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Mid-Term Evaluation Pilot Inclusive Horticulture Value Chain

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PROMOTING HORTICULTURE BY INTRODUCING FARM-LEVEL CULTIVATION IMPROVEMENTS

Best practices and lessons learned from an RVO pilot project in Jordan



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Introduction

In 2018, the Netherlands Enterprise Agency (RVO), in close consultation with the Embassy of the Kingdom of the Netherlands (EKN), launched the pilot project 'Inclusive Horticulture Value Chain Jordan (IHVC)'. Since then, Jordan had become one of the focus countries of the Dutch Ministry of Foreign Affairs. The Netherlands invests considerable sums of money to support the country with its large refugee population. A sizable portion of the funds have been dedicated to the agricultural sector, with a particular focus on the horticultural sector. According to the Ministry of Foreign Affairs, a stronger horticulture sector has the "potential to contribute to economic growth, food security, and employment generation for Jordanian host communities and Syrian refugees".

The horticultural sector interventions are framed by the Dutch development policy and strategies, including objectives such as increasing incomes, generating employment, decreasing water use and saving energy. It follows a value chain approach, with interventions supporting the sector from the preparation process through to crop production, and post-harvest, as well as marketing and exports.¹ Accordingly, the IHVC pilot project aimed to contribute to increasing the competitiveness and performance of Jordanian Small and Medium-Sized Enterprises (SMEs) in the export-oriented horticulture sector and thereby lead to rural job creation and income generation in horticulture. RVO and EKN selected the Dutch consultancy 'Advance Consulting' (AC) to implement the project for the project duration of 3 years, starting in January 2019. The total budget for the IHVC pilot project is Euro 1.8 million.

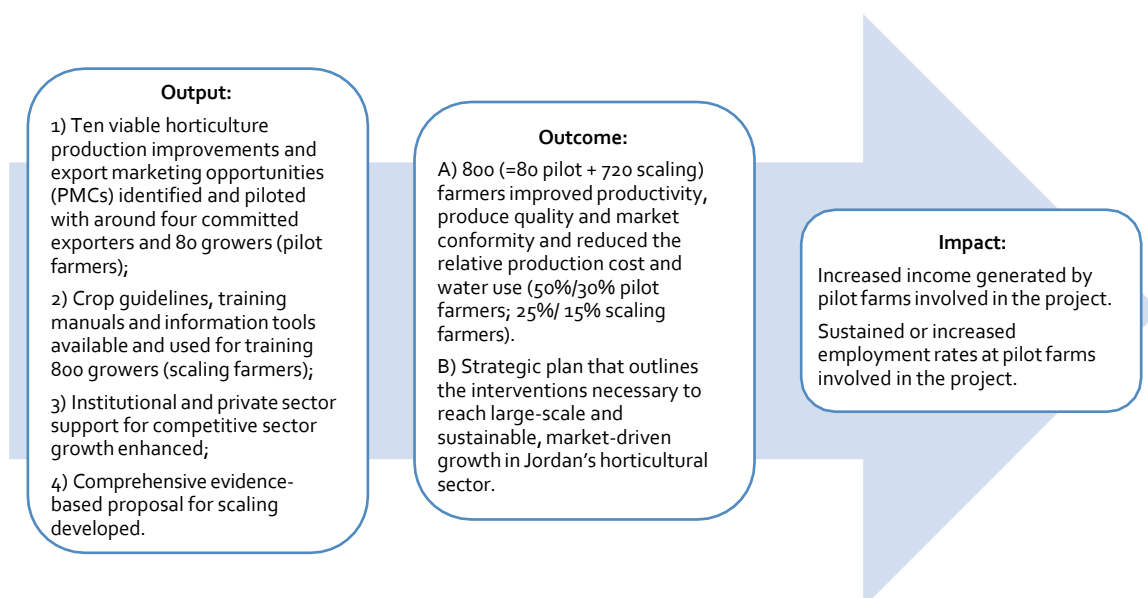
¹ Kingdom of the Netherlands. Annex A: The Netherlands in Jordan: Economic Agriculture Programming.

Overall, the underlying theory of change (further explained below) assumes that if SME farmers adopt improved farming practices and technologies leading to higher productivity efficiency, including water use efficiency, then farms will become more competitive and profitable, and employment and income levels will increase. To set this process in motion, the project focuses on identifying and introducing commercially feasible and operationally sustainable cultivation improvements. These innovations are tried and tested under the prevailing conditions of SME horticultural producers and their (export) traders.

In November 2021, RVO and EKN commissioned KIT Royal Tropical Institute and Technopolis to conduct a Mid-Term Evaluation (MTE), including a desk review, a series of (online) interviews and a field visit. The MTE was carried out against the OECD/DAC evaluation criteria including: (1) Effectiveness, the extent to which the intervention achieved its output in an effective way; (2) Relevance, the extent to which the intervention objectives respond to the needs of the beneficiaries; (3) Coherence, the compatibility of the intervention with other interventions in a country and sector; (4) Efficiency, the extent to which the intervention delivers results in an economic way; (5) Impact, the extent to which the intervention has generated or is expected to generate significant positive or negative, intended or unintended, higher-level effects, and; (6) Sustainability/scalability, the extent to which the net benefits of the intervention continue.

