to the Dutch Embassy in Amman and the Ministry of Foreign Affairs in The Hague will enable in the further development of a comprehensive support programme for horticulture contributing to improving the viability and resilience of the horticultural sector in Jordan.

Prof. J.G.A.J. (Jack) van der Vorst
General Director Social Sciences Group (SSG)
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Executive summary

The horticultural sector in Jordan is in danger because its exports to the east of Europe have been blocked by the war in Syria. We advise the horticultural sector in Jordan to make innovation and capacity development core aspects of the way it operates, in good times and in bad. Innovation and capacity development is needed to improve the position of the sector and the community it impacts. To this end, the government of Jordan should pursue an innovation and capacity development policy with the Agricultural Knowledge and Innovation System (AKIS) as object of the governance.

Such an innovation and capacity development policy should promote a sustainable, internationally competitive and inclusive sector, with products for high-end markets, high water use efficiency and the capacity to continuously innovate in terms of technology, products, services and markets.

The further development of the present support projects in innovation and capacity building could be bundled into a four-year comprehensive programme that enables Jordan to make concrete and big steps forward in making innovation and continuous capacity development in horticulture systemic. This will result in a sector with a significantly improved international competitive position, moving towards a much higher water use-efficiency and offering gainful employment opportunities for a large number of people. This transformation in making capacity development and innovation the core of the development strategy requires concerted actions of both the commercial sector and the government.

It is proposed that to use a Living Lab setting be used to gain experience with the management of a number of innovation projects and capacity building projects (figure S1). The concept is based on a systematic user co-creation approach integrating research and innovation processes, along with education and training. This allows all stakeholders to consider progress and align projects and work towards making capacity development and innovation systematic. A core element is that it turns the beneficiaries of the programme into co-creators. The objective of the Living Lab project is to align the different projects in the programme and teach the actors to run the programme as a well-functioning AKIS so that the programme is internalised in the actions of the various institutions.
Members of the Living Lab are those responsible for innovation in Jordanian horticulture (director level at the Ministry of Agriculture, NARC, some universities, Ministry of Education, Ministry of Labour, Training institutions) and private actors (Jepa, farm organisation, young farmers association) as well as project leaders of the projects in the Economic Engine and the Capacity Engine of the proposed program.

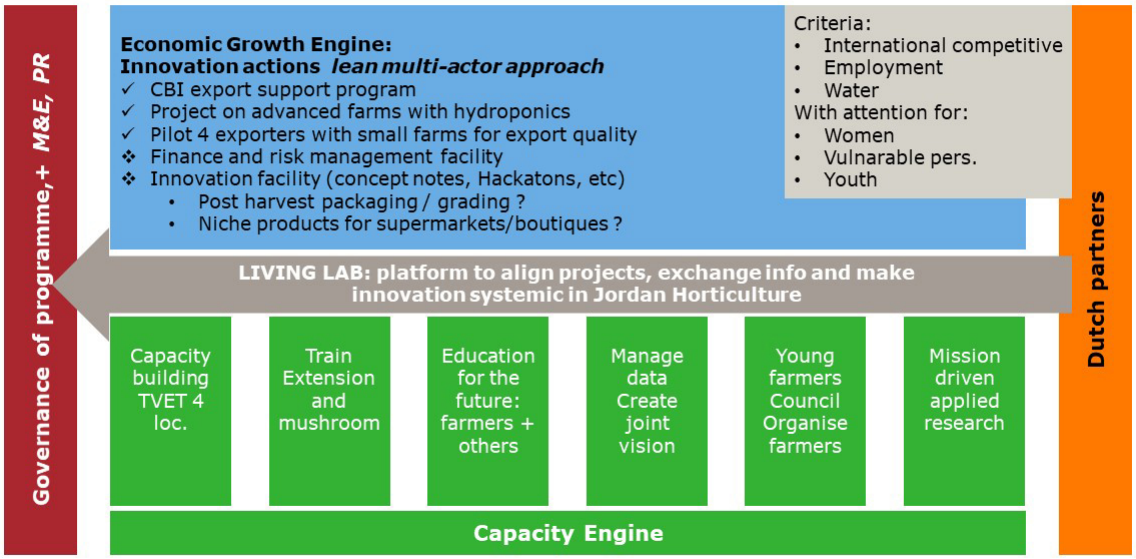

Figure S.1 *Schematic design for a programme to make innovation a core aspect of horticulture in Jordan*

A number of innovation projects are conducted under the banner of 'Economic Growth Engine.' Some of these have already begun. Projects target immediate needs in the current crisis, to show new pathways for income and employment generation. Water management is a key issue, as water is becoming scarcer and the high level of pesticide residues is partly the result of inadequate irrigation in the fields.

A number of projects are suggested under the banner of 'Capacity Building' that upgrade the competences of current institutions to support the horticultural sector in its innovation and in education and training. They include improving TVET (Technical and Vocational Education and Training), extension, education, applied research and data management. The proposed projects under the capacity building banner will cooperate with and be fed with the information and results for the project under the economic banner and also once they are up and running they will contribute to and reinforce the project under the economic banner.
In the possible further development of the programme it is important to discuss to which extent the Netherlands could and should support the Living Lab.

These recommendations for a strategic intervention with a four-year programme (see chapter 4 for more details) are based on an analysis of the current AKIS in Jordan (discussed in chapter 3). This analysis (based on two missions and a fact finding report) concludes that the *education, technical training, research and data collection* function is the most important of the functions in the Jordanian AKIS. An AKIS programme serves to repair or enrich a knowledge infrastructure that may not necessarily be meeting the needs of the sector, where cultural institutions influence public perception about agricultural careers, and with a lack of sufficient interactions among actors, leading to insufficient connections between research, education, and training and the needs of the sector. It is also an area that shows some of the greatest promise for improvement, as it has TVET providers who are actively interested in collaboration and make up the public education system of the agriculture sector.

The *knowledge diffusion through networks* function is crucial for linking farmer experiences and needs to research, education and training in order to support entrepreneurial activities that achieve a common vision for the sector. The public and private extension systems are not adequately meeting

the needs of the sector. However, TVET providers eager to collaborate provide an opportunity to help overcome the challenges facing this function as well.

Problems facing the *development of a vision shared by all stakeholders for the agricultural sector* function primarily have their roots in two places: 1) the formal and informal institutions within the ministries and power dynamics between the ministries that lead to siloed governance approaches and 2) the financial capacity challenges facing the country, as a whole, and the agricultural sector, in particular, that negatively impact the ability of farmers and entrepreneurs to envision a long-term future and the mobilisation of financial infrastructure resources. Development of a vision is further hindered by inadequacies in the *education, technical training, research and data collection* and *knowledge diffusion through networks* functions, and the lack of a vision itself negatively impacts entrepreneurial activity.

1 Introduction

Jordan (officially named the Hashemite Kingdom of Jordan) is a Middle Eastern country located on the East Bank of the Jordan River. It has a population of 9.7 million people, which is expected to double by 2050 (Ministry of Water and Irrigation, 2016). Jordan ranks as one of the most water-scarce countries in the world, with current annual renewable water resources of less than 100 m^3/capita (Ministry of Water and Irrigation, 2016).

With approximately 80% of its land area classified as sparsely vegetated rangeland or desert receiving less than 200 mm of annual precipitation (ICARDA, 2016), the area suitable for crop production is limited. Horticultural crop production occurs primarily in the Jordan Valley, with some also occurring in the Jordanian Highlands east of the Valley. Agriculture accounts for just 3%-4% of Gross Domestic Product (GDP) but is the main source of income for about 15% of the population and employs about 6% of the workforce (Central Intelligence Agency, 2015; Ministry of Water and Irrigation, 2016). Agriculture also supports export-oriented value chains and many jobs in parts of the country where alternative job creation is difficult (Humpal et al., 2012). Agriculture is seen as part of the solution for future food security (EBRD and FAO, 2015; Talks, without date).

Horticulture is an important sector within agriculture. On a total of 275.000 ha of crops, about 50% (135.000 ha) is fruit and vegetables, including 8.000 ha of plastic tunnels and glasshouses (De Groot et al., 2018). Measured in value added that means that horticulture is the biggest sector within agriculture[1]. A report by de Groot et al. (2018) found that the agricultural sector, as a whole, and the horticultural sub-sector in particular, are facing a declining export market and are poorly positioned to succeed in the future. The report found that the agricultural sector is negatively impacted by the following principal conditions:

- Regional conflict has closed road-based transport to Jordan's traditional export markets in Eastern Europe and Russia. In potential export markets in the Gulf Cooperation Council (GCC) countries, Jordanian horticultural goods face competition for other exporting countries like Morocco and Egypt. This is especially the case in wintertime, when there is also substantial production in the Gulf itself. Next to that GCC countries are putting stricter regulations on pesticide Maximum Residue Levels (MRLs) in place and for Jordan exporters it is quite a challenge to meet these stricter requirements. The MRL issue is also more in general a growing challenge to any potential export market for Jordanian goods.
- Productivity and the product quality in the agro-food sector in Jordan are relatively low, and the domestic cost of production is relatively high, often leading to production costs that exceed market price.
- At present, farmers and other sector actors within the agricultural value chain lack the knowledge and skills that could support a healthy horticultural sector.
- In both the public and private sectors, applied research, common agricultural research and a development agenda are all lacking.
- Agriculture is not viewed as an attractive sector to work in, which threatens the long-term sustainability of the sector, hindering the employment potential of the agro-food sector when it comes to attracting young entrepreneurs and young professionals.
- Education and employment opportunities in agriculture are limited. There have been no initiatives by the public or private sector to identify opportunities for improving education, training, employment and innovation in the agricultural sector.

[1] This big share of horticulture is one of the reasons we use the words agriculture and horticulture interchangeable in this report. Jordan needs an innovation policy, we argue, for agriculture and we used the standard term AKIS (Agricultural Knowledge and Innovation System). But our analysis and advice is based on the horticultural sector, that is the biggest sector. Dutch readers should realise that with open air fruit and vegetables (and tunnels) the differences in this respect with agriculture are not as big as between glasshouse horticulture and arable farming in the Netherlands.

These challenges facing the agricultural sector largely a result of the lack of a functioning Agricultural Knowledge and Innovation System (AKIS). An AKIS describes the network of actors and how they interact to impact agricultural innovations (EIP-AGRI, 2018). A well-functioning AKIS is one in which new know-how and technologies (hardware, software and orgware) are developed, tested and actively disseminated and job profiles and competence-based curricula are in line with the needs and opportunities of the sector. An AKIS includes the whole range of actors in an agricultural system along the entire value chain, including farmers and farm workers, agricultural input suppliers, food processors, consumers, retailers, exporters, research stations, extension service, technical training and education institutes, governmental and non-governmental actors, international organisations and supporting services such as credit providers (EU-SCAR, 2013, 2012).

Central to overcoming the challenges facing the AKIS in Jordan is the role of Technical and Vocational Education and Training (TVET).[2] There are three main providers of public TVET in Jordan: the Ministry of Education (MOE), the Vocational Training Corporation (VTC) and the Al-Balqa Applied University (BAU) community college system. Of the providers of TVET in Jordan, VTC is the only institution providing vocational training in agriculture. While agriculture TVET in Jordan is currently limited, it receives specific attention in this report because of the potential for it to have a positive impact on the capacity building aspect of AKIS. The role of TVET in the Jordanian AKIS is explored in detail in chapters 3 and 4.

The overarching goal of this study is to assess the overall functionality of the Jordanian AKIS and how strategic investment by the Government of the Netherlands can build capacity to support the horticultural sector in the country. This is accomplished through six sub-goals:

1. Assess the current barriers to a well-functioning AKIS, with special focus on TVET and applied research, and identify opportunities for improving the system to build capacity in the agricultural sector.
2. Review the activities of NGOs, international organisations and donors in the field of practical agricultural education in Jordan to identify opportunities for collaboration and avoid duplicative activities.
3. Identify local partners who could assist in the development of a long-term vision for the agricultural sector in Jordan.
4. Identify TVET education, training and employment opportunities in the agricultural sector, with recommendations for supporting specific types of professions, career paths and skills development.
5. Identify entry points and pathways for creating commitment and concrete actions for building a vibrant AKIS, with a focus on applied research and TVET.
6. Develop a scope of possible support by the Government of the Netherlands, and identify the education levels, individual sectoral concerns and particular value chain issues to target with the available resources.

This report is organised as follows: The next chapter provides insight into the methodology of the study. Chapter 3 reports on the identified barriers and opportunities in the AKIS for reviving the horticultural sector in Jordan. Chapter 4 lays out a plan to take the AKIS in Jordan to a higher level.

[2] See appendix 2 for the full report of the education and TVET systems in Jordanian agriculture.

2 Methods

To conduct the analysis of the Jordanian agricultural AKIS and how it supports the horticultural sector, this study draws on methods from the Agricultural Innovation Systems (AIS) (e.g. Turner et al., 2016). AKIS and AIS developed in parallel and share many similarities (Klerkx et al., 2012; Rivera et al., 2006), the key difference being that AIS methods more explicitly capture the role of infrastructure (knowledge, physical and financial) and institutions – both formal (policies and regulations) and informal (customs and culture) (Hall et al., 2006; Klerkx et al., 2012).[3] A report from a previous mission by de Groot et al. (2018) identified the central role of infrastructure and institutions in the Jordanian horticultural sector, warranting explicit attention for analysis of the AKIS.

