



**USAID** | **YEMEN**  
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# SCALING UP YEMEN'S HORTICULTURE SECTOR

*AN ASSESSMENT AND APPROACH TO ADDRESS FOOD SECURITY AND HUNGER*



July 2013

# SCALING UP YEMEN'S HORTICULTURE SECTOR

## *AN ASSESSMENT AND APPROACH TO ADDRESS FOOD SECURITY*

### **ACKNOWLEDGMENTS**

This report was prepared by a core team of the Community Livelihoods Project (CLP), a program of the United States Agency for International Development Mission in Yemen (USAID/Yemen).

Dr. Mohammed Ilyas, CLP Senior Agricultural Specialist, planned the implementation and led the overall report research effort. Tom Green, CLP consultant, prepared the initial draft of the study and the macro-economic analysis (Annex 3). The assessment benefited from the generous contributions of time and guidance of many individuals from the horticultural sector in Yemen, notably: Farouk Mohammed Kassim Al-Alawi, Ministry of Agriculture and Irrigation (MAI); Abdulhafidh Abdurahman Qarhash, MAI; Tawfiq Sallam Mohammed Saleh, Independent Consultant; and Muhsin Kassim Al-Hubaishi, CLP. Review comments provided by Mr. Prasanna Vernenkar, Creative Associates, are gratefully acknowledged. Dorelyn Jose, CLP, Communications and Outreach Officer, authored the green house story (Annex 4). Pierre Beaulne, CLP, Communications and Outreach Officer, edited and produced the report.

While this report includes new findings from consultations, the analyses also draw upon the findings of previous studies funded by other donor agencies. Where such research has been sourced, every attempt has been made to provide credit to the respective authors and agencies.

This report was prepared under the overall guidance and direction of Tamara Halmrast-Sanchez, USAID/Yemen.

### **COMMUNITY LIVELIHOODS PROJECT**

The Community Livelihoods Project (CLP) is a program of the USAID/Yemen. CLP is improving the lives of people who are most in need by working with communities, the Republic of Yemen Government (RoYG), and local companies to create a more stable and resilient society. The program works in areas of economic development, agriculture, health, education and governance. The CLP agricultural sector works with the Yemeni Government, partners and beneficiaries to boost food security and improve incomes in project governorates.

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Cover Photo: Mohammed Al-Sanabani, USAID Community Livelihoods Project, 2013. This image of a grocery store in Sana'a, Yemen reveals a country of contrasts. While some retailers are responding to increased domestic demand for higher quality horticultural products—a trend that bodes well for farmers who can produce quality horticultural products—hunger and food insecurity remain pressing issues for the vast majority of the population.

### **DISCLAIMER**

The views expressed in this report do not necessarily reflect the views of the United States Agency for International Development or the United States Government. Creative Associates International prepared this report under the Community Livelihoods Project (CLP). Cooperative Agreement No. 279-A-00-10-0032-00.

# CONTENTS

<b>EXECUTIVE SUMMARY</b>	5
<b>SECTION 1: OVERVIEW OF AGRICULTURE AND HORTICULTURE</b>	8
1.0 Background	8
1.1 Crosscutting issues: Gender, climate change and water, qat, small enterprises	9
<b>SECTION 2: SECTORAL ANALYSIS</b>	11
2.0 Introduction	11
2.1 Horticulture sector SWOT analysis	11
2.2 Key factor analysis	13
2.3 Production and support systems	14
2.4 Market opportunities and value inputs	19
2.5 Market summary of Section One analysis: Key findings and responses	26
<b>SECTION 3: APPROACH TO STRENGTHEN THE VALUE CHAIN</b>	32
3.0 Key concepts overview	32
3.1 Outline of approach and project objectives	37
3.2 Approach to strengthen the value chain	38
3.4 Conclusions	45
<b>ANNEX 1: Illustrative activities and results to achieve four strategic goals</b>	46
<b>ANNEX 2: Definitions and resources</b>	60
<b>ANNEX 3: Estimate of macroeconomic impact of proposed value chain approach</b>	62
<b>ANNEX 4: Success story: USAID greenhouse inspires farmers to innovate</b>	64