Evaluation approach – Reviewing the Theory of Change

The evaluation is based on the assessment of the theory of change (ToC) and an intervention output-outcome-impact logic. This logic provides a systematic building up and sequence of the key project elements. The ToC of the project presented below summarizes the higher-level and long-term impact, intermediate outcomes and the direct output related to activities:



It is worth noting that the originally defined Output 1 focused on identifying export marketing opportunities and piloting with committed exporters. However, during the inception phase and subsequent reality checks on the ground, AC flagged the low interest from exporters and questioned the outcome expectations with regard to income and employment generation. In consultation with RVO and EKN, AC proposed focusing on pilot innovations at the farm level demonstrating a range of low-cost and quick-win cultivation improvements that are likely to contribute to better incomes for farmers, improve water efficiency, and are affordable and achievable.

This paper summarizes the main findings of the MTE, identifies best practices and lessons learned and discusses contextual factors with regard to the ToC. The remainder of this paper discusses the evaluation results of Output 1 and 2 against the evaluation criteria since these were the bulk of the activities and allocated project funds.

Output and Effectiveness

Output 1: The introduction of ten viable cultivation improvements for pilot farmers

In fall 2019, AC launched the introduction of horticulture cultivation improvements by selecting farm-level innovations in close consultation with project partner Wageningen Plant Research during initial missions in Jordan. The local AC team subsequently started to identify pilot farmers of SMEs via their business contacts and via the personal networks of local agronomists in four main regions: Greater Amman, Jordan Valley, Northern Highlands and Suknah. AC planned the introduction of the innovation with each farmer in detail, based on motivation, interest, record keeping abilities, and communication skills, amongst others. AC provided technical support activities such as training, workshops, and field visits afterwards. AC further provided close guidance to farmers assisting them to introduce the cultivation improvements and to monitor implementation. The pilot farmers got to use the equipment for free during the pilot and must buy the equipment if they decide to adopt the technology in the case of specific tools (e.g., hooks, blower).

At the time of the MTE, 69 pilot farmers signed agreements to introduce nine cultivation improvements (the original project targeted 80 pilot farmers). The pilot farmers cultivate various crops in open fields or tunnels including tomato, cucumbers, eggplant, bell pepper, squash, onions, potato, lettuce, herbs, strawberries, and zucchini. Table 1 presents an overview of the cultivation improvements.

The pilot farmers employ an average of 10 employees and 9 contract workers, depending on the season. Farmers are either well educated with a degree in agriculture or inherited the farm from their family and have been farming for generations. Most farms are officially registered, but there are also smaller unregistered farms. These smaller farms tend to have more informal workers. The pilot farmer often does not own the land they cultivate. They rent the land under long-term lease arrangements. For the other farmers, the land is owned

by their families, which sometimes results in land fragmentation. If a farmer passes away, the farm is inherited by his or her sons and the farmland is split and divided amongst the children.

Table 1. Overview of cultivation improvements introduced by IHVC pilot project

Type of cultivation improvement	# of pilots	Crops	Benefit/value added	Additional observations (desk review/fieldwork interviews)
1. Blower for pollination	10	Tomato, Cherry tomato	Saving on production costs (labor)	Before, farmers used hormones or shake plants. The blower is used in combination with bees.
2. Fertigation program	31	Cucumber, Sweet pepper, Potato, Tomato, Lettuce	Increasing production, optimizing water management	Farmers save costs by using less fertilizer. The improvement goes hand in hand with testing soils samples (to learn what nutrients are missing), and water gauges to monitor water use.
3. Fogger	2	Tomato, sweet pepper	Increasing product quality and productivity	Thermal fogger is used instead of spraying. The use of the fogger in agriculture for insecticides is currently subject to some legal constraints (because it is only allowed for insects or mosquitos in buildings).
4. Hooks for tomato trellising	8	Tomato, cherry tomato	Saving on labor costs, increasing production, Increased density	The hooks imply more plants per tunnel and result in healthier and less damaged plants.
5. IPM pre- harvest interval	10	Cucumber, Tomato	Raising product quality, better market conformity, reduce costs.	The result is targeted at spraying when needed and decreases the cost of spraying.
6. IPM scouting & spraying	22	Tomato, sweet pepper	Raising product quality, better market conformity reduces costs.	Quality and practices of pesticides promote workers' health and food safety. Controlling maximum residue levels (MRLs) is one of the key challenges in the export of Jordanian products.
7. Irrigation	14	Potato, Cucumber, Tomato, Sweet pepper, Eggplant	Optimizing water use Saving on production costs (water)	A water meter is used in combination with the soil moisture sensors and fertigation program. AC has placed the meters and sensors at the farm and the data will be either automatically or physically (pictures of water gauge made when visiting the pilot farmers) sent to WUR for analysis.
8. Late Blight	2	Potato	Raising product quality and production losses	App helps to identify late blight disease for potatoes.
9. Shade net against flying insect pests	2	Grape for leaves	Raising product quality and production losses	New pilot will be implemented next season.
Total number of pilots	101			

Most pilot farmers sell their produce at the Central Vegetable Market in Amman. Many of them do not know if their produce is eventually sold on the local or export market as there is almost no communication or feedback between traders and farmers. A few farmers also supply local markets in the neighborhood, restaurants, hotels, and local shops. Some of the farmers interviewed own packing houses aggregating harvests for export and domestic markets. At present, there are very few contract farming or outgrower operations in the Jordan horticulture sector.