The AIS approach allows for the diagnosis of systemic problems in order to identify where interventions can be targeted to optimise functioning of the AKIS and which functions need particular attention (Turner et al., 2016). The execution of the functions is influenced by the presence and quality of four structural components: *actors, institutions* (such as regulations, norms and values), *interactions in networks of actors,* and *infrastructure* (including physical, knowledge and financial infrastructure) (Wieczorek and Hekkert, 2012)(See table 2.1 for more detail).

Table 2.1 *Structural components of a TIS (Klein-Woolthuis et al., 2005; Turner et al., 2016; Wieczorek and Hekkert, 2012)*

Actors	Individuals and organisations and can include: government, non-governmental organisations (NGOs), civil society, private sector companies (ranging from small enterprises to multinationals), knowledge institutes (universities and research centres), international donors and financial and legal organisations. They are delineated based on their role in economic activity rather than their role in the innovation process because of the ambiguity between producers and users in most innovation systems
Institutions	Established practices, or shared habits, cultures and routines, used by actors in repetitive situations (informal institutions) organised by institutional measures, such as regulations, policy and standards (formal institutions)
Interactions	The relationships between actors, and they can be analysed at the level of individual contacts or at the levels of networks or actors
Infrastructure	Consist of three categories: (1) physical infrastructure, consisting of roads, buildings, ports, data networks and machines; (2) knowledge infrastructure, which includes research, expertise and agricultural extension; and (3) financial infrastructure, such as subsidies, grants and financial programmes

The analysis uses seven functions adapted from Hekkert et al. (2007) to analyse the dynamics of the current Jordanian agriculture AKIS. Some of the function names have been adapted for clearer applicability to this study. The innovation systems literature, in general, is rather academically oriented, and the adapted function names are more appropriate for a larger audience, focused more on applied, development-focused analysis. The seven functions used in this analysis are (see table 2.2 for more detail):

1. Education, technical training, research and data collection
2. Knowledge diffusion through networks
3. Development of a vision for the agricultural sector
4. Entrepreneurial activities
5. Market formation
6. Creation of legitimacy
7. Resource mobilisation

[3] As the AKIS concept has evolved to become 'Agricultural Knowledge and *Innovation* Systems' from its original 'Agricultural Knowledge and *Information* Systems", AKIS and AIS have conceptually merged (Dockès et al., 2011; Klerkx et al., 2012), making their methods relatively interchangeable.

Semi-structured interviews were utilised in small group interview settings of two to twenty people, representing farmers and trade organisations, women's groups, TVET institutions, universities, government ministries, bilateral donors, NGOs and international research centres. A total of at least 80 people were interviewed. Semi-structured interviews allow for flexibility, so the interviewer can focus on interesting comments and aspects of the topic on which interviewees have more expertise (Bruges and Smith, 2009; Turner et al., 2016). Several interviews were conducted on-site at the interviewee's location, with the opportunity to discuss the premises of a farm, research station, wholesale market etc. Interviews were carried out in the first week of September 2018, followed by a second round in the last week of September 2018 to review and discuss findings and to design a plan to improve the AKIS (chapter 4).

Table 2.2 *The seven functions of an AKIS (Adapted from Andersen, 2015; Bergek et al., 2008; Hekkert et al., 2007; Hekkert and Negro, 2009; Turner et al., 2016)*

1.	*Education, technical training, research and data collection*	Fundamental to the innovation process and involves the learning processes related to developing and utilising new knowledge of a technology or set of practices. The development of new knowledge can occur through formal research (e.g. at universities and governmental and non-governmental research centres), the private sector (e.g. agri-business) or at the individual level (e.g. farmers).
2.	*Knowledge diffusion through networks*	The exchange of information through networks, where research and development (R&D) meets government and markets. Policy decisions should be guided by the latest technological research, and R&D agendas should be adapted to changing environmental, market and social conditions.
3.	*Development of a vision for the agricultural sector*	Refers to the creation of a vision for the AKIS and mobilisation of incentive structures to promote that vision. Incentive structures may change in response to factor prices and regulatory pressures (e.g. product prices, taxes and subsidies), expectations in market growth potential, new knowledge, expression of interest by customers, cultural changes and external events.
4.	*Entrepreneurial activities*	Turn the potential of new knowledge, networks and markets into concrete actions to develop and capitalise on business opportunities.
5.	*Market formation*	Is about creating demand for the outputs of the innovation process. New technologies or practices often have difficulty competing with the *status quo*, so a market must be created via institutional change. Market creation can occur through changes in regulation and taxes and/or investment in infrastructure complimentary to the innovation.
6.	*Creation of legitimacy*	It is necessary to overcome resistance to a new technology or set of practices from the existing production, trade and consumption systems. The innovation must be considered appropriate and desirable by incumbent actors for resources to be mobilised rather than blocked.
7.	*Resource mobilisation*	Is closely linked to the creation of legitimacy and concerns financing investment in innovation in the form of access to credit, seed funding, venture capital, investment in human and social capital and the development of complementary products, services, infrastructure etc.

3 Analysis of the Jordanian AKIS

The Jordanian agricultural AKIS is characterised as poorly functioning. Its key deficiencies centre around: poor matching between the needs of the agricultural sector and the education and training currently being offered to students, a public extension system that lacks capacity to provide effective services to farmers, a private extension system that does adequately serve small-holder farmers, the lack of a common vision among both public and private entities for how the agricultural sector should prepare for the future and a deficiency of the elements needed to support entrepreneurial activities.

In the following section we analyse the Jordanian AKIS in detail, specifically identifying the barriers to its functioning successfully and highlighting potential opportunities for the Government of the Netherlands to have a positive impact.

3.1 Analysis of the seven functions of the AKIS

3.1.1 Education, technical training, research and data collection

The current research, education and technical training system is not meeting the needs of the Jordanian agricultural sector as a whole and those of the horticultural sector within the context of this project. This knowledge development system is impacted by three primary challenges: 1) insufficient matching between the needs of the sector and the types of education and training provided to students entering the agricultural workforce; 2) a lack of coordination among research organisations and between research and the private sector; and 3) the absence of a functioning data collection system to inform cropping and business decisions by farmers and other actors.

Central to the inadequate matching between the needs of the horticultural sector and the education and training pipeline is the societal preference in Jordan for obtaining academic credentials that convey a higher social status and the negative view of agricultural careers. Within Jordanian society, agriculture is often chosen as a 'last resort.' It is viewed as being the career path for people who score lower on national education exams. Thus, there is a stigma associated with careers in agriculture that dissuades people from entering the sector.

There is a need in both the university and TVET systems to evaluate the education curricula for appropriateness to sector needs. No such analysis has been conducted by the government in over ten years. One particular gap in the education system is the absence of an extension curriculum at both universities and technical schools. This contributes to knowledge capacity problems within the Ministry of Agriculture's (MOA) public extension system, with few extension officers in training.
Multiple meeting attendees indicated that graduates of both university and TVET programmes receive insufficient support in finding employment in agriculture after graduation and indicated a need for services that connect graduates with employment. For example, within the agricultural job market there is a strong preference by students for bachelor's and graduate degrees (specifically for engineering degrees), while the sector needs more trained technicians. University agricultural programmes offering bachelor's and graduate degrees are overly focused on developing theoretical knowledge and the applied, technical education that the sector needs. Meeting attendees brought up potentially positive actions to overcome this skills gap. Representatives from the Syndicate for Agricultural Engineers, a well-networked, non-governmental association with elected leadership, have indicated that they offer training to university graduates in an attempt to provide them with the skills needed in the sector.

Like in many other countries, technical and vocational career paths are viewed as less desirable than those that require a university degree. In the Jordanian horticultural sector, these career paths are also lower paying and the jobs are in rural locations, which are generally viewed as less desirable than

cities. As a result, TVET programmes are often viewed as a path to bachelor's or graduate degrees for those who scored lower on the national exams. While this contributes to the trend of sector employees seeking credentials that may not benefit horticulture in Jordan, graduates of TVET programmes who continue on to university study arguably possess more of the technical skills needed in the sector than their peers who pursued the university-only path.

Regarding inadequate matching between agricultural research and the needs of the horticultural sector, there are two challenges: 1) Among all organisations conducting agricultural research (public and private), universities and the private sector there is ample room for much more collaboration on research, in general. The low level of collaboration creates inefficiencies in research, leading to potential duplication among sector actors and lost potential gains from a lack of collaborative, multidisciplinary research. 2) The research agenda at the public sector agricultural research organisation, the National Agricultural Research Centre (NARC), could be much better informed by the challenges and needs of farmers and other actors in the food chain. Currently, NARC mainly conducts research at its own centres, rather than in collaboration with farmers in their fields, and farmers have very little interaction with the research being conducted at NARC facilities. This hinders the establishment of relationships with famers. It should be noted that NARC recently underwent a restructuring and the new leadership has recognised these challenges. NARC is eager and willing to work with the Netherlands to further improve its current capacity challenges.

Finally, in order for farmers to make informed planning decisions for their farm operations, they need accurate data on weather and climate and on market trends for horticultural goods, both for domestic consumption and export. The current systems for collecting these data have insufficient financial capacity to function effectively. Meeting participants indicated that there are currently too few weather stations to collect accurate data on weather and climate. Participants also indicated that the existing market trend tracking system is not functioning adequately. The government is aware of these challenges and has indicated a desire to improve both systems through learning exchanges with the Netherlands.

Despite these challenges, feedback from participants from multiple meetings point to some positive developments with regard to education and technical training. The first is a recent effort by the National Centre for Human Resources Development (NCHRD), which has conducted a study over the last five years to identify gaps in all economic sectors, including agriculture, in Jordan (the first in the Arab World). For the agricultural sector it has found that almost 32,000 job opportunities exist for Jordanian youth. When combined with the food sector the potential increases to almost 50,000 jobs. Preliminary results of the study have found that Jordanian students are beginning to shift to TVET training because there is a growing realisation that there are jobs for people with applied, technical training. This points to a potential opportunity for investment by the Government of the Netherlands to create positive change in the knowledge development system by increasing capacity among existing TVET providers.

The primary providers of TVET in the agricultural sector are Al Balqa Applied University (BAU), MOE and, to a limited extent, the Vocational Training Centre (VTC), MOL and MOHE. Other institutions, such as NARC and the Agricultural Engineers Association, also provide limited technical training through short-term courses. The MOE is the principal ministry for vocational education in the agricultural sector. MOE funds and manages a general agricultural vocational path for the last two years of the secondary education system (years 10-11). There are 23 schools for this training, five for women and eighteen for men. The curriculum, however, is outdated and not meeting the requirements of the agricultural sector. MOE is aware of this and is attempting to develop stronger ties to the sector. VTC is under the ministry of Labour (MOL) as well as the ETVET fund (see annex 3). GIZ is an important actor in improvement of TVET.

While the current TVET system as a whole suffers from the challenges of outdated equipment and facilities, insufficient coordination between TVET providers and poor matching to the training needs of the private sector, some TVET providers see potential for helping to improve the horticulture AKIS in Jordan. TVET training institutes and centres for agriculture are also distributed throughout Jordan, which provides access to those seeking training in the areas where they live. While currently

underutilised, TVET schools have the potential to act as important facilitators for connecting research to farmers and agricultural technicians. Additionally, the new leadership at NARC has indicated that they want to establish stronger ties to vocational schools for certificate programmes.

Some interesting TVET providers are BAU and VTC. BAU is a government-sponsored university, with twelve faculties spread throughout the country, offering technical diplomas and associate, bachelor's and master of science degrees. The curricula are iterative and adaptive, and claim to be adaptively based on the changing needs of the sectors they educate. BAU Consulting Center certifies all private technical universities in Jordan. Although BAU does not currently have an agriculture faculty, its agriculture and water academia and research are closely connected and BAU has expressed an interest to develop a technical training program for agriculture. This to improve the agricultural TVET system with a demonstrated track record of working with other Jordanian universities, both public and private. BAU has worked with international partners, including ERASMUS, IC Delft and Wageningen UR. Representatives from BAU have expressed their interest in participating in consortia with other universities to improve the agricultural TVET system. Representatives have indicated that they would need technical advice from the Netherlands on how to develop the university's agriculture programs.

While it is currently constrained by budgetary limitations, VTC offers technical training in seventeen specialisations in the agricultural sector, having trained approximately 365 students between 2015 and 2018. They base the scope of their training courses on feedback from farmers on the sector's needs through 'follow-up units.' VTC offers two training tracks, field studies and a consultative track that trains technicians to work in the private sector. Approximately 68% of graduates of the programmes have found work after graduation. Representatives from VTC indicated that they are well-connected to farmers in their region of the Jordan Valley. They also indicated that with support they could coordinate with the Government of the Netherlands to train farmers in specific skills identified as needed for capacity development in the sector.