# ACRONYMS

ADN	Agricultural Development Network/Steering Committee
CLP	USAID Community Livelihoods Project
CMCPL	Coral Management Consultants Partnership Limited
GAP	Good agricultural practice
GDP	Gross domestic product
HACCP	Hazard analysis critical control point
ICT	Information and communication technology
IFAD	International Fund for Agriculture Development
IPM	Integrated pest management
ISO	International Organization for Standardization
MAI	Ministry of Agriculture and Irrigation, Republic of Yemen Government
MFI	Micro-finance institution
R&D	Research and development
RoYG	Republic of Yemen Government
SFD	Social Fund for Development
SWOT	Strengths, Weaknesses, Opportunities and Threats (Analysis)
USAID	United States Agency for International Development
WTO	World Trade Organization
WUA	Water user association

## System of Units

ha	hectare
kg	Kilogram
m <sup>3</sup>	metric unit of volume or capacity equal to 1000 liters
mm	millimeter
MT	Metric ton (1000 kilograms = 2,205 pounds)
Oz	Ounce
USD	United States dollar
YER	Yemeni Riel

# EXECUTIVE SUMMARY

## INTRODUCTION

Yemen has a long history of agricultural production and the sector remains important in its contribution to gross domestic product (GDP), but more so for its food security and employment role in the rural areas. In recent years, Yemen has diversified agriculture by investing in irrigation systems and higher value annual horticulture crops. Despite these efforts, a 2012 World Food Programme report found that upwards of 50 percent of the population was food insecure, 22 percent were “severely food insecure, unable to produce or buy the food they need... with almost half of the children under five in the country—two million children—chronically malnourished and one million acutely malnourished.”<sup>1</sup> The findings of this study indicate that the volumes of production for most horticultural products are increasing, largely due to increased irrigated land area rather than increased productivity.<sup>2</sup> The recommendations point towards the value of building capacity across the value chain to increase the farmers’ profits, strengthen food security and address hunger.

## PURPOSE AND ORGANIZATION OF REPORT

This report provides an objective assessment of the horticulture sector in Yemen to identify potential opportunities for strengthening its food security. The report is organized in three main sections that reflect the tasks assigned to the research team, which are aligned with development objectives of the United States Agency for International Development (USAID) and priorities of the United States’ Global **Feed the Future Initiative**:

**Section 1** includes an overview of Yemen’s agricultural sector, highlighting cross-cutting issues: gender, climate change and water, qat, and small enterprise development;

**Section 2** includes an in-depth analysis of the horticulture value chain, a SWOT analysis and market opportunities;

**Section 3** describes an integrated approach to strengthen the value chain in Yemen (see **Annex I** for details)

It is hoped that the findings and recommendations in this report will be of interest to stakeholders in Yemen’s horticulture sector, the Republic of Yemen Government (RoYG), and donor agencies exploring potential opportunities to support future development interventions that address food security and help create a more stable, resilient economy for the people of Yemen.

## METHODOLOGIES

This report is a result of desk research, consultations with key stakeholders, and direct observations in the field by staff of the USAID Community Livelihoods Project (CLP). Stakeholder consultations were conducted with farmers in Yemen, staff at the Yemen Ministry of Agriculture and Irrigation (MAI), sector specialists, and private sector value chain actors, including input dealers, market intermediaries, credit providers, and other key stakeholders. In addition, where relevant, best practices observed in other countries are drawn upon. The CLP research team evaluated the market system, market opportunities, and market segmentation. This activity included interviews with importers, market intermediaries and middlepersons, collection and wholesale market participants, supermarkets, and subject matter experts in the government and donor communities as well as field interviews with cooperatives and extension workers. **Annex 2** elaborates on various definitions used in this report.

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1 World Food Programme (2013). “Yemen: Overview” [web page]. Accessed on July 31, 2013 at <http://www.wfp.org/countries/yemen/overview>

2 Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis, Production and Consumption Of Vegetables In Republic Of Yemen, 2011

## KEY FINDINGS

**Weaknesses across the value chain are impacting the quality of horticulture products.** The sector is characterized by lack of innovative technologies, quality of cost effective inputs, crop protection strategies, and credit availability. Research and development, public sector institutional capacity, extension services, and technical assistance are weak.

**Capacity of farmers' organizations needs strengthening.** Lack of collective entrepreneurship among farmers, significant amounts of post-harvest losses, unstable market information and linkages have all contributed to inefficiencies that threaten the competitiveness of the sector.