Motivation

During the MTE interviews, the pilot farmers explained their motivation to participate in the project; they expect to increase the quality and productivity of their cultivation while lowering production costs. They indicated that they are interested in learning about new innovations and technologies and getting advice from the AC agronomists. The farmers expressed much appreciation for the technical assistance and advice they received from the project, in particular from the Wageningen Plant Research (and other Dutch expertise). In addition, farmers appreciated the fact that AC is an independent party, and, therefore, they trust their advice more than advice from commercial parties, such as agro-dealers.

The relationship and direct contact with the AC agronomists have been essential key factors for the successful introduction of the cultivation improvements. In addition to the visits and advice related to the pilot, farmers appreciated the ad-hoc advice provided by the project and commitment from the AC team. The organized farm visits where pilot farmers visit other farms were also an essential way of training and contributed to the uptake of the innovations. Farmers indicated that training events and visits from other Dutch experts were very useful and practical (*"What we have learned so far has been saving us lots of money and lots of effort."*).

Some stakeholders indicated that most projects in Jordan are providing financial support to beneficiaries and that this may be a challenge for the IHVC project related to the uptake of the innovations by farmers. Indeed, some farmers indicated that they struggle financially. However, many farmers also mentioned that financial support is less important (*"Knowledge is more important to me to reduce the production cost than money."*).

Output 2: The development of guidelines, training manuals and information tools reaching scaling farmers

Under working package 2, AC and Wageningen Plant Research developed crop guidelines, training manuals and information tools to reach 720 additional 'scaling farmers': a larger network of horticulture farmers who adopt the cultivation improvements, eventually contributing to the higher-level objectives.

AC has reached and registered scaling farmers directly and indirectly via four channels:

- Live interactions: direct training sessions and demonstrations by the AC team on the ground. AC organized these events at pilot farms amongst others. Farmers are registered as reached when they have attended the events.
- Traditional and social media: dissemination of publications, posts, and videos to disseminate messages and invite farmers to adopt innovations. Farmers are registered if they leave contact details with the program team for further engagement.
- Dissemination involving supply chain partners and input suppliers transferring agronomic advice to farmers (connected as a partner for innovation). Farmers are registered as reached when they have participated in small-scale events hosted by input suppliers.
- Extension activities of officers and trainers of the Ministry of Agriculture (MoA) and University of Jordan (UoJ) who were trained by AC.

Social media

AC has developed several promotional videos and other social media materials that were disseminated via [Facebook](#) and the [YouTube](#) channels to reach the scaling farmers. The materials, featuring pilot farmers, cover fertigation schedules, MRLs, pre-harvest intervals and good spraying practices. Moreover, dissemination materials include a pest identification and pesticide selection tool, a ToT manual for horticultural extension workers, and flyers explaining the innovations of blowers and hooks.

The project made effective use of Facebook and the YouTube channels, which are the most popular social media channels in Jordan. AC has posted six videos on IPM, hooks and blower and hosted two webinar events. Counting the views, likes, comments etc., the posts reached around 41,700 persons. More specifically, the posts generated 9,600 written reactions on the project’s Facebook page, showing the importance of social media channels.



Promotion video: tomato hooks



Information video: spraying practices



Promotion video: leaf blower



Promotion video: IPM (sticky traps)

Regarding the registration of scaling farmers, AC's database includes information on how the scaling farmers were introduced to the project and details of the channel and events. AC handles two categories of recording scaling farmers:

- Active participation through personal or face-to-face interactions at live events (demonstrations etc.)
- Participation through traditional and digital/social media exchanges (viewing, commenting etc.)

Table 5 lists the numbers of scaling farmers reached via the different channels.

Table 5. Number of scaling farmers reached

Year:	2019	2020	2021	Total
Active participation in attending events				
Pilot farm field day/demo	0	0	8	8
In person demo/training	0	0	32	32
Digital media/online tutorial	0	1	52	53
Input supply demo/training	0	0	81	81
Institutional partner demo/training	0	19	76	95
Subtotal	0	20	249	269
Participation through traditional/social media registering interest via view, comments etc.	0	45	201	246
Total scaling farmers reached	0	65	450	515

Field days & demonstrations

The training and demonstration events at pilot farms and in-person meetings were very much appreciated. At the time of the MTE, six demonstration events were organized at the production sites of pilot farmers. Box 2 presents some of the experiences of the farmers.

Box 2: Farmers' experiences of farm visits

"When we went to other farmers, I got to see what other farmers do, which I thought would not be possible. So got to know through their experience that something would be possible. I got knowledge from other people what I did not expect. Got linked to other farmers. Problems I could ask about with other farmers. We helped each other, so we had more knowledge of the local market. As a result of the pilot and dissemination, the pilot farmers sometimes organize meetings with other pilot farmers. Instead of asking AC, I will now go to the farmers and ask them and check for myself what they did."

"I helped about 5-6 people with pesticide. I would recommend pesticide on what I succeeded in and what had positive impact on my farm. I did help maybe three farmers."

"My neighboring farm is not part of the pilot project, but we are sharing experiences and I give him tips, they benefit from me, and they also provide me with some support from their experiences."