In addition to BAU and VTC, NARC conducts a large number of trainings for local stakeholder and also organizes a large number of training courses for neighboring countries. It sees itself as a 'training hub' for the region. NARC has the ambition to step up its activities in TVET and expressed the intention to develop a Centre of Excellence located at an existing research station, preferably in the context of cooperation with the Netherlands.

3.1.2 Knowledge diffusion through networks

In the Jordanian agricultural AKIS, the *knowledge diffusion through networks* function is closely linked to the *education, technical training, research and data collection* and *development of a vision for the agricultural sector* functions. This is because the sector is interested in innovation for the purpose of developing the functional capacity of farmers, technicians and farm managers to implement agricultural best management practices that can increase productivity, bring farm outputs in compliance with international export standards and improve the long-term sustainability of horticulture in Jordan. Thus, the links between education and training, research and extension are primarily centred on appropriately identifying labour and technical needs at the farm level and connecting them to well-established agricultural production principles, with a firm basis in research, to achieve a vision for the sector.

In a well-functioning extension system, a knowledge network utilises feedback mechanisms to innovate a technology or sets of practices – farmer experience is relayed to research and research knowledge to farmers through extension, which builds legitimacy and demand for the sustainable agriculture practices (Rivera and Sulaiman, 2009). The primary public organisation responsible for extension activities is the Ministry of Agriculture (MOA). Housing extension with the central authority of MOA is part of a recent reorganisation within the government. Prior to this reorganisation, extension and research were both under the authority of NARC, a semi-autonomous organisation with its own Director General under the authority of MOA.

While MOA is in the process of restructuring extension, the public extension system in its current state suffers from human resource, knowledge and financial capacity challenges. There are too few

extension staff to meet farmer demands (currently only approximately sixty extension agents for the whole agricultural sector), extension agents do not have sufficient training in modern agricultural practices and disciplinary specialisations, the service does not have enough vehicles for its agents to reach farmers and there are no performance-based mechanisms to motivate agents to engage with farmers or obtain additional training. These capacity challenges within the public sector extension system mean that there are no functioning mechanisms to connect farmers to agricultural research, decision-makers and policymakers.

Representatives from MOA clearly indicated that the Ministry is aware of these shortcomings and spoke of the realisation that the Ministry itself had lost its connection to farmers and that farmers had lost faith in the Ministry. They noted that the recent restructuring is part of an effort to overcome these challenges. High on MOA's priority list is to develop a relevant approach to extension that has trusting, collaborative interactions with farmers. The Ministry has a plan to expand the extension service to 200 agents, and funding has been secured for eighty new agents in the near term. Part of this plan also involves increasing the quality of the knowledge extension agents possess and the services they provide. It is yet to be seen whether the decision to divide research and extension between NARC and MOA will enable or hinder knowledge flow between farmers, extension and research. Representatives from the Agricultural Engineers Association indicated that they are hopeful the reassignment of extension to MOA will provide an avenue through which farmer experiences can reach policymakers. It would be useful for the Government of the Netherlands to pursue a supportive approach to help this reorganisation of the public extension system to become a success.

Private extension services provided by agricultural input suppliers are better regarded among farmers than public extension. However, private sector extension services focus on wealthier farmers who buy the providers' products and are not meeting the needs of poorer small-holder farmers. One influential private sector individual noted that the extension services provided by input suppliers are motivated by profit and that there is a need for a strong public sector extension system to ensure that all famers are reached with relevant independent and appropriate know how and technologies. MOA does not yet have a mechanism for coordinating with private sector extension, and there are potential gains to be made by developing stronger ties between the private and public sectors.

Noteworthy secondary actors involved in *knowledge diffusion through networks* include the International Fund for Agricultural Development (IFAD), the Jordan Valley Authority (JVA) and VTC. IFAD has funded the creation of farmer field schools. These schools are implemented by the Jordanian Enterprise Development Corporation (JEDCO) and focus on helping farmers develop knowledge along the entire value chain for one crop. Through this project, IFAD has developed close ties with leader farmers, who then go on to train other farmers. JVA is noteworthy in the Jordan Valley, as the ministry-level agency is well engaged with and has a favourable reputation among farmers in the Valley. Finally, while VTC primarily focuses on training technicians, representatives from the Centre indicated that they base their training courses on feedback from farmers on what they need.

Across both public and private sector extension, knowledge diffusion for developing a market for Jordanian horticultural products is ineffective. Current horticultural exports are hindered by MRLs that exceed international standards, and farmers have too little capacity for implementing best management practices to achieve MRLs for export markets. Neither public nor private sector extension services focus on a full business model approach that links agricultural best management practices to farmer profits.

Both of these shortcomings in the current knowledge diffusion system provide opportunities for donor investment to make a measurable difference in the sector. Efforts could focus on building consortia to work with TVET providers, private sector exporters and extension services, and trusted sector actors to connect farmers with trained agricultural technicians who could provide pesticide application services, which could bring Jordanian horticultural goods in line with international MRL standards.

3.1.3 Development of a vision for the agricultural sector

Broadly speaking, there is no national vision for how the Jordanian agricultural or horticultural sector should position themselves for the future. Neither there is a vision on the role of innovation and the way the Agricultural Knowledge and Innovation System in Jordan, with all its components, could contribute to that future position of the sector. Among the ministries involved with agriculture, each ministry has its own vision for the future, and differing priorities between the ministries may occasionally lead to policies that are poorly aligned. Meeting participants noted this to be the case specifically between the Ministry of Water and Irrigation (MWI), MOA and the Ministry of Environment (MOEnv)[4]. There is no joint strategy between ministries, and while there has been some coordination on individual policy implementation, there is no broad strategy for coordination. For the AKIS, the visions of the Ministry of Labour (MoL) and of Education (MoE) are relevant as well. Multiple donor projects have attempted to increase inter-ministry coordination, but these efforts have not been very successful. The recent merger of the Ministries of Agriculture and Environment might provide a new window of opportunity for policy coherence.

Generally speaking, the sector is disorganised, with multiple organisations, including public and private sector and industry groups, working towards different visions and goals. This lack of coordination between actors hinders information sharing and feeds back into the *knowledge diffusion through networks* function. For cultural reasons, multidisciplinary teams are uncommon in Jordan, which makes it challenging to establish the types of teams needed for the sector to succeed. The agricultural sector has generally not embraced modern agricultural practices, and the impression is that at least in the past the sector is not a high priority for the Jordanian government. As in many countries the MOA was not the most influential ministry in the government, but that might change with the new Minister for Agriculture and Environment and the increasing awareness on climate change. An encouraging sign is that the government in dialogue with the WorldBank has identified agriculture as a priority sector in its so-called Growth Matrix.

Specific to AKIS, there is no national priority for innovation and research in the Jordanian agricultural sector. At the ministerial level, some meeting participants noted that MOA does not have a vision or the capacity for innovation. This is demonstrated by the ministry's continued preference for hiring individuals with graduate degrees for extension officer positions rather than those with the right technical training to meet the needs of farmers. MOA has also failed to focus on building formal connections with MOE and MOHE to develop education paths that will help it meet its priorities within the ministry. This disconnect with the education pipeline carries over to MOA's poor ties to universities with agriculture faculties and extension training programmes. From the policy standpoint, there is an overemphasis on public sector extension and not enough of an appreciation for the role of private extension services in the AKIS. This narrow focus is a missed opportunity for achieving broader goals in the agricultural system.

Representatives from MOA indicated that the ministry is aware of its shortcomings. While there is currently no national vision, MOA is currently in the process of developing a national strategy for extension, which will be the first national strategy for extension in Jordan. It is not yet clear what this strategy will look like, as it is currently under development. Ministry officials indicated that they are open to input and developing stronger connections with the private sector and are willing to work with the embassy of the Netherlands to develop the strategy.

Lack of a vision for the agricultural sector and AKIS is not solely a public sector challenge. During a roundtable discussion with representatives from multiple private sector organisations the majority of participants indicated that there is an inability to plan for the long-term within the sector – most participants discussed a planning horizon of only the next year. One participant indicated that for farmers to be able to plan for the future the following must be addressed: farmers' access to financing, a lack of marketing in the sector, poor extension services and a lack of access to markets for exports. There is currently no organised private sector leadership for long-term economic recovery of the agricultural sector.

[4] In October 2018 the Ministry of Agriculture and the Ministry of Environment were amalgamated. Effects of this have not been included in this report.

As noted in the previous section, neither public- nor private-sector extension services focus on a full business model approach that links agricultural best management practices to farmer profits. This narrow focus demonstrates a disconnect between a vision for transforming the agricultural sector and responding to individual priorities in a piecemeal fashion.

3.1.4 Entrepreneurial activities

A culture of innovation in the Jordanian agricultural sector is largely absent. This stems from a combination of external factors, such as regional turbulence, internal factors including institutional, network and capacity problems and the lack of a vision for the sector, as described in the previous section. As a result, agricultural entrepreneurs are hesitant to invest in the sector and do not have the financial means to invest in technical innovations and new market development (de Groot et al., 2018).

At the institutional level, formal institutions, such as government ministries and regulatory measures, fail to provide sufficient support for turning the potential of new knowledge, networks and markets into concrete actions to support a thriving private sector for horticultural goods (for both domestic and export markets). Informal institutions, such as political and social cultural norms, dissuade individuals from pursuing careers in agriculture (as described in section 3.1.1) and reduce the pool of potential entrepreneurs for the horticultural sector.

The role of the private sector in the AKIS is undervalued by government ministries. So while there are entrepreneurial pioneers in the market creating solutions for sectoral challenges, they are not supported or engaged by the government. People avoid working in agriculture because many of the jobs do not provide social security and health care, because income is seasonal, and because working conditions in the Jordan Valley, in particular, are difficult.

This has ripple effects throughout the private sector. Because of the current unappealing nature of agricultural careers, entrepreneurs who seek to make a good living often turn to other sectors or pursue government jobs for access to social security and health care and for better working conditions. A lack of financial and human resource capacity creates a feedback loop and lack of a vision for the private sector that was discussed in section 3.1.3. If agricultural entrepreneurs do not have the resources to plan beyond the current cropping season, they cannot adequately invest their resources to identify and capitalise on potential business opportunities. Farmers would benefit greatly from an organisation that acts as a single point of contact connecting them to technical specialists they can hire for farm services, such as pest control and fertilising. This would allow them to focus on developing the skills for whole-farm management and increase their opportunities for greater productivity and income generation. There is currently no such organisation that provides this service.

These challenges need to be addressed if entrepreneurs are going to be attracted to the sector. Financial capacity problems at the ministry level make public support for initiatives to address these challenges difficult. An opportunity exists for creating public private partnerships (PPP), forming associations where both public and private money is allocated to subsidise social security and health care. In such a scheme, famers would pay the market rate for labour, and the association would amortise payments over the course of the year to provide a steady source of income. The PPPs could also integrate the development of single point of contact farm service organisations that provide agricultural technical specialists. Additional mechanisms could be developed and supported through the PPP to ensure that farmers, labourers and technicians have contributions made for social security and health care.

3.1.5 Market formation

Market formation for Jordanian agricultural goods and services is closely related to the *entrepreneurial activities* function. Due to the external and internal factors described in the previous section, the agricultural sector is in a 'holding pattern', while Jordan's export markets are continuously evolving (de Groot et al., 2018). Because of this, Jordanian horticultural goods in general face difficulties in complying with international market standards and access to export markets is being lost. There is

limited export to Europe, including to English supermarkets that have very high quality standards (de Groot et al., 2018).

With Jordan's traditional export markets (neighbouring countries, Eastern Europe and Russia) functionally cut off due to the closing of land transport routes through conflict zones, the potential for forming new markets for Jordanian horticultural exports is limited. Opportunities do exist for the country to open up new export markets, in the GCC in particular, but Jordanian goods face fierce competition from domestic production in those countries (de Groot et al., 2018). Additionally, it is a serious challenge for Jordan to comply with international MRL standards. This hinders opportunities for exports. Opportunities for better graded and packaged products as well as specialty products also exist within Jordan, especially with some supermarkets as well as in short supply chains. The current market organisation, structured around the Amman wholesale market, is not instrumental in providing feedback from such market opportunities to farmers.

In order to create a well-functioning market for horticultural goods and services, institutional change is necessary. Improving regulatory mechanisms and the horticulture AKIS appear to be two of the most effective means of creating markets for horticultural goods.

With regard to meeting international MRL standards, existing regulations require more effective enforcement, and new regulations may be required to improve Jordan's competitiveness in export markets. An opportunity exists for addressing this through the private sector by engaging exporters and agricultural input providers to provide high quality extension services to farmers concerning best management practices for meeting MRLs. This also connects with the PPP discussed in section 3.1.4 that could provide farmers with a single point of contact for agricultural technicians trained in best management practices for pesticide spraying.

The *market formation* function also connects with the *education, technical training, research and data collection, knowledge diffusion through networks* and *development of a vision for the agricultural sector* functions. By building the capacity to train farmers in whole-farm management, establishing a well-functioning market tracking system, increasing the attractiveness of the agricultural job market and developing stronger knowledge diffusion networks the quality of crops and production of market-appropriate crops for export could be increased. Effective engagement and capacity building among TVET providers, as discussed in previous sections, would significantly assist in achieving these goals. Finally, for any of these efforts to be successful, a cohesive vision for the sector, among both private and public sectors, must be developed.