**Climate change, water scarcity and qat production pose serious challenges to the horticultural sector.**

There are two overriding threats: water scarcity and increasing qat production. An estimated 90 percent of available water is used for agriculture. Efficiency of agricultural water use is estimated at 40 percent and per capita water availability is already predicted to halve by 2050, even without the effects of climate change. Qat production is replacing horticulture crops in terms of prime land areas, and Qat out-competes other crops for scarce inputs and overall investment into the sector.<sup>3</sup> Expansion in Qat production has been mainly at the expense of other horticultural areas. Prime land has fallen to qat, which can best be reversed by improving quality and adding value to other horticultural products.

**Horticultural production plays a key role in food security, employment and mitigating internal migration.** Although the horticultural sector in Yemen is characterized as lacking capacity, it still plays a key role in achieving food security by diversifying the economic base and reducing poverty, particularly in rural areas. It is also the foundation for integrated rural development and a stabilizing factor for the population that helps limit internal migration.

**Modern subsurface irrigation systems could significantly reduce water use.** Current irrigation methods in flood and furrow irrigation are estimated to be 40 percent efficient. Modern subsurface irrigation systems can generate 50 to 60 percent water savings and yield increases up to 60 percent. However, more technical and managerial solutions need to be promoted and adapted in water conservation management such as rainwater harvesting and storage, and efficient management through drip irrigation systems.

**Greenhouse pilot projects are producing significant results, replication.** CLP is demonstrating greenhouse technology that has considerable potential to enhance input efficiency, improve quality and productivity, and save water, which may transform horticulture into a more competitive sector. CLP has established eight greenhouse demonstration sites in various ecological regions, backed by training and awareness materials, and integrated with solar and drip irrigation technologies. Innovative farmers are adapting similar practices to their own context within their own resource limitations in Sana'a and Dhamar governorates. In the near future, small-scale locally made greenhouses can promote intensification and diversification, primarily for household use but also for specialty crops such as flowers, strawberries, parsley, ginger and lettuce (see **Annex 4**) as substitutes for imports.

**Investment in input supplies, value adding and microfinance are major opportunities** that exist for expansion of the sector, while low productivity and low quality seeds, outbreak of crops diseases, and a lack of credit facilities are marked as the weaknesses and threats.

**Present infrastructures in Yemen for market information systems are nonexistent or very weak.**

General market information is limited and often inaccurate. Intermediaries and farmers communicate primarily through cell phones however on a broader basis the result is a poorly organized supply chain with vertical integration at the sector level lacking due to poor communication downstream. Previous donor funded market information collection and dissemination system programs closed down after funding withdrew. The lack of market information inhibits farmers from

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3 World Bank Report No. 54196-YE, Yemen Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications, 2010

understanding the criteria for higher value production standards and the possible price increases that may accompany quality gains.

**Many farmers and the intermediary suppliers have expressed interest in participating in a new marketing system.** Much of the export is cross-border trade with Saudi Arabia. The main concern of buyers in the export markets is low quality and inconsistent supply. There are significant differences between farm gate and local market prices due to the involvement of so many intermediaries in the market structure. For this reason, many farmers and the intermediary suppliers have expressed interest in participating in a new marketing system as they see the limitations in the existing one.

**Strengthening existing farmer organizations would provide organized demand and stimulate on-and-off-farm market opportunities.** The private sector in the horticulture value chain is almost nonexistent. There are many farmer cooperatives, associations, interest groups, and water user associations; however, few are functioning. Such groups offer means to disseminate new technologies and to bargain collectively for production inputs, commercial loans, and reduce transaction costs. If existing farmer organizations were strengthened, they would provide organized demand and stimulate on-and-off-farm market opportunities.

## RECOMMENDATIONS

**Four strategic goals: Over 80 illustrative activities, 5 planning and assessment measures.**

There is no one-size-fits-all solution to the complex challenges facing the horticultural sector in Yemen. Consequently, after reviewing the findings and in-depth discussions with stakeholders, this study proposes a comprehensive set of over 80 activities within four complementary components to achieve four strategic goals.

### Components, goals and number of illustrative activities recommended

Components	Strategic Goals	Activities
<b>ONE</b>	Improved agricultural productivity	<b>27</b>
<b>TWO</b>	Improved capacities of agriculture extension workers, services providers, farmers and nutrition workers	<b>20</b>
<b>THREE</b>	Improved and sustainable agriculture production and post-harvest technologies and practices	<b>20</b>
<b>FOUR</b>	Improved market efficiency	<b>20</b>

**Section 3.1** includes a one-page overview of component activities and goals. **Annex I** includes a matrix of the four major components, including (1) key challenges, (2) activity descriptions, (3) implementation arrangements, and (4) anticipated outputs and results.