Partners of innovation: input suppliers

Since 2020, AC has introduced a new approach to reach scaling farmers by involving input suppliers. The incentive for joining the project is reputational for input suppliers, and it provides an opportunity to extend their client base and to sell more by offering additional advice to clients. Collaboration was started with eight agricultural input suppliers to promote several cultivation improvements to horticulture growers and has evolved into a network of 21 input suppliers. AC trains input suppliers and provides banners and promotional materials are provided with the shops (on the hooks and blower) and charts to compare different pesticides and their effectiveness.

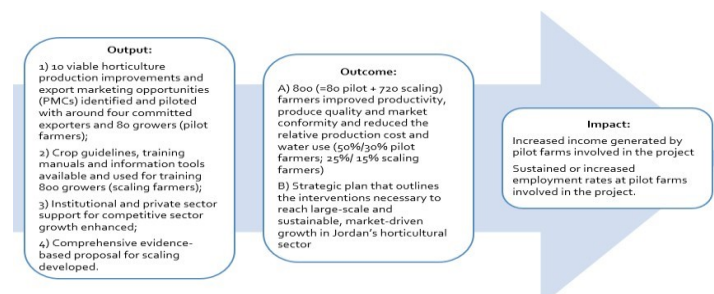
COVID-19 implications and measures

COVID-19 has had an impact on the project implementation of Outputs 1 and 2. Strict lockdown started on 15 March 2020 due to COVID-19, which caused almost all project activities to be put on hold. During the lockdowns, farmers needed permits to leave their house to reach farms. The curfew restricted working hours on the farm and only allowed a few workers, which was not enough during harvest time (or generally).

As a result of the lockdowns, Dutch members of the team were repatriated to the Netherland, and the trainings planned with the highlands farmers were cancelled. Nearly all project activities could be carried out as planned between April and October 2021, with the exception of activities which involved Wageningen Plant Research. The AC team shifted focus to institutional developments and preparation for the upscaling of successful horticultural innovations during a six-month period. Meanwhile, AC quickly developed and switched to online scaling and dissemination activities via social media, which they consider a factor in reaching scaling farmers successfully.

Outcomes

The previous section reviewed Outputs 1 and 2. This section addressed the outcome level of the theory of change, which concerns improved productivity, produce quality and market conformity, and reduced the relative production cost and water use.



AC recorded data on progress as costs/benefit profiles and farm-level data, as well as comparing cultivation data from test and control tunnels at the farms. The data include yield, costs, revenue, and usage of inputs as

labor, water, electricity, fertilizers, and chemicals (the scope and depth of the data collection is new for the Jordanian horticulture sector). However, the MTE team experienced challenges with aggregating and analyzing existing data at outcome level. AC's primary focus and understanding was on the introduction and technical monitoring of the cultivation improvements (see inception phase), resulting in incompleteness of outcome level data for the project as unit of analysis. Moreover, there were no detailed data collected for all scaling farmers apart from how they got involved in the project and the type of activity they were involved in. Based on the available (somewhat fragmented) sources of information, the MTE team assessed the IHVC project at the outcome level as follows.

Higher production volumes

The pilot farmers reported higher productivity in tunnel cultivation practices in terms of higher yield levels. Through increased nitrogen and potassium in the fertigation cycles, for instance, yield increased significantly; two pilot farms in al Sukhned increased yields by 12% in 2021. In the 2020-2021 Jordan Valley season, ten improved fertigation pilots were started involving addressing crop nutrient requirements, soil status and irrigation water used. Comparing data from the pilot and control tunnels, there was a 50% reduction in dropped fruit and additional yield realized because the hooks promote better crop use.

Reduced production costs

AC presented several cost-benefit analyses of the pilots involving costs decrease and profit increase (see table 6). The analyses suggest a positive outcome for the pilots concerned.

Table 6. Assessment of the results and gains (income for farmers and assess additional gains, benefits, positive externalities (discount negative externalities).

	Cost decrease	Profit increase
Baby cucumber fertigation pilot (2020)	6%	46%
Lettuce fertigation pilot (2020)	5%	25%
Cucumber fertigation pilot (2020)	3%	19%
Cucumber soil moisture pilot (2020)	0%	19%
Lettuce fertigation pilot (2020-2021)	1%	12%
Cucumber soil moisture pilot (2020-2021)	1.3%	17%
Okra IPM Scouting & Spraying pilot (2020-2021)	6%	3%

Lowering chemical residue levels

The issue of meeting MRLs is one critical factor of low competitiveness in export markets. Most farmers supply their products to the packing houses, where their products are often mixed with products supplied by other producers. There is no incentive nor traceability, and farmers are not rewarded for producing products with low

chemical residue levels (*"I deliver good products, but it is sold in bulk, and I get the blame for low quality while it is not my production."*).

AC put in a lot of effort to address the issue with MRLs in the Jordan horticulture through training and raising awareness on different parts of IPM through the various pilots and training curricula. This included crop scouting, selecting the right crop protection chemical, good spraying practices (mixing, quantity, spraying equipment, PPE gear), pest identification, using insect traps (pheromone and sticky traps), and app-based technology (Late Blight App, Tuta App). During the MTE interviews, farmers mentioned that they try to avoid the use of pesticides as much as possible. Farmers acknowledge that there is a need for healthy products with low chemical residue levels (*"We try to avoid the use of fertilizer. We try to use organic fertilizers."*). AC put an emphasis on IPM because it is one of the main limiting factors for exports that farmers can actually work on themselves (e.g., in contradiction to geopolitical factors in other countries that hamper market access).