3.1.6 Creation of legitimacy

For a set of practices or a capacity building initiative to develop effectively, legitimacy for it must be built to overthrow the current production regime or to become part of it (Hekkert et al., 2007). The initiative must be considered appropriate and desirable by incumbent actors for resources to be mobilised rather than blocked. Thus, the barriers to and opportunities for increasing legitimacy in the AKIS should be identified.

The challenges facing the agricultural sector are widely known and accepted among sector actors. However, past experience by the agricultural community with government and donor projects aimed at improving the sector have negatively impacted the credibility of such efforts for the future. There are a few causal factors for this. First, MOA and the research and extension system in Jordan are poorly regarded by farmers. Farmers often do not feel that ministry representatives act in their best interest or lack the necessary training to help them improve their agricultural practices. Sixt et al. (2018) found that the cultural institution of *wasta* (an Arabic word that translates loosely to 'connections', 'clout' or 'influence') and its role in helping some individuals obtain government jobs is responsible for an erosion of trust in government, undermining efforts to support sustainable agriculture practices.

Second, in developing countries, donor activities can sometimes hinder legitimacy for improved production and management practices (Sixt et al., 2018). Some meeting participants noted that while

donor initiatives are often welcomed, some past efforts have failed to achieve desired goals because there were no effective policies to hand off projects to communities and farmers once the funding cycle ended. When insufficient capacity is developed among recipients this can create the perception that the practices being advocated for by a donor are not effective for them without significant outside resources. To overcome this, any donor-funded initiative must have reflexivity built into the innovation process so that the system is able to monitor and involve stakeholders in the process of self-governance (Weber and Rohracher, 2012).

To create legitimacy for improving the Jordanian AKIS, the Government of the Netherlands should focus on engaging trusted actors to build capacity in the TVET system, identifying sector labour needs, creating PPPs, developing a vision for the sector and coordinating with existing donors as described throughout section 3.

3.1.7 Resource mobilisation

Resource mobilisation in Jordanian agriculture is almost exclusively the domain of international donors. MOE has a limited track record of promoting hands-on technical agricultural education, but these efforts have all been funded by donors. Overall, the view of donors among the sector stakeholders is positive, but meeting participants mentioned that some donor projects have not had reflexivity mechanisms built in, as discussed in section 3.1.6.

Resource mobilisation connects with the *education, technical training, research and data collection, knowledge diffusion through networks* and *development of a vision for the agricultural sector* functions. As indicated throughout this report, the sector lacks a highly competent labour force. Accordingly, there is a need for education and technical training that is informed by sector needs and connected to research and extension. However, a vision for the sector is necessary in order to facilitate this.

Largely absent from the sector as a whole are financing and credit mechanisms to support entrepreneurial activity and market formation. As indicated in section 3.1.3, the agricultural sector is not a priority for the government, and there is no clear government-wide vision for the sector. As a result, there are few, if any, sources of government-subsidised financing to farmers to support entrepreneurial activities and market formation for horticultural goods. Within the private sector there is no common vision for agribusiness companies to offer programmes that pay to educate future employees. Additionally, organisations representing small-holder farmers do not have a strong history of advocating for small-holders and creating access to resources for those they represent.

Finally, as indicated in section 3.1.1, information systems for collecting and distributing weather, climate and market data throughout the value chain are largely absent from the sector. Resources need to be mobilised to address these shortcomings so that the sector is better supported by well-functioning information systems.

Potential opportunities exist to mobilise resources through the creation of competitive innovation funds that support the private sector in developing innovations for the sector. These innovation funds could include support for approaches that improve information systems, or those could be addressed separately as part of the larger initiative.

3.2 Summary of the Jordanian AKIS

There are three principal functions impacting the Jordanian AKIS: (1) *education, technical training, research and data collection, (2) knowledge diffusion through networks* and (3) *development of a vision for the agricultural sector*. These functions are closely interrelated and feed back into each other and are the primary drivers influencing the other functions, particularly entrepreneurial activities.

The *education, technical training, research* and *data collection* function is the most important of the functions in the Jordanian AKIS. It is highly influenced by cultural institutions related to perceptions

about agricultural careers, a knowledge infrastructure that is not meeting the needs of the sector, and a lack of sufficient interactions among actors, leading to insufficient connections between research, education and training and the needs of the sector. It is also an area that shows some of the greatest promise for improvement, as it has TVET providers who are actively interested in collaboration.

The *knowledge diffusion through networks* function is crucial for linking farmer experiences and needs to research, education and training in order to support entrepreneurial activities that achieve a common vision for the sector. The public and private extension systems are not adequately meeting the needs of the sector. However, TVET providers eager to collaborate which provides an opportunity to help overcome the challenges facing this function as well.

Problems facing the *development of a vision for the agricultural sector* function primarily have their roots in two places: 1) the formal and informal institutions within the ministries and power dynamics between the ministries that lead to siloed governance approaches and 2) the financial capacity challenges facing the country as a whole, and the agricultural sector in particular, that negatively impact the ability of farmers and entrepreneurs to establish a vision for a long-term future and mobilise financial infrastructure resources. Development of a vision is further hindered by inadequacies of the *education, technical training, research and data collection* and *knowledge diffusion through networks* functions, and the lack of a vision itself negatively impacts entrepreneurial activity, as described in section 3.1.4.

The Government of the Netherlands could make a significant positive impact in the *education, technical training, research and data collection, knowledge diffusion through networks* and *development of a vision for the agricultural sector* functions.

4 Plan to improve AKIS in Jordanian horticulture

4.1 Introduction

The analysis provided in the previous chapter shows a need to improve the Agricultural Knowledge and Innovation System in the horticultural sector in Jordan. In this chapter we propose a path for investment in the Jordanian horticultural sector to make innovation in the sector systemic, based on improved capacities of all actors.
The basic idea is to take up the challenges of the current crisis in horticulture with an innovation strategy. In Dutch horticulture this has always been a standard response to combat a crisis and has made the sector very strong in the long term. Jordanian horticulture should take a similar approach to make the most of the current crisis situation.
The Jordan government or outsiders could help the sector with innovation projects and capacity development, but the most important issue is that the horticultural sector in Jordan should make innovation and related capacity development core aspects of the way it operates, in good times and bad. The AKIS-concept implies that not only capacity development (knowledge) and innovation are promoted, but that this is done in a systemic approach, tied to the needs of the sector and society and that the synergies and trade-offs between the different innovation and capacity development projects, programmes and institutions are managed.
This objective of being able to manage an AKIS could also be the exit strategy for a programme (co-)financed by an outside donor: after the programme the Jordanian sector (business and government) should be able to take continuously innovation and related capacity development in the sector to a higher level than in the past. A programme must be designed so the Jordanian sector is able to monitor and involve stakeholders in the process of self-governance (Weber and Rohracher, 2012).

We propose to further develop the current projects into a four-year comprehensive programme to support Jordan in achieving this objective to make innovation a core part of horticulture through innovation projects that target urgent innovation needs and capacity development projects. Ideally these two types of projects should be linked by a living lab in which key public and private stakeholders in the sector learn to run an AKIS policy. Such an AKIS-innovation policy should promote a sustainable, internationally competitive and inclusive sector, with products for high-end markets, high water use efficiency and the capacity to continuously innovate in terms of technology, products, services and markets.

Figure 4.1 provides an overview of this idea in form of a four-year comprehensive programme. It includes a number of innovation projects. Some of these have started already. This cluster of innovation projects is the 'economic growth engine' for the sector. Projects target immediate needs in the current crisis, to show new pathways for income and employment generation. Water management is a key issue, as water is becoming scarcer[5] and the high level of pesticide residues is partly linked to irrigation in the fields. Innovation projects (as well as capacity building projects, discussed below) should also pay special attention to young people, women and other vulnerable persons. This not only reflects potential donor policy priorities but makes good sense from an innovation perspective; bringing new types of people into the discussion can lead to new approaches and innovative solutions in cases were the current relationships do not produce the required innovation. Potential innovation projects are discussed in more detail in the next section.

Complementary to the Economic Growth Engine with its innovation projects, we propose a number of capacity development projects, clustered as 'Capacity Engine.' These projects upgrade the competences of current institutions to support the horticultural sector in innovation with capacity

[5] Some argue that export of vegetables is de facto export of water and, given its scarcity, should not be promoted. However, it is not a very attractive future that Jordan or the Middle East has to import all its fresh vegetables for its cities. So even without export, the production for the home market has to improve its water efficiency and learn to be competitive in a situation with much higher prices for water and more water recycling.

development. They include improving TVET (Technical and Vocational Education and Training), extension, education, applied research and data management. To the extent possible, these activities should be tied to the innovation projects, for example training the advisors in the extension service that are active in the innovation projects and their colleagues to replicate successful projects elsewhere in the country. Data from the innovation projects could serve as the basis for improved data management and to support building a common vision of the future of the horticultural sector. The capacity building projects are discussed in more detail in section 4.3.

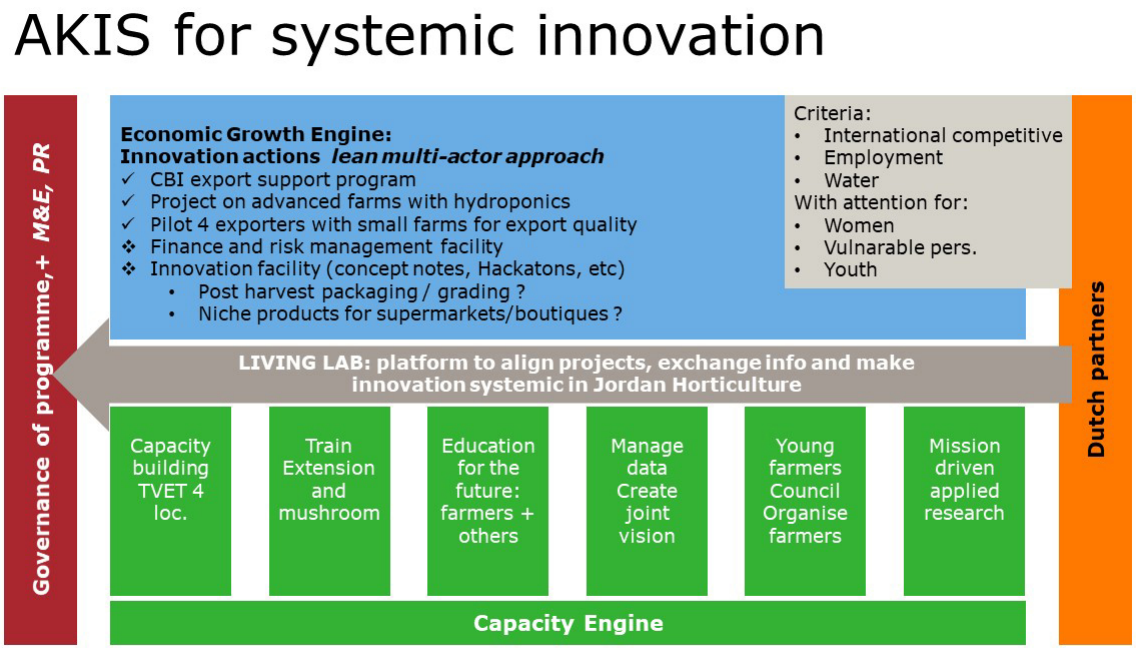

Figure 4.1 *Schematic design of a programme to make innovation a core aspect of horticulture in Jordan*

The third element in the programme is the Living Lab. This is a platform of important decision-makers in Jordanian horticulture who have to learn through on-the-job training to make capacity development and innovation a core aspect of the sector. This can be done by aligning the projects in the Economic Growth Engine and Capacity Engine and taking decisions on what the project results mean for the strategies of the different actors in Jordan.
In our view the development and the function of the Living Lab is the central and critical element in the transformation towards a horticulture sector AKIS-policy and practice in which capacity development and innovation are core. In the possible further development of the programme it is important to discuss to which extent the Netherlands could and should support a Living Lab set-up, recognizing that it is the Ministry of Agriculture in Amman that is ultimately responsible for policy making.

4.2 Economic Growth Engine

To create a sustainable, internationally competitive and inclusive horticultural sector in Jordan, with products for high-end markets, high water-use efficiency and the capacity to continuously innovate in terms of technology, products, services and markets, it is important to run a number of projects that show that innovation works. These projects should target immediate needs. The Netherlands is already running two innovation projects, and a third one will start early 2019. These are discussed below. We then propose two additional projects to accelerate innovation.

Export support programme
Market intelligence for exporters has been identified as an important bottleneck. The loss of markets in eastern Europe and the competition in the Gulf markets signal a constant need to identify opportunities in the market and have growers take advantage of them in terms of product qualities and quantities. Therefore a project has been launched in which CBI (The Netherlands) and JEPA (Jordan) improve export options by making market intelligence available in combination with coaching of exporters on how to use such information. Twenty companies have been trained and coached in how to use market intelligence of foreign markets, develop new markets and achieve entry into these markets.