Increased product quality and higher market conformity

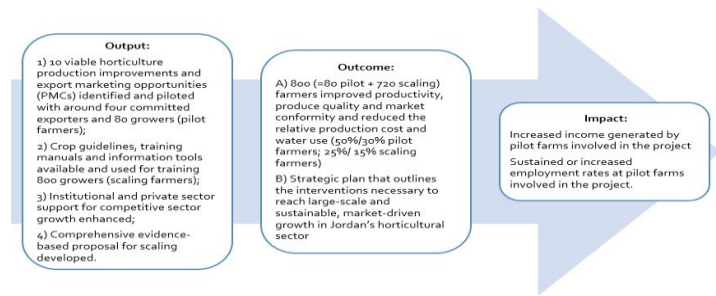
Pilot farmers reported an increase in product quality. Examples are bigger and better colored fruits. The pilot farmers did not mention that the improved product quality created new or more sales opportunities. In reality, there is no incentive to produce higher quality products since the supplied products are mixed by pack houses when collecting products for the central vegetable market.

Reduced water use

The project provided the water meters and the fertigation schemes. The farmers interviewed explained that they are saving water and using less fertilizer as a result (*"In this way I am saving water and using less fertilizer"*). One of the IHVC project pilots to significantly reduce water usage was the use of a fogger as an alternative to spraying pesticides. In comparison to the 100 liters of water per tunnel used in traditional spraying applications, the fogger used 3 liters per tunnel. This is of particular benefit in the Jordan Highlands, where water prices are significantly higher than in the Jordan Valley. Water pricing and its scarcity is a complex issue in Jordan. The government subsidizes tap water production, so the price is low, which means that farmers are generally not very concerned about the use of water. It seems that the 'business case' for reducing water use involving this cultivation improvement is less evident for farmers.

Impacts

This section addresses the project results at a higher-level impact level, in particular, increased income and increased or sustained employment.



Increased income

The original impact of the theory of change aimed to increase incomes generated by the pilot farms involved in the project. However, as mentioned above, AC stated during the project inception phase that significant income increases are not a result that can be expected in current sector circumstances and market conditions. Moreover, aggregated data on incomes at the impact level are not available in the M&E system, therefore, it is not possible to draw a solid conclusion with regard to increased income. Despite the lowered expectations, there are indications of improved income generation in fragmented evidence available by cost and benefit profiles developed for pilot farmers (see Table 6).

However, the unfavorable business environment, market conditions, and the COVID-19 pandemic have hampered the full realization of potential profits and benefits. Exports have further decreased, and more farmers sell their products at local markets. As a result, the supply of horticulture products in Jordan has been much higher than the demand, which resulted in low selling prices (*"Marketing is major challenge due to a surplus at the local market"*). Moreover, the government regulates selling prices to protect consumers from high food prices, and the price-setting mechanisms of the government are not transparent (*"In the previous season the box of lettuce was sold for 12 JD, after one week 35JD."*).

During the project period, the input costs have increased substantially. The low selling prices are problematic for farmers who are confronted with increased input costs such as seeds, fertilized, electricity, labor and water, and subsequent cash flow issues arise (*"Sometimes I make a loss and don't even sell it because it is more expensive to bring it to the market"*).

Employment creation

After the project inception, AC, RVO and EKN agreed that employment generation or sustaining of jobs was no longer a direct and specific target of the project. Rather they are a high-level desired effect that can be reached once farmers across the sector adopt project-promoted practices and improve their business performance. Indeed, there are no indications that the pilot has created employment. None of the farmers interviewed during the MTE field visit mentioned the creation of employment as a result of the pilot project.

Conversely, farmers reported having engaged fewer laborers due to unfavorable local and export market conditions. Other reasons include the effects of COVID-19 lockdown, the availability of migrant workers and the fact that several cultivation improvements imply labor-saving practices. For example, the hooks and the blowers reduced the labor hours spent per tunnel. AC does observe that due to the cultivation improvements, labor has become available for other priorities on the farm.

Other insights about the Jordanian labor market are relevant in this regard. Farmers often hire Egyptian migrant workers. In fact, the interviewed farmers during the MTE expressed their preference for Egyptian workers (*"Because they are often single, have specific and relevant agricultural knowledge, and live on the farm so they are 24/7 available and focused on the farm"*). During lockdown, most Egyptian migrant workers went home, and the Jordan Ministry of Labor decreased the number of work permits for foreigners to stimulate the hiring of Syrian refugees and Jordanian workers. Pilot farmers suggested being reluctant to hire refugees and Jordanian workers in the near future.

Relevance of the project for the target groups

Needs of horticulture SMEs

The MTE team concludes that the cultivation improvements respond well to the needs of pilot farmers. Based on a number of visits during the inception of the project, AC framed the selection of innovations around improving tunnel cultivation techniques, labor-saving practices, and lowering the use of chemicals and water. It is important to note that the profile analysis of the pilot farmer shows that most of them are well educated, open to innovation and have the resources and means to adopt the cultivation improvements (see the section on scaling farmers).

The MTE interviews with the farmers during the field visits confirmed that key problems of agriculture were addressed, in particular with regard to the use of pesticides and fertilizers, more effective use of labor, and reducing water (*"The project made it possible for me to work on all of the problems that we have in agriculture."*).

Ambitions of the farmers

It is critical that the cultivation improvement outcomes and impacts are in line with the ambitions of the farmers as the target group. Farmers expressed different ambitions in this respect. About half of the farmers interviewed indicated that they want to expand their business and export their products. They have ambitions to grow and a few hope to establish a pack house to engage more in exports in the future (*"It is easier to have your own pack house, as it assures higher quality and getting a higher price."*).

The other half of the farmers interviewed are pessimistic about the future. Some fear the closure of their business due to the unfavorable domestic market conditions and high costs (*"If the situation stays like this, I*

might end up closing due to the high costs.”), others want to remain in agriculture but think they are not able to expand (“For the future I don’t think I will be increasing more because it is risky times. I cannot predict what will happen in the future. Farming is like a baby; you have to provide a lot for it to grow.”).

Coherence regarding policies and programs of other actors

Jordan institutional actors

The project included the development of a strategic plan (Outcome B - not discussed in this article), which aligns cooperation with relevant Jordan institutional actors in the horticulture sector, mainly the Ministry of Agriculture (MoA), the University of Jordan (UoJ), the National Agricultural Research Center (NARC), and the Jordan Exporters & Producers Association for Fruit & Vegetables (JEPA). The strategic plan aimed to reach a consensus on interventions necessary to reach large-scale and sustainable, market-driven growth in Jordan’s horticultural sector. The working group for the development of the strategic plan included staff from the UoJ (agriculture department).

During the initial stages of the project, the MoA, UoJ, NARC and JEPA were not really involved in the training and farm-level activities due to other priorities. Halfway through the project, AC increasingly involved extension officers from these organizations in ToTs, in the launch event of the tuta app and late blight app innovations, and in the field visit to pilot farms around Amman. AC aims to involve the Jordan institutional actors more actively in future events with the view to reaching larger numbers of scaling farmers.

Dutch and other horticulture support in Jordan

The horticultural sector interventions funded by the Netherlands are based on the strategic framework which includes the objectives of increased earnings, decreasing water use, and saving energy amongst others. While consistent with and supportive of the Dutch objectives for the horticulture sector, the IHVC pilot project has been original in its focus to introduce affordable and scalable cultivation improvements, specifically for SME farmers.

In addition, AC coordinated with the Dutch Centre for the Promotion of Imports from developing countries (CBI) market research in the Gulf Region and succeeded in including a number of pilot crops. The different interests of AC and CBE regarding the scope of the study limited further coordination. A renewed knowledge exchange with CBI toward the end of the project could provide updated insights into export possibilities and challenges.

A related Dutch-funded project is the Hydroponic Agriculture and Employment Development Project (HAED-Jo), implemented by Eco-Consult. The project targets large-scale farmers with advanced technologies, in

particular high productivity farmers. Eco-Consult adjusted the project after launch and now also targets SMEs and community farms for simpler hydroponic systems.

AC reports relatively little engagement with non-Dutch-funded donor initiatives, with the exception of initiatives from the World Bank, IFAD and the Norwegian Refugee Council. AC and WB have discussed the strategic plan and exchanged lessons learned about the pilot innovations. Similarly, AC expressed the ambition to align activities with IFAD projects. Furthermore, the Norwegian Refugee Council showed their interest in AC's experience with the piloting of soil moisture sensors for irrigation and agriculture projects.

In the 'ILO Decent Work program' framework, ILO addresses the concern of labor standards and worker safety, amongst others regarding the handling of chemicals. AC involved ILO to provide input for the farmer training sessions on occupational health and safety standards. Specifically, joint training is planned on the safe and responsible use of pesticides and safe spraying techniques, and workers' safety and conditions.

Efficiency

Although the MTE team did not carry out an in-depth analysis of the financial statements, it believes that the conversion of inputs (funds, expertise, time) into outputs, outcomes and impacts was realized cost-effectively, based on available data, interviews, and field observations. There are no indications that resources are not well spent or wasted by financial malpractices.

What is signaled, however, is that the number of introduced cultivation improvements and the number of farmers reached is relatively low, taking the total project budget into account. The total cost of the project (1.8 million Euro) seems relatively high considering the introduction of (existing) cultivation improvements for around 80 farmers and reaching another 525 with training and social media campaigns without having an overall insight on impact. Ideally, aggregated data provided by the project would enable an estimation of the overall project gains in financial terms: production growth, productivity growth, employment creation etc. Comparing these gains with the project budget would enable a better justification and assessment of return on investment than currently possible.

It should be noted that starting this project on the ground from scratch implies significant upfront 'sunk' costs: initiating activities on the ground, building local networks and trust, engaging pilot farmers, sorting out hardware purchases, and linking up with local institutions. In addition, RVO and EKN acknowledge the importance of gaining lessons and best practices for further developing horticulture development interventions. Against that background, the efficiency of the project will be justified to what extent future initiatives build on the sunk costs and apply the lessons and best practices learned. Against that background, the program has generated valuable lessons for the remainder of the project, follow-up projects and other future initiatives.