Project for introduction of hydroponics (HAED)
A second innovation project focusses on improvement of Jordanian greenhouse horticulture and reduction of water use by demonstrating modern greenhouse technology and up to date cultivation practice amongst other the use of hydroponics technology. The objective is to show that improved greenhouse systems can lead to substantial higher production, help to solve the challenge of water scarcity and are a cost-effective solution for mid –size and larger horticultural farms. In 17 locations farmers are supported with investment subsidies, training and advise in improving their production . In the HAED project some 20 technical papers, 10 reports, some 20 horticultural basics courses and climate and yield data are brought together. This could somehow be incorporated in future attempts to develop courses and create data basis. The project is managed by ECOConsult (JO) with Wageningen UR and HollandDoor as Dutch partners. The official title of the project is Food Security and Creating Employment Opportunities for Refugees and Jordan's in Hydroponic Agriculture and Improving the Value Chain in the Agriculture Sector (HEAD).

Upgrading production and the value chain to meet market demands (Inclusive Horti VC Pilot)
A third innovation project, to be launched in early , is code-named Inclusive Horti VC Pilot. Its objectives are improving productivity, reducing water use and reducing costs at farm level while ensuring that MRLs meet the market requirements in combination with better post-harvest care, resulting in better prices in the international market. By working with four leading exporters, market requirements are translated to production and post-harvest activities. Each exporter works with ten lead farmers and each lead farmer involves ten 'follower farmers' to innovate their value chain. Inexpensive, sensor-based decision support software is introduced at farm level. All these actors are supported through intensive training and coaching. The plan is to scale those approaches and practices that prove successful in the pilot up as soon as possible and thus achieve massive improvements in quality, water use efficiency and production cost reductions. Whereas the hydroponics project mainly targets larger, more capital-intensive holdings, this project is of importance for smaller farmers.

In addition to these three projects that have already started or will start soon, we see a need to have two additional projects in the Economic Growth Engine. One deals with financing and the other with bottom-up innovation processes.

Financing and risk facility
As banks in Jordan only lend on the basis of collateral, it is impossible to attract financing on the basis of a business plan. This is problematic for scaling up innovation. If, for example, the hydroponics facilities are successful and can be replicated, the replication will be difficult due to a lack of access to financing. Risk reduction facilities, like insurance, not only for farms but as well for traders and banks are welcome too. For small-holder farmers, microcredit and a government-backed guaranty system (*borgstellingsfonds*) could work. SBIR grants could be a facility for financing innovation projects. A consultant could scope this project in more detail.

Innovation support facility
The aforementioned projects have been identified by consultants for the Dutch embassy in Amman to support immediate needs within the horticultural sector. To make innovation a core aspect of the system, it is important to promote bottom-up innovation activities, to improve the entrepreneurial function of the AKIS based on opportunities that farmers see. The European Innovation Partnership that promotes innovation in the second pillar of the Common Agricultural Policy with operational

groups, focus groups and thematic networks (alongside facilities for investment aid and extension) can be an inspiring example. The objective of such an innovation support facility is to promote and implement entrepreneurial innovation by farmers and others in a multi-actor approach. This can also improve the image of the sector and help attract talented young people.

There are many tools available to solicit innovative ideas, like hackathons, challenges for students and young farmers/young agri-enterpreneurs etc. Seed money, of 500 Jordanian dinars for example, and a facilitator can be made available for farmers who face a bottleneck. This can be used to help them describe the bottleneck, propose some potential pathways to alleviate it and identify which actors are needed to work on the solution. This proposal can then be granted more support (on a competitive basis), including coaching, developing a business case and plan and access to financing through an incubator facility. There may also be possibilities for linking projects to angel investors, venture capitalists or innovation funds. In Jordan the Shoman Foundation and Business Development Centre have gained quite some experience in running innovation facilities.
In different international development project the Netherlands has gained quite some experience with setting up innovation facilities. Recently two new Netherlands supported horticulture projects have started, one in Rwanda a horticulture development project under the name Hortivest and and one West Africa under the name Hortifresh. Both have an innovation facility and could be an relevant source of inspiration[6].

A Small Business Innovation Research (SBIR) programme and grant scheme could also help. Based on a call for proposals, such a programme could support projects through a three-phase approach. In phase I the most promising proposals from the call are given a first phase assignment, with a six-month duration, to develop a viability study. In phase II a fraction of the applicants from the first phase, those with the most promising feasibility study results, will be given a second, longer assignment (with a duration of one to three years, for example) to further develop their proposed innovation into a viable pilot. Phase III encompasses the commercialisation, introduction and scaling up of the innovation. This would last about one year, and no support is provided other than coaching. The innovation programme would, however, monitor progress. Innovations that can be linked to capacity building efforts or encourage public-private partnerships in education could be prioritised.
It is important not to restrict these innovations to farm level, nor to technical innovations. At a minimum, innovations have organisational and social aspects, and sometimes they are 'just' social or marketing innovations. As an innovation they do not have to be new to the world or even new to Jordan; new to the village or the supply chain is enough. In our missions we identified the scope for innovations in short supply chains, linking farmers with supermarkets and clients in Amman, as well as for post-harvest packaging and grading innovations.

4.3 Capacity Engine

To create a sustainable, internationally competitive and inclusive horticultural sector in Jordan, with products for high-end markets, high water use efficiency and the capacity to continuously innovate in terms of technology, products, services and markets, it is important to not only show that innovation works but at the same time run a number of projects that increase the capacity of actors to innovate and continuously improve curricula for education and training. We see a need to upgrade competences through capacity building in six areas.

TVET: Practical farmer training and job-oriented skill training for youths
As discussed in the previous chapter and in appendix 2, TVET requires attention. Job opportunities for Jordanian youths in the food sector are estimated at a potential of almost 50,000 jobs when there is appropriate applied, technical training. The objective of such a capacity building project is to improve the capacity of TVET providers in Jordan to train a large number of farmers and youths to successfully work in market-oriented value chain arrangements, including for high-end markets, with highly efficient water use. In this context it should be mentioned that H.E. Ibrahim al Shahahdeh has during his visit to the Netherlands in November requested to jointly develop a Jordan-Netherlands Centre of

[6] For more information see the links to the innovation facility of these two projects: http://www.snv.org/update/hortinvest-project-investment-and-innovation-fund-open-applications-now and http://ghanaveg.org/grants/

Excellence at a research station; the Centre will function as the central hub for TVET, extension and innovation.
In order to make training for farmer families and youth easily accessible, a possible Centre of Excellence could be combined with an existing TVET location (with a venue that as has access to equipment, farm land with a network of farmers and trainers) and upgrade it to modern training facilities. It could be considered to select one facility in Mafraq (highlands) and the others in the the Jordan Valley. These training facilities will be instrumental for the HEAD and the Inclusive VC-projects (see above) for short farmer training courses (and projects by others). The project staff of these projects will play a key role in training youths (students, job-seeking graduates, young employees at farms or in the chain). As in other sectors, sector councils will be instrumental in shaping the description of different job profiles and competence-based curricula. Where possible the agriculture TVET programs will be integrated with nationally recognized programmes offering qualifications and certification.
For developing evidence-based practical content for the training, use will be made of the e-learning modules developed for Horti Professional Education (technical associate degree; see below). At all levels of education more emphasis should be given to management of a farm as a whole. This includes more attention to management aspects (business economics, management science, human relation management, farm planning etc.). A modular approach can also be used as the basic training for extension staff and could be integrated into the formal education system, so as to develop integrated knowledge for farm management. The modules should assess the present level of knowledge among stakeholders and must be in line with present international knowledge and what can be done within the context of stakeholder needs. The European Qualification Network is a useful tool (see the website https://ec.europa.eu/ploteus/en/content/descriptors-page). Modules should consist of a theoretical and a practical part including hands-on crop contact.
Developing sustainable business models for the training centres will be part of the project. One solution for this could be to create an ETVET Fund with resources coming from fees for work permits collected from companies employing visitor/non-Jordanian workers, including those employed in the agricultural sector. Such financial resources can be used to support training and employment initiatives/projects in the agricultural sector.

Training a pluriform extension system to mushroom innovations
The extension system (private, by the input industry, and the public Extension Service) is underdeveloped. This is recognised by Jordanian stakeholders, and the Ministry of Agriculture has repositioned, and is planning to upgrade, the Extension Service. This is a good basis for strengthening change. The results of the Economic Engine projects will result in the ability to continuously improve the advisory capacity with new 'locally tested' knowledge and technology. Local staff working in the Economic Engine could be the core trainers of the extension/advisory staff, complemented by specialised trainers from the Netherlands.
The objective of this capacity building project would be to improve the capacity of the public and private (product-related) advisory services through a combination of improving competences and achieving deep technical knowledge. For the governmental extension service a point of attention is to develop a good mix of general, well-equipped field level staff and (T-shaped) specialists (fertigation, Integrated Pest Management (IPM), post-harvest etc.).
Such a project only finances capacity building, not hardware like cars. However, IT for the back office might be a point for attention. A first step in co-creation of a project is to invite a small, high-level public-private team from Jordan to study the organisation and performance of extension/advisory services and knowledge circulation in the Netherlands, Germany and Belgium.

Education of future entrepreneurial farmers, chain operators, service providers and others
Training farmers and advisors is one thing, but for the longer term it is also important to upgrade the education system. A project is needed to create competence-based job profiles for entrepreneurs and high level professionals with a good blend of deep specific horticultural know-how and skills combined with human resources, applied economic and business know-how and skills and ability to manage a modern market-oriented farm or other nodes of the value chain (education level 4/5).
Stakeholders in Jordan referred to this as 'creating a well-rounded person' as opposed to the current educational emphasis on just horticultural topics. The curricula must be based on e-learning/blended learning to enable upscaling. The modules will also function as a 'clearing house' for promising proven and new practices and technologies developed in the various 'economic engine' projects. So they will

be based on 'state-of-the-art, local, relevant' know-how and technology in agriculture. Elements of the curricula could also be shared with other disciplines at a later stage, to promote the multi-disciplinary dissemination of agricultural education. As such, these modules can also be used as a basis for training extension staff and as a starting point/reference for developing farmer and youth training. Balqa Applied University is a good candidate to lead this on the Jordanian side. It has already developed a similar programme for 'water professionals' and has thirteen colleges under its direct authority, while supervising another 28 private sector community colleges (for additional information, see appendix 2).
A first step in co-creation of a project between Jordan and the Netherlands is to arrange a study tour for a public-private team to the Netherlands to study 'green education' in the Netherlands and generate ideas for advancing horti/agri education in Jordan. The goal of the team should be to apply collectively reforming programs, curriculum, exams, TOTs, at the technical, vocational and/or training levels. In the following years the project would oversee the application of the curricula at higher education and TVET level and engagement with the first cohorts of qualified graduates from the program entering the labour market.

Mission-driven applied research
Current research agendas are driven more by the Higher Council for Science & Technology or Royal Scientific Society rather than by the innovation challenges in the sector. It is necessary to make the research agenda more driven by a vision for the future of horticulture and Jordan and bottlenecks in the transition of horticulture to an internationally competitive, inclusive and sustainable sector.
Through the Living Lab a Strategic Knowledge and Innovation Agenda (SKIA) with a list of topics for applied research can be created. A process can be implemented for establishing priorities resulting in for example four or five themes to be supported. This all with the aim to create implementable innovations for prioritized challenges and at the same time making applied research more innovation-driven.
The project could make four or five sandwich PhDs available at Wageningen UR or other universities. These PHD-students take up research questions stemming from the prioritized research themes.

Stakeholders expressed that the issue of increasing salinity should certainly be one of the themes. As a starter activity, a team could be asked to develop a detailed research agenda for this topic. Another topic that could be included is one PhD in Communication and Innovation studies at Wageningen UR (Prof Laurens Klerkx) to monitor the entire programme and determine whether it could serve as a framework for strengthening AKIS in other middle-income and developing countries.
Finally it is good to note the difference between the innovation facility and the mission driven applied research. The innovation facility is primarily geared towards bottom-up innovation by entrepreneurs and will provide grants and technical support. The applied research agenda will work on a limited number of prioritized challenges that cannot be solved with the available knowledge and technologies and for which new unique solutions have to be developed and that will require full funding.

Young Farmers' Council and Farmers' Organisation
One of the problems faced in achieving better alignment of the sector's education, extension and research needs is that the sector is poorly organised and has no voice; (small) farmers, young farmers and women in farming should be empowered so they can influence other actors in the system to contribute to their innovation needs.
Jordan does not have strong organisation for farmers/horticulturalists, and young farmers are not organised at all. Both types of organisation are considered crucial for developing a healthy, inclusive and sustainable sector. As a first step, a scoping mission is needed, on cooperatives and farmers' organisations. Moreover youth groups that are qualified in agriculture-related subjects, and aspiring entrepreneurs should also be identified. In the Netherlands, exchanges with NAJK CEJA and Agriterra could be organised. It can be noted that Agriterra (www.agriterra.com) has already responded positively on the request to explore possibilities for setting up a support programme for farmer organisation in Jordan.

Manage data and create vision
Data management in Jordan's horticulture sector has to be improved. For a well-functioning extension service, training and education of farmers and evidence-based policymaking it is important to have

good data. Reliable data is also needed for benchmarking of financing innovation on the basis of business plans. At present, economic and sustainability data (e.g. on water use and pesticide use) for farms are non-existent. There are no systems to exchange data and insights, neither in farm study groups, nor in the sector.
The projects in the Economic Engine are a first source of data that has to be managed. This could be the basis for a first publication with standards (like in the Dutch KWINs that provide standard gross-margin and cost-price calculations for products) and innovation performance in the sector (like in the Dutch Agricultural Economic Report or the German Agrarbericht), perhaps in the form of Harvard cases that can also be used for teaching and training.
The overall objective of this project is to manage the data in the horticultural sector and inform the sector on trends and scenarios, with special attention to showcasing innovation and updating the vision for the future of horticulture.
The extension service also expressed an interest in a feasibility study for a Farm Accountancy Data Network, as has been installed by Wageningen Economic Research in Turkey and Saudi Arabia. This was done to encourage farmers to use their own data and for benchmarking purposes (Poppe and Vrolijk, 2017). A third aspect is to use the data and analysis from the Living Lab to help the sector develop a vision and identify the main issues for making the sector future-proof.

4.4 Living Lab

The Living Lab is the most essential part of the triptych, with the Economic Engine and Capacity Engine in a programme to improve the AKIS if one wants to make capacity development and innovation systemic in Jordan's horticulture. A living lab is a user-centred ecosystem in a public-private-people partnership. The concept is based on a systematic user co-creation approach integrating research and innovation processes, along with education and training. This allows all stakeholders to consider progress and align. It turns the beneficiaries of the programme into co-creators.
The objective of the Living Lab project is to align the different projects in the programme and teach the actors to run the programme as a well-functioning AKIS so that the program is internalised in the actions of the different institutions. The Living Lab platform reports to the governance of the programme on progress and action to be taken to achieve the objective of the full programme. The result of the Living Lab is also the exit strategy of the intervention. After this programme the Jordan stakeholders should be able to maintain the AKIS on their own in the future.
Members of the Living Lab are those responsible for innovation in Jordanian horticulture (director level at the Ministry of Agriculture, NARC, some universities, Ministry of Education, Ministry of Labour) and private actors (JEPA, farm organisation, young farmers association) as well as project leaders of the projects in the Economic Engine and the Capacity Engine.
At the end of the meeting in which projects are reviewed (reflexive monitoring) the learning experiences form the basis for decision-making. This is done without the project leaders of the various projects. During the programme the decisions are partly recommendations to the governance of the programme (Dutch Embassy) and partly to the relevant ministers (e.g. do this or that with the extension service). This is essential, because it will teach the actors to run an agricultural knowledge and innovation system.
Important documents in the Living Lab are a vision for the sector, a SKIA (Strategic Knowledge and Innovation Agenda) and a self-assessment for external reviews. These are based on the reports from the data management project to support evidence-based policymaking. The Living Lab will be supported by regular external reviews/audits of the capacity building activities/their beneficiary institutions.
Jordanian stakeholders responded very positively to this concept but requested that they be allowed to start initially with a '*Dutch coach*' steering the Living Lab before being handed over to a '*Jordanian coach'*. With this approach, reflexivity is built into the innovation process so that the system is able to monitor and involve stakeholders in the process of self-governance (Weber and Rohracher, 2012). In the possible further development of the programme it is important to discuss to which extent the Netherlands could and should support the Living Lab.

4.5 Governance of the programme

The Economic Growth Engine, Capacity Engine and Living Lab are ideally developed as a single programme, as the interaction in this triptych and between the projects must be managed. This does not necessarily mean that it must be outsourced as a single programme. Some projects in the Economic Growth Engine have already been commissioned. However, there are two important reasons not to split up the programme too much. First of all, the capacity of the Embassy to run many projects at the same time and manage their coherence is limited. Secondly, there is a need for co-creation between Jordanian and Dutch partners and that is easier to arrange in a larger programme than in smaller projects. Borderless Network[7] partners and other relevant partners could play a role in this. The governance of the programme should include activities such as public relations (website, some journalistic press coverage) and monitoring and evaluation (possibly supported by a sandwich PhD in the project for applied research). The monitoring and evaluation is not only relevant as reflexive monitoring for the programme itself but could also deliver relevant knowledge for similar activities in other MENA or developing countries. It could be interesting to exchange insights with the European research programme PRIMA for the Mediterranean.

4.6 Next steps

The concepts and plans to improve the AKIS in Jordan, as presented above, should be seen as an independent recommendation from the authors to the governments of Jordan and the Netherlands. We hope and expect that the report provides a good basis for further policy discussion and eventually for developing a full-fledged comprehensive sector support with capacity development and innovation as the core. We realise that the proposed set up has a high ambition and requires considerable resources, both from the Jordan and the Dutch side. In case the available resources do not match with the proposals we would suggest not to skip one of the components as we are convinced that all the components reinforce each other and invoke win-wins in many aspects. In that case we rather would suggest to scale down some of the components, e.g. the number of TVET institutes to be supported or reduce the number of research topics. In that way the Living Lab in which the Jordanian stakeholders install an innovation policy to manage the AKIS and mobilise Jordanian resources stays a central activity. Alternatively the Jordan government could take responsibility for the Living Lab itself.
We also strongly recommend to develop a possible programme through a process of co-creation of Jordan stakeholders and the Dutch stakeholders. A first good step could be one or two study visits of Jordanian stakeholders to the Netherlands. This will enable them to form an informed opinion on which fields and with which partners Jordan might benefit most, this possibly in par with starting some first concrete cooperative activities (in addition to those projects in the Economic Engine that already have started), e.g. developing a strategic innovation agenda for the issue of salination. We also would like to suggest to give in the coming months priority to developing the innovation facility, the finance facility and the Education of future entrepreneurial farmers, chain operators, service providers and others, as well as the activity of Managing data and create vision and starting up of the living lab.

[7] The Borderless Network is a Dutch network of knowledge institutes in the agricultural sector with a focus on international collaboration. The research and education institutes have joined their forces to further strengthen the green knowledge and innovation system in the Netherlands. Within Borderless Network the knowledge institutes work together with the Dutch government and business (through the Top sectors Horticulture and starting material and Agro&Food. Internationalization is an important priority for the Dutch Green Education sector. Therefore the Dutch institutes at all levels are aligned in the 'Borderless network' partnership. It intends to combine academic with basic and advanced TVET activities in order to serve the parties in need of training the best way we can. The network explores the options to jointly develop training options with parties in the local regions, making use of the Dutch expertise. It will help to stimulate upcoming economies, and strengthen the Dutch and foreign knowledge infrastructure alike. Website: https://www.borderlessnetwork.nl/.

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Appendix 1 Agricultural/horticultural sector actors and abbreviations

Ministries and Jordanian government organisations

- Jordan Valley Authority (JVA) (Under the authority of MWI)
- Ministry of Agriculture (MOA)
- Ministry of Water and Irrigation (MWI)
- Ministry of Education (MOE)
- Ministry of Environment (MOEnv.)
- Ministry of Higher Education (MOHE)
- Ministry of Labour (MOL)
- Ministry of Trade (MOT)
- National Center for Human Resources Development (NCHRD)
- National Agricultural Research Centre (NARC) (Under the authority of MOA)
- Department of Statistics (DOS)

Education

- Al Baqa Applied University (BAU)
- Jordan University of Science and Technology (JUST)
- University of Jordan (JU)
- Centre of Accreditation and Quality Assurance (CAQA)
- Community College (CC)
- Technical and Vocational Education and Training (TVET)
- National Center for Human Resources Development (NCHRD)

Private sector/local NGOs

- Agricultural Engineers Association
- Jordan Exporters and Producers Association for Fruit and Vegetables (JEPA)
- Shoman Foundation
- Vocational Training Corporation (VTC)
- Water User Associations (WUAs)

Donor organisations/international centres

- United Nations Relief and Works Agency for Palestine Refugees (UNRWA)
- GIZ
- JICA
- USAID
- IFAD
- UNDP
- SIDA
- ICARDA

Appendix 2 Organisations represented in meetings

First mission

Day 1
- Meeting 1 – Ministry of Agriculture
- Meeting 2 – Ministry of Education, Vocational Education Dept.
- Meeting 3 – CAQA/Ministry of Labour
- Meeting 4 – GIZ
- Meeting 5 – Agricultural Engineers Association, GIZ, Dates Association, DG of NARC

Day 2
- Meeting 1 – Jordan Exporters and Producers Association (JEPA), Syndicate for Engineers, Private sector agricultural consultants, seed and pesticide experts, Ruyana NGO, JOPEA Olive Oil Association, permaculture entrepreneur, Union for Women Farmers
- Meeting 2 – NARC
- Meeting 3 – Al Balqa Applied University (BAU)

Day 3
- Meeting 1 – BAU, VTC, CAQA, MOE, National Centre for HRD
- Meeting 2 – NARC Research Centre
- Meeting 3 – VTC

Day 4
- Meeting 1 – ICARDA
- Meeting 2 – Shoman Foundation

Second mission

Day 1
Wholesale market in Amman
BAU research centre in Jordan Valley

Day 2
IFAD
UoJ research station
NARC research centre in Jordan Valley
Farmer with roadside sales point near Amman

Day 3
Reception with relevant stakeholders at the residency of the Ambassador

Day 4
Large exporting strawberry farmer
Workshop at embassy with main stakeholders of potential future programme

Day 5
Presentation at Ministry of Agriculture, discussing the findings with H.E. Khaled Hnaifat

Appendix 3 Report on TVET in Jordanian agriculture

Prepared by Mr Hisham Rawashdeh

Introduction

Jordan is a small country of 89 thousand square kilometres with limited resources situated in the Middle East region to the east of the Mediterranean Sea. According to the 2015 population and housing census, Jordan's total population is 9,531,712 of which 6,613,587 are Jordanian citizens, representing about 70% of the total population, while 2,918,125 are non-Jordanians (30% of the population) and 1,265,514 are Syrians (43% of all non-Jordanians) who left their country mainly due to the ongoing Syrian crisis which began in 2011.
Jordan is burdened with water scarcity that greatly affects its economic growth in general and its agricultural sector in particular. Annual precipitation in 90% of Jordanian land is no more than 155 mm, 5.5% of the land receives 200-300 mm and only 4% receives more than 300 mm, with maximum rainfall reaching 600 mm in some areas *(MOA annual report 2016)*.
The collective contribution of the agricultural, hunting, forestry and fishing sectors to Jordan's GDP in constant prices was estimated by DOS statistics (Jordan in figures) to be 3.5% in 2017.
Total planted land in Jordan was 1,662,107 Donom (Donom=1000 m^2) in 2016, of which 1,242,826 (i.e. 75%) was planted with field crops, 387,627 (23%) with fruit trees and 31,654 (2%) with vegetables.

Scope of the TVET education report

The focus of this part of the report '**Mapping the current AKIS/TVET in Jordan to develop enhancement recommendations**' is to explore the current status of technical and vocational education and training in the agricultural sector in Jordan to develop recommendations that contribute to the development of the Agriculture Knowledge Innovation System (AKIS) in Jordan. The report briefly describes the education and TVET systems in Jordan, exploring the role of TVET and opportunities available in the agricultural sector, identifying other supporting resources/services for TVET in the agricultural sector and concludes with findings for the purpose of developing recommendations that include the Netherlands' intervention for supporting enhancement of TVET in agriculture in Jordan.
To achieve the report's aim of exploring TVET status and developing required recommendations, the mission team conducted various activities that included:

- Reviewing related literature/documents
- Individual discussions with TVET institutions and other stakeholder representatives
- Visits to stakeholder institutions
- Three roundtable discussion meetings with:
  - MOA-related departments
  - Public and private agricultural sector organisations/representatives
  - Representatives of TVET and other supporting institutions

Education system in Jordan

The education system in Jordan as shown in figure 1 consists of preschool, basic (primary) and secondary stages as well as higher education. The Ministry of Education (MOE) is responsible for the preschool, primary and secondary stages, while the ministry of higher education and scientific research (MOHE) is responsible for higher education in community colleges (CCs) and universities.

The basic (primary) education stage lasts ten years and starts at six years of age, and this stage is compulsory for the age group concerned. According to statistics from the Department of Statistics (DOS) for 2016/2017, the number of pupils participating in the basic stage was 1,680,000.
The secondary education stage is two years, and the pupils are 16-17 years old. The secondary stage includes comprehensive academic and **vocational streams** in addition to applied secondary education. The number of the pupils in the secondary stage was 190,300 in academic year 2016/2017. Agriculture education is part of the vocational stream in the comprehensive secondary stage in MOE.
The post-secondary education, which is supervised by the Ministry of Higher Education (MOHE), ranges from 2-5 years. Institutions providing such education are universities and community colleges. Programmes of study at universities are up to five years long and culminate in the award of a Bachelor of Science or Arts degree for graduates. Community college programmes are 2-3 years and lead to an associate diploma certificate. Agriculture specialisations are offered at both levels of higher education in Jordan: the diploma level at community colleges and Bachelor level at universities.
Post-graduate study opportunities are available at some Jordanian universities (Master and PhD) in some fields, including agricultural specialisations.