Sustainability

Given the fact that the project is a pilot, AC and the MTE team have reviewed options and ideas for a sustainability plan, which has to be developed towards the end of the pilot. The MTE provides several insights with regard to the sustainability potential of the project in the short and long run, from a technical, financial, and an institutional point/ownership of view.

Sustainability regarding technical product improvement

Most cultivation improvements introduced by AC do not involve advanced technical expertise. For blowers, foggers, and hooks, for instance, there will be hardly any further assistance needed to enable the farmers to continue applying these improvements. Other cultivation improvements (water meters, pesticides, fertigation schemes) involve more advanced knowledge for reading and interpretation of measurement data, which is currently carried out by AC and Wageningen Plant Research. Continued guidance will be required to achieve sustained adoption of these improved practices.

Technical sustainability refers to the further development of cultivation improvements too. Since innovation is an ongoing process responding to changing economic contexts and realities, the technical cultivation improvements will likely be relevant for a certain period of time. To remain competitive, the pilot farmers have to update and further upgrade technologies in the future (see innovation capacity section below).

Financial sustainability

Financial sustainability refers to farmers having continued access to finance to invest and apply cultivation improvements. Although no detailed financial data on investment and incentives are collected, the pilot farmers are committed to applying the cultivation improvements for the coming seasons. Most farmers expressed interest and are able and willing to purchase the associated hardware. At the same time, market incentives for certain cultivation improvements are not strong since there is little demand for a higher quality of production, higher and lower quality products are often mixed, and there is little willingness to pay higher prices for higher quality.

Institutional sustainability and ownership

AC established a local project office in Amman for the implementation of the pilot project. The intellectual ownership of the technology and monitoring of agricultural practices in the current project is with AC and Wageningen Plant Research. There are no Jordanian organizations foreseen under the pilot that could eventually take ownership of the technology and the further development and dissemination of the project. AC did establish initial contacts with the MoA, NARC and University of Jordan to explore a possible

involvement. The MTE did not identify an institutional structure that, at short notice, could take over, support, develop, and disseminate the cultivation improvement after the conclusion of the pilot project.

A related dimension of sustainability refers to the capacity of the farmers to take up the process and further innovation initiatives. Although the project did not explicitly aim at strengthening innovation capacity, it could be a point of attention in the remaining project period or future initiatives. AC did most of the planning and selection of pilots for farmers, with implied limited 'ownership' of the introduction process of the cultivation improvements.

Conclusions - best practices and lesson learned for scaling up

Dissemination and reaching scaling farmers

The MTE concludes that the cultivation improvements brought substantial benefits to the pilot farmers. AC has put a lot of emphasis on the introduction and realization of the cultivation improvements at the farm level in close consultation with the farmers. This is an important and practical achievement of the project and much appreciated by farmers and other project stakeholders. The available evidence showed improved productivity, product quality, market conformity, and reduced production costs and water use. Many farmers plan to upscale the pilot improvements to the rest of the tunnels and open fields on their farms and do not see many obstacles in doing so. The idea is that the successes of the pilot farmers are disseminated to a much larger group of scaling farmers.

There are, however, several observations from the MTE to take into consideration with a view to relevance and effectiveness. AC selected the pilot farmers based on their openness to cultivation improvements and their willingness to act as an example or model in promoting the innovations. It is unclear, however, to what extent the pilot farmers and their profile represent the larger population of scaling farmers and whether the latter are willing and capable of adopting the cultivation improvements. Some suggest that scaling farmers may be less innovative than pilot farmers. The cultivation improvements may respond less well to the needs of the scaling farmer because they may have a different profile in terms of education, innovativeness, sources available, and motivation. Further insights are required to verify the extent to which pilot farmers are representative of the larger population of SME farmers.

For scaling up, it is therefore critical to get a solid understanding of the broader population of SME horticulture farmers as a potential target group. Farmer segmentation techniques could facilitate the understanding of sub-groups. Along with the analysis of the broader population, scaling also requires the decision of whether the target group only includes SME farmers or also includes smallholder farmers to assure coherence with other local government and international donor programs. More donors have gradually started to initiate horticulture

development programs targeting smallholder farmers and large-scale farmers. No programs at the time of the MTE specifically focused on SME farmers, which is still a niche in this respect.

Types of innovation

AC has successfully realized a number of cultivation improvements. These low-cost, quick-win innovations address critical issues and have resulted in higher yield, better fertigation practices and reducing water use. However, the unfavorable business environment, market conditions, and the COVID-19 pandemic have hampered the full realization of potential profits and benefits. At present, the horticulture production supply for the local market is much higher than the demand, and the export market is challenging to access. Against that background, cultivation improvements only focusing on increasing the production volume may not be sufficient to increase incomes and create employment. Other types and/or another perspective on innovation could address these challenges in a complementary way.

For example, innovations that focus on substantially lowering production costs (input, fertigation water and labor) could result in cheaper ways of production and still be profitable in the domestic market. One other option is to introduce management and SME-level types of innovations with a view to revisiting export market opportunities and involve innovations that enable the introduction of new products while radically lowering chemical residue levels. Marketing management innovation in terms of organizing the export in a more advanced way, including post harvesting, and involving and strengthening supply chain actors. One should also be realistic about the export ambitions since current geopolitical tensions often do not provide stable export opportunities.