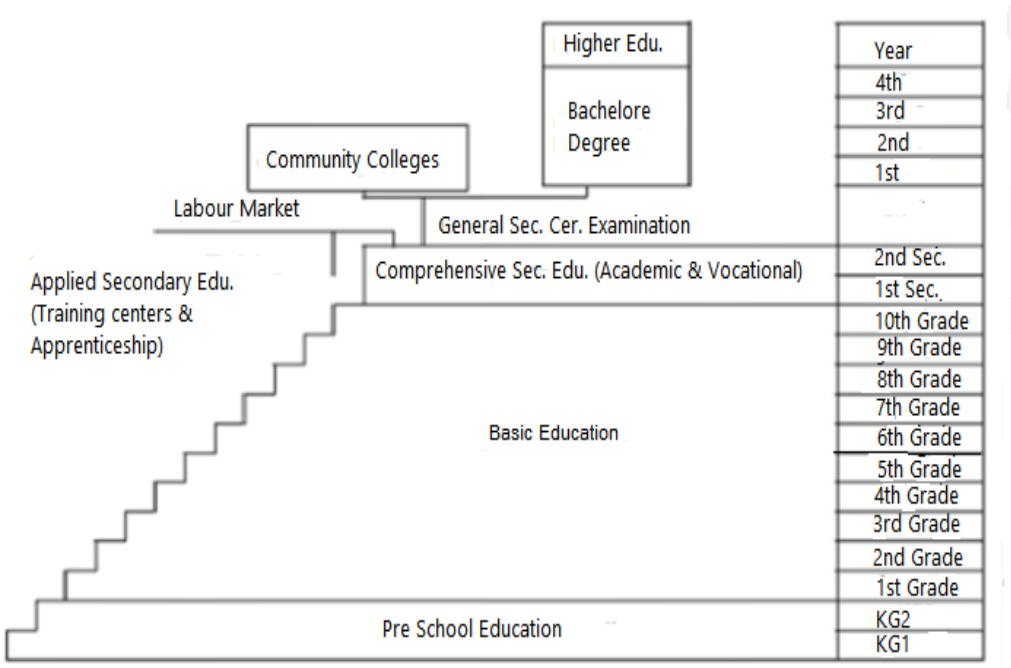

Figure 1 *Education System*

TVET providers

Main providers of technical and vocational education and training programmes in Jordan are: Ministry of Education (MOE), Vocational Training Corporation (VTC) and community colleges.

- MOE

Vocational education at MOE is managed by the vocational education and production department within the ministry. There are 197 MOE schools providing vocational education throughout Jordan, some of which are specialised vocational centres while others are comprehensive schools having both academic and vocational streams and branches. Pupils in vocational secondary programmes sit for the national general secondary certificate exams (Tawjihy), and those who followed a specific study plan that included additional subjects may continue their higher education at universities or community colleges. Otherwise they can join the labour market as skilled workers.
All teaching/learning/training activities, including both theoretical and practical parts of vocational education programmes under the MOE, are conducted institutionally at the equipped vocational

schools. Vocational education students at MOE schools are required to practice their specialisation for 24 days either in workplaces in the labour market or in their school's workshops during summer holiday.
The comprehensive secondary vocational education stream provided by MOE schools includes the following branches:

- Industrial Education
- **Agriculture Education**
- Hotel and Tourism Education
- Home Economics Education

- VTC

The Vocational Training Corporation is a governmental institution, semi-autonomously governed by a board of directors comprised of representatives of government, civil sector organisations and the private sector, and it is headed by the Minister of Labour.
According to its law No. 11 of 1985 and its amendments, VTC is mandated with:

- Providing vocational training opportunities to prepare the technical workforce and raising its level of efficiency in the various non-academic vocational training levels and specialisations, and working on diversifying vocational training, including:
  - Vocational apprenticeship that allows the young and adults to undertake long-term organised training
  - The training of institutions' employees in specialised training centres and in their work locations in order to raise their level of proficiency
  - Extensive and speedy training for various professions
  - Training in the fields of occupational safety and health
- Providing supporting guidance services for the establishment and development of small and medium enterprises (currently ineffective)
- Regulating the practice of occupations in the labour market by classifying working sites and workers therein

To understand the role of VTC in vocational training and workforce development in Jordan, it is important to mention that the occupational skill levels currently adopted in Jordan are comprised of five categories/levels: the semi-skilled, skilled, craftsman, technician and professional levels. VTC's main role is to prepare the workforce at the three basic occupational levels (semi-skilled, skilled and craftsman levels) through its vocational training programmes.
In addition to the training programmes conducted by VTC for durations usually ranging from several hundred hours to two years that prepare the workforce in various occupational sectors at the three basic levels (in some cases to technician level, in cooperation with BAU), VTC also conducts upgrading and continuous training courses targeted at workers who are already employed and other members of society in general.
Training programmes cover various occupational areas, particularly in the industrial and service sectors. To implement its training programmes, VTC has 42 vocational training institutes spread all over Jordan, and the training is mostly work-based, implemented in cooperation with workplaces and companies in the labour market through an apprenticeship training system.

- Balqa Applied University/Community Colleges (BAU/CC)

BAU is the main provider of technical education in Jordan through its colleges in various areas of Jordan. It has thirteen colleges under its direct authority, while supervising the technical aspects of the programmes at another 28 private-sector community colleges, United Nations Relief and Works Agency for Palestine Refugees (UNRWA), military and other governmental institutions/ministries.
In addition to the main, two- to three-year technical education programme, BAU/CC provides short-term training courses for individuals interested in developing their skills.
Technical education programmes at BAU colleges cover many occupational fields, including but not limited to: electrical work, automotive, air conditioning, plumbing and central heating, machining, computer maintenance, smartphones, dressmaking, ceramic crafts, chemical products and agriculture.
In addition to the main TVET providers mentioned above, there are other institutions that provide vocational training, such as the National Employment and Training Company (NET), UNRWA and private sector training institutes/centres.

TVET in the Jordanian agricultural sector

Agriculture education in Jordan is provided through the various types/levels of TVET system, including vocational training, vocational education and technical education as well as the agriculture education at university level.
The following is a brief description of the TVET opportunities available in Jordan within the agricultural sector.

- **Vocational training in the agricultural sector**

Among the main TVET providers in Jordan, VTC is the only institution providing vocational training in agriculture in which 80-90% of the training is practical. Such vocational training courses at VTC are usually short to medium-length training courses that range between forty and 700 actual training hours. Training courses in agriculture that lead to the semi-skilled worker level are usually open to pupils who have dropped out of school at sixteen years of age or older, while continuous/upgrading training courses are open to pupils/students of any educational level and age from surrounding farming communities (men and women).
Agriculture vocational training courses at VTC are provided at three training institutes in the Jordan Valley, in northern Ghore (Al Masharea Training Institute), middle Ghore (Al Ghore Al Awsat Training Institute) and southern Ghore (Ghore Al Safi Training Institute). However, only one of them (Al-Mashare Training Institute) has training facilities for agricultural training, and these are modestly equipped. There is only one staff member/agricultural engineer working as a trainer at the Al Masharea Training Institute.
The three Vocational Training Centres providing agriculture training in the Jordan Valley are conducting training courses in cooperation with other governmental institutions (MOA and Jordan Valley Authority offices in the region) and surrounding large scale farms.
In total, 524 (302 men, 222 women) trainees attended agriculture vocational training at VTC during the period 2009-2018, in the following training courses:

Training course	Duration (hours)	Type/level of the training course
Planting and pruning of ornamental plants	200	Semi-skilled
Plants grafting farmer/ worker	180	Semi-skilled
Soil and irrigation worker	200	Semi-skilled
Vaccinating date palm trees	700	Semi-skilled
Planting ornamental plants	100	Continuous training
Care of date palm trees	100	Continuous training
Irrigation pump service/maintenance	40	Continuous training
Jam production	100	Continuous training
Classifying and drying vegetables and pickle production	300	Continuous training

In addition to VTC, other institutions provide short-term training courses in agriculture, such as NARC and the Agricultural Engineers Association.

- **Vocational education in agriculture**

In Jordan, vocational education in agriculture is provided by MOE in the secondary stage. Agriculture vocational education is open to pupils who successfully completed the 10th grade, who are usually sixteen years old. A total of 23 schools offer agriculture vocational education in different governorates and sub-governorates all over Jordan, as shown in the table below.

Governorate	Number of agriculture schools	Number of agriculture teachers
Amman	3	16
Al Zarqa	1	4
Al Balqa	3	14
Madaba	1	6
Al Mafraq	2	12
Jarash	1	6
Ajloun	1	5
Irbid	9	53
Al Karak	1	5
Al Tafeleh	1	3
Total	**23**	**124**

Worth mentioning here is that in the two important agricultural areas of Jordan - the Jordan Valley Al Ghore and Mafraq governorate - there are five agriculture schools, four of which are in Al Ghore (two in north Ghore and two in middle Ghore) and one in Mafraq. Schools providing secondary vocational education in agriculture are comprehensive schools which usually provide both academic and vocational education in different streams in the same schools. There are no longer any specialised agriculture schools under the MOE.
Out of the 23 schools providing agriculture vocational education, there are five schools for women.
The curriculum for the two-year vocational agriculture programme includes subjects covering plant production, animal production, agricultural industries/food processing, environment, agricultural resources and agricultural economics (theory and practice) in addition to general subjects (history, languages (Arabic and English), religion, IT etc.).
All the 124 vocational teachers/trainers working in agriculture education at MOE have a B.Sc. in agricultural engineering. Agriculture vocational education teachers at MOE took in-service technical skill improvement courses provided by BAU in the last two years, while their pedagogical skills training was organised and provided internally by MOE. However, the technical and pedagogical training of agriculture teachers at MOE is not based on a systematic approach incorporating the actual periodic identification of the training needs of the targeted group of teachers.
While some of the agriculture vocational branches in the comprehensive schools are sufficiently equipped, others are not and need to be upgraded. Agriculture vocational education curricula are also old and need to be updated to include new technologies that have been introduced in the agricultural sector.
The number of new pupils enrolled in the first secondary class in agriculture vocational education for academic year 2017/2018 was 1,495, forming about 11% of the total number enrolled in vocational education, which is 14,000; the number of pupils in the second secondary class was 1200. A total of 885 agriculture vocational pupils sat for the national general secondary certificate exams in academic year 2017/2018, of which 432 (48.8%) successfully passed the exams.
No tracer studies have been conducted on the graduates of the agriculture vocational education in the last ten years. However, according to the general impressions of those interviewed at MOE/Vocational Education, a very low percentage of the graduates join and work in the agricultural sector; they either go to universities/community colleges or join the labour market in sectors other than agriculture.

- **Technical education in agriculture**

This level of agriculture education is provided by BAU community colleges in two programmes: plant production and food processing. Agriculture technical education at BAU is provided through four community colleges, as follows:

Community college	Programme	Accredited hours	Current number of students	Governorate/region
Irbid CC	Food processing	72	108	Irbid/north
Al Salt CC	Plant production	72	47	Balqa/middle
Al Karak CC	Food processing	72	14	Al Karak/south
Al Shobak CC	Plant production	72	10	Maan/south
Total number of students			**179**	

The technical education programmes at community colleges are open to pupils who have successfully passed the general secondary certificate exam (Tawjihi). The two-year programmes in agriculture end with the national comprehensive exam, and those who pass the exam earn the associate diploma degree, which enables them to either continue at a university for a BSc degree or enter the labour market to work as a technician in their field of specialisation.
The curricula of the 72-accredited-hour technical education programmes in agriculture at BAU/CC consist mainly of four components: technical/specialised skills, supporting skills, employability skills including entrepreneurship skills and general/life skills.
Curricula development is not based on a systematic approach that includes conducting studies/surveys of the labour market for analysis and identification of training needs in different sectors including agriculture, but ad hock committees are formed as needed with representatives from the private sector to develop related curricula in different programmes. On the other hand, no tracer studies have been conducted to follow up on graduate employment.

It is worth mentioning here that none of the TVET agriculture programmes in Jordan are currently receiving or have in the last few years received any kind of development technical assistance/support from donors or international cooperation organisations.

Supporting services/resources for TVET in the Jordanian agricultural sector

- **Related studies/surveys**

Studies/surveys required for TVET in agriculture are mainly the sector training needs demand (numbers and skills) and tracer studies for programme graduates.

Available studies on the demand of the agricultural sector in regard to workforce are two conducted by the National Center for Human Resources Development (NCHRD). The two studies were conducted at the national level and covered all areas of Jordan. The first one was on agriculture (plants and animals production) and the second was on food industries.