Embedding in existing formal institutions and social capital

Although the project is working with various public and private sector partners, the current project is not really embedded in local institutional structures. For future project scaling, it is essential to assure institutional embedding involving Jordanian universities, the Ministry of Agriculture/NARC, research/S&T centers, and agricultural extension services. Institutional embedding with formal institutions may be challenging, as these institutions have other priorities and programmers (although not involving them is not an option).

As innovation is an ongoing process responding to changing economic contexts and realities, it is expected that the IHVC cultivations will be relevant for a limited period of time (the current cultivation improvements are not successes that never end in terms of raising competitiveness). To remain competitive, companies have to update and upgrade to the continuously changing economic reality. Against that background, promoting local ownership of and involving local institutions in the innovation (process) is essential in a scaling strategy.

At the start of the project, there was little trust among the SME farmers. As a result of the demonstration visits and other exchange activities, there are first and promising signs of the creation of an informal network around

the project, which suggests the development of 'social capital'. One interesting and promising possibility could be to explore this emerging network of pilot and scaling farmers. Leveraging the existing network will be an interesting avenue to pursue with regard to promoting local ownership.

Link up with Jordanian Food Systems Strategy 2021-2030

In 2021, the Jordan government formulated its food security strategy 2021-2030. Within this framework, the government developed a vision of how the food system in Jordan should look in 2030. With regard of the scalability of the project, the project has several interesting elements to link up with the Jordanian food systems strategy (Annex 1). The strategy states that more emphasis and support are needed to boost applied research and promote technology transfer and innovation. The project is a solid example of applied research on the ground.

Theory of Change and (higher level) outcome and impact

The original project ToC suggests that increasing numbers of farmers would adopt the improved farming practices and technologies, leading to higher productivity and efficiency (including water use efficiency) levels in the SME horticulture sector. It is correct that the improved farming practices resulted in higher productivity and efficiency for the pilot farmers.

It was further assumed in the ToC that SME farms are becoming more competitive and profitable and employment levels will increase. Productivity levels in terms of production costs and production increased as a result of the project, potentially strengthening competitiveness. However, considering 'competitive' as having an active position and market share in the Jordanian or the regional market, this aspect did not materialize due to the reasons described above.

AC already flagged during project inception that these elements were not realistic. It is likely that the initial project call, developed by RVO and EKN, did not sufficiently take the context into account. The theory of change should have been based on a more rigorous analysis of the realities of the Jordanian horticulture sector and economic context. With regard to scaling, the further development of a ToC should include realistic expectations in terms of quality (adoption) and targets (outcomes, impacts) and measurement.

On the other hand, for the project implementer, it is essential that, towards the end of the project, the outcome and impact levels get sufficient balanced attention in terms of aggregated data collection. This will allow evaluations to get a comprehensive understanding regarding the realization of the ToC. This refers to the issue of whether expected outcomes and impact have been reached, and more importantly, about analyzing, understanding, and learning from the underlying causes and contexts.

Monitoring and Evaluation

Evaluating the project results at outcome and impact levels requires systematic data collection. The MTE team flags that the current M&E system of AC does not allow an aggregated assessment of higher-level outcomes and impact. Moreover, there is no detailed insight available regarding the scaling farmers and to what extent they introduce the cultivation improvements and the subsequent higher-level outcomes and the impact on income and employment. AC is currently collecting detailed insights on the profiles and uptake among the scaling farmers.

For future programs, the MTW team suggest incorporating a solid monitoring, evaluation and learning (MEL) plan, including KPIs, baseline/endline data collection points, and earmarking 5% of the project budget to it.² Adding stories of change and case studies could provide further insights regarding uptake and higher-level outcomes and impact.

² 5-10% is the standard for MEL in international development programs today.

Annex 1: Jordanian Government food systems strategy

Essential elements in the food systems strategy	Aspect of the IHVC project that could be linked with the strategy
Essential in the strategy is acknowledgement that the multi-disciplinary and multi-institutional nature of food systems requires reconsidering the roles and responsibilities of the different institutions and stakeholders.	The project created an early network of farmers that could assume a role and responsibility. Governance and ownership are essential elements to further promote.
Women and youth should be granted more attention as their role in the change process is vital.	This is an aspect that should be taken into consideration.
The strategy states that more emphasis and support are needed to boost applied research, technology transfer, and innovation system.	The project is a successful example of applied research on the ground.
Proper database for agricultural production, food and other relevant fields is a high priority in the strategy including responsive and smart monitoring, evaluation, and reporting systems.	The project has started with an M&E system in Odoos which could be further developed in another such database.
The food systems strategy acknowledges that efforts toward improving available water use are still far from being appropriate or efficient. This is mainly due to the water loss and inefficient use of ground water.	The water reduction insights gained by the project link up well.
It is equally important to create/identify champions of change to manage and lead the process at local, regional, and national levels.	The pilot farmers are de facto 'champions of change'.
Consensus building and commitment of the stakeholders including government, private sector, civil society, donors and UN organizations.	The idea of a white paper could contribute to this process.

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