The agriculture study was conducted in 2014, and its main results in regard to gap between supply side from education institutes for the years (2011-2013) and estimated demand in the agricultural sector for the years (2014-2016) were as follows:

- A surplus on the supply side at the professional level (university graduates) in various agricultural specialisations/occupations was indicated by the study to be (1,243), representing about 92.5% of the total number of graduates (supply side), which totalled (1,344).
- A surplus on the supply side at the technician level (community college graduates) in plant production was indicated by the study to be (124) out of the total of (164) graduates, i.e. (75.6%). On the other hand, the survey indicated a slight demand for animal production at technician level of (6) technicians, taking in consideration that there is no education programme in this specialisation on the community college/supply side.
- The study indicated a deficit between the supply and demand at the skilled level in the agricultural sector amounted to (8,802) sheep breeders, cow breeders, vegetable farmers, field crop and animal feed farmers, tree gardening and fruit trees farmers and fish breeders. On the other hand, there is a surplus at the same levels, indicated to be (1,158) workers in tree pruning and grafting, chick production poultry breeders and bee breeders.
- The study also indicated a deficit between the supply and demand at the semi-skilled level in the agricultural sector, which amounted to (19,676) workers, almost all in plant and animal production.

Other important findings of the conducted study were as follows:

- Gender distribution of employees in 2014 in the agricultural sector was (78.9%) men and (21.1%) women.
- The majority of employees in the sector had less than a secondary high school education and their literacy rate was (86.44%) for men and (94.31%) for women.

- Graduates of various TVET programmes lacked required general skills that support employment, such as communication skills, teamwork, planning, organising and administration of time and analysis and problem-solving skills.

The food industries study was conducted in 2015 and its main results in regard to gap between supply side from education institutes for the years (2012-2014) and estimated demand in the agricultural sector for the years (2015-2017) were as follows:

- The study indicated that the demand for workers at various skill levels in the sector during years (2015-2017) amounted to (12,425), (9,383 men and 3,042 women). The majority of the demand was concentrated in occupations in the fields of breads and pastries baking, milk products making and biscuits machines operator. On the other hand, the study indicated that the number of graduates from various education institutions during the period (2012-2014) amounted to (4,494), which made the deficit between demand and supply (7,931).
- The study indicated that there was a modest deficit number of 252 between the demand for women workers for years (2015-2017), which was (3,042), and graduates during years (2012-2014), which was (2,790).

Other important findings of the conducted study were as follows:

- Gender distribution of employees in the food industries sector in Jordan in 2014 was (92%) men and (8%) women.
- 73% of women employees in the sector had a secondary education level or below, while for women this figure was 72%.

In regard to tracer studies for the graduates of TVET programmes, none of the TVET providers or any other institutions have conducted tracer studies for graduates of the agricultural sector, which led to an unclear picture about the employment status of graduates as well as employers' feedback on their performance that can be used for curricula development.

Supporting financial resources for TVET in the agricultural sector

Compared with academic education, TVET programmes are generally more costly and demanding. In Jordan, financing resources for TVET programmes including agriculture at the MOE and VTC comes mainly from the governmental budget in addition to other minor resources from trainee/student fees and other services/production works provided by VET schools/institutes to individuals and society in general. For the community colleges, the main financial resources come from the BAU. It can be said, in general, that TVET programmes suffer from lack of financing resources that may negatively impact the programmes' implementation efficiency, and consequently the quality of outcomes.

In 2005 a fund was established for financing and expansion of on-the-job training and demand-driven technical and vocational training by both public and private providers, as well as improving the efficiency and quality of programmes. The fund is called the **Employment and Technical Vocational Education and Training Fund (ETVET Fund)**. Its financing comes from a deduction of JoD (70) from each worker's permit granted to foreign labourers.

The fund finances initiatives/projects proposed by public/private sector actors if aimed at providing/enhancing training and employment opportunities for Jordanians in various sectors.

As for financing vocational training in the agricultural sector, the fund financed the following initiatives/projects during the period (2016-2018):

Initiative/project	Partner	Objective(s)	Financial support (JD)	Number of beneficiaries (trained/employed)
Training and employment of newly graduated agricultural engineers	Agricultural Engineers Association	To facilitate employment of newly graduated engineers in the private sector	316,800	400
Establishment of a training station for agriculture in Jordan Valley	Agricultural Engineers Association	To train agricultural engineers and workers on new technologies in agriculture	183,360	150
Training and employment of Jordanians on date palm trees	Al Goul Farms	To provide training tied to employment for Jordanian workers on date palm trees care	19,640	15
Agriculture vocational training for individuals with special needs	Bayt Alleqa for individuals with special needs	To train handicapped people to perform agricultural work	14,920	25
Training and employment of vets	Jordan University of Science and Technology	To provide training and employment for newly graduated vets	50,000	10
Employment and entrepreneurship training project	Jordan Valley Farmers Union	To train Jordanian youths for employment and entrepreneurship in agriculture	142,810	270

Quality assurance

Quality assurance in TVET programmes is required to ensure adequate inputs that affect the quality of the training process and consequently its outputs. Quality assurance for TVET in Jordan is the responsibility of the **Centre of Accreditation and Quality Assurance (CAQA)**, which was established in 2012 under the umbrella of the ETVET Council.

CAQA's role is:

- To prepare and develop TVET standards
- To license and accredit TVET institutions
- To conduct vocational tests and issue licenses to practice

In regard to the agricultural sector, CAQA, in cooperation with MOE, had accredited (8) programmes for students in vocational education that included: farming worker (semi-skilled level), cow breeder (skilled), poultry breeder (skilled), plant production farmer (skilled), sheep breeder (skilled), general field crops farmer (craftsman), general horticulture farmer (craftsman) and general poultry farmer (craftsman).

Conclusions

Based on the mission team visits, meetings and discussions with related stakeholders at the agricultural sector in Jordan (MOA, MOE/VE, MOL/CAQA, private sector representatives, NARC, BAU, VTC) as well as a review of related documents, conclusions can be classified as strengths and weaknesses/challenges and summarised as follows in regard to TVET in the agricultural sector in Jordan:

Strengths

- Various levels of training/education in the agricultural sector are provided through the three main TVET providers in Jordan: Balqa Applied University/Community Colleges for technical education, MOE for vocational education and, to a limited extent, VTC for vocational training. Other institutions, such as NARC and Agricultural Engineers Association also provide vocational training, but mainly through short-term courses.

- TVET providers' training institutes/centres in the agricultural sector are spread throughout Jordan, which facilitates designing, organising and implementing training programmes/courses as needed in different areas.
- BAU provides study programs in agriculture at the technical and university levels and implements applied research in agriculture, which leads to a kind of integration that improves the quality of educational programmes and satisfies the needs of a wide range of targeted beneficiaries (students, farmers, other institutions etc.).
- In addition to the technical component, the curricula of TVET programmes include other components related to entrepreneurship, soft skills and employability skills.
- Availability of the ETVET Fund, with resources coming from fees for work permits, collected from companies employing visitor/non-Jordanian workers, including those working in the agricultural sector. Such financial resources can be used to support training and employment initiatives/projects in the agricultural sector.
- Availability of CAQA within MOL, responsible for accreditation of VET programmes and issuance of occupational licences for workers, which is intended to enhance the quality of training programmes according to specific criteria that include developing occupational standards.
- Availability of TOT institutes, one under BAU and one under VTC, which can be used to develop trainers' competences to provide training at TVET institutes, including those in the agricultural sector training programmes.

Weaknesses/challenges

- Training curricula and related training equipment/facilities are not updated on a regular basis to reflect the skills currently needed in the agricultural sector.
- TVET providers work in isolated islands, and there is no coordination/cooperation among them.
- Coordination/cooperation efforts between TVET providers and private sector in agriculture with regard to designing, implementing and evaluating the training are scattered and not organised in a systematic way.
- Absence or lack of the supporting studies required for the continuous development of TVET programmes in agriculture, such as systemic identification of labour market training needs and graduates tracer studies in the agricultural sector.
- Weak enrolment in the agriculture TVET programmes. MOE, for instance, the institution with the highest intake capacity in agriculture among TVET providers, takes only about 11% of those who join the vocational education stream.
- The agricultural sector is not an attractive sector for Jordanians to work in for the following reasons:
  - Low wages for workers in the sector
  - Long and hard working conditions
  - Unavailability of social and health insurance benefits for workers
  - The seasonal nature of work on agricultural farms

Recommendations

Recommendations have to deal with identified weaknesses/challenges related to TVET in the agricultural sector, on one hand to alleviate their effects and consequences and on the other hand to foster identified strengths. Therefore, the mission team recommends supporting the implementation of the following two components, which included required actions related to the identified challenges/weaknesses:

Component 1: Capacity building of TVET providers in the agricultural sector

This component aims at developing TVET capacity in regard to curriculum development and TOT through effective cooperation and integration between TVET institutions and in partnership with the agricultural sector (private and public) in Jordan.

The component will be implemented as follows:

- Capacity development focus areas will be on curricula development, and TOT for technical aspects.
- Proposed TVET providers to be involved are: BAU/Community Colleges, MOE vocational education/agriculture branch and VTC/agriculture vocational training.
- Curricula development to cover one programme/course for each of the TVET providers involved.

- Selection of programmes/courses to be developed should be based on a systematic approach to identifying the actual training needs of farmers in priority agricultural areas, such as Jordan Valley and Mafraq.
- Identification of technical and pedagogical training needs of teachers/trainers in the selected training programmes in light of the developed curricula.
- Organising and implementing the identified technical upgrading of training needs courses for teachers/trainers, either in Jordan or abroad, in the Netherlands.
- Organising and implementing the identified pedagogical training needs courses for teachers/trainers at the TOT institute/centre in BAU or VTC.
- Each developed curriculum to be piloted at the college/institute/school of the related TVET provider in the identified priority agricultural areas.
- Accreditation of the developed training programme/course curricula by CAQA.
- The component is to be managed by the Project Management Unit (PMU), located in BAU, and directed by a steering committee with members representing all stakeholders (involved TVET providers, Agricultural Engineers Association, other private sector agriculture representatives and the Netherlands' project coordinator).
- Tracer studies to be conducted for the graduates of the implemented pilot courses, as required.
- The Netherlands' support, to include technical and financial assistance required to implement the component activities, including but not limited to:
  - Establishment of the PMU in partnership with BAU
  - Secondment of long- and short-term experts as required for implementing the component's activities
  - Upgrading training facilities equipment in the selected TVET providers' college/school/institute for piloting the developed programmes/courses
  - Upgrading related teachers'/trainers' technical skills through training courses in both the Netherlands and Jordan

Component 2: Support establishment of service centres in the agricultural sector

This component aims at strengthening the link between TVET programmes and employment of Jordanians in the agricultural sector through enhancement of the employment conditions.

As mentioned previously, one of the challenges facing the TVET in the agricultural sector which 'may be the most critical one' in Jordan is the unattractiveness of the sector for Jordanians to work in, even those who graduate from agricultural TVET programmes. Although other factors may affect this issue, such as economic, social and political factors, the main causes for the unattractiveness of the sector identified by many of the stakeholders who were involved in the meetings and discussions were as specified above, in the challenges. The proposed concept for dealing with causes of unattractiveness of the agricultural sector is through the establishment of service centres, based on the following:

- Established service centres will provide:
  - Permanent recruitment/employment opportunities in the agricultural sector for young men and women, with appropriate benefits (wages, social insurance and health insurance, in accordance with labour law requirements)
  - Pre-employment/initial and on-the-job training for newly recruited agriculture workers, as well as upgrading training to cope with agricultural technology developments in the sector
  - Providing farmers with agricultural workers, according to their needs, on a monthly, weekly or daily basis
  - Identification of needed skills in agriculture in the surrounding area, systematically and on continuous basis
  - Other services needed by farmers, like leasing agricultural equipment
- Each service centre to be established and managed by a private sector agriculture organisation/association, under the direct supervision of a board of directors with one or more representatives of the government (related institution/suggested MOL, MOA)
- Suggested private sector agriculture organisation/association for the management of the service centres include, but are not limited to: Agricultural Engineers Association/Karamah training station, Water Users Associations and farmers' unions
- Twinning/partnership agreement to be established between each service centre and the nearby agriculture TVET institute. According to this agreement, the institute will provide pre-employment/initial and upgrade training for the service centres' recruited agriculture workers/employees

- Financial resources for the establishment and operation of the service centre will include:
  - Project support from the Netherlands for a transition period of two to four years
  - ETVET fund support for a transition period of two to four years
  - Revenue of the service centre from the work of its employees on farms and in other services
- Tripartite partnership agreement to be signed by parties to the selected association to establish the service centre, ETVET fund and the Netherlands' project to identify each financial contribution in support of the establishment and operation of the centre
- The Netherlands' support is to include financial and technical assistance required to implement the component activities, including but not limited to:
  - Provision of equipment and furniture as needed to establish service centres
  - Transferring the Netherlands' experience in establishing and operating similar service centres through secondment of long- and short-term experts, as required
  - Conducting study tour(s) for the centre's key staff to the Netherlands to introduce them to similar experiences
  - Capacity development of the twin/partner TVET institute concerning initial and upgrade training design and implementation
- With the support of the Netherlands, starting establishment of two pilot service centres in two different agriculture areas in Jordan, after which this can be repeated in other areas as required, based on the Jordanian experience gained and local financial resources
- Each service centre to be financially independent within a maximum of four years after its establishment

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