**Five planning and assessment measures** can be found at the end of **Annex I**.

**Partnering Yemen with the US Feed the Future Initiative.** This study finds considerable support for taking steps to bring Yemen into the United States' Global **Feed the Future Initiative** as a partner and focus country. There are several reasons: Yemen's role in the Middle East region in recent years; established, strong partnerships among donors and the Yemeni Government; pressing food security issues; wide spread hunger, cross-cutting issues (i.e., gender, climate change, environment); and the complexity of issues facing the horticultural sector.

## ESTIMATED IMPACT OF PROPOSED APPROACH

**Increases in farmers' profit margins, enhanced food security.** This study estimates that significant macroeconomic impacts are associated with the value chain approach proposed (see **Annex 3**). For example, based on a scenario for 20 leebna (889 square meters) of open field tomatoes, farmers could see 50 percent to 100 percent increases in their profit margins. Food security would be enhanced, economic development strengthened and significant impacts realized if this approach is scaled up across the horticultural sector.

## SECTION ONE

# OVERVIEW OF AGRICULTURE AND HORTICULTURE

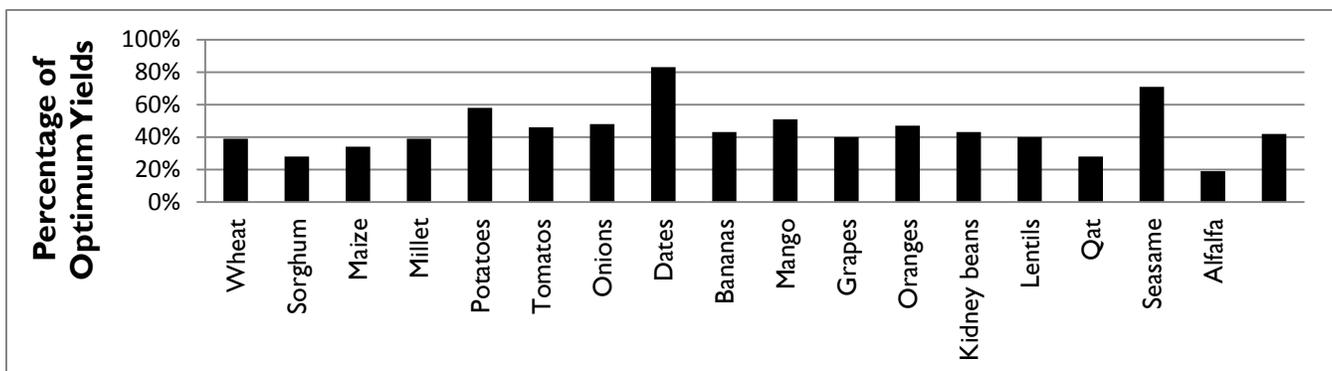
## 1.0 BACKGROUND

Yemen is largely arid, with little rainfall available for use and is particularly vulnerable to climate change and variability impacts because of its well-documented water dependence and current high levels of water stress. As a percentage of total land area, arable and permanent cropland only amounts to 3.2 percent of land. Of this 3.2 percent, approximately 50 percent is irrigated, the remainder is rain fed (average annual rainfall ranges from 500 to 800 mm in the high lands, 40 to 100 mm in the coastal areas and 50 mm in the desert areas). Furthermore, almost all of Yemen's rainfall is rapidly lost due to evaporative transpiration.<sup>4</sup>

Due to increased groundwater extraction and the dramatic increase in water-intensive qat production, the agricultural sector uses an estimated 90 percent of available water in Yemen. Although the future of agriculture is uncertain, and investment is minimal, agriculture remains an important productive sector employing more than 50 percent of the workforce. Nevertheless, this sector contributes only an estimated 15 percent to the gross domestic product (GDP) of Yemen.

In the past, Yemen was well known for the use of terraces, water-harvesting systems and irrigation schemes—many built more than 1,000 years ago. Traditionally, production of coffee, grapes, apricots, dates and other crops were oriented towards sustainable production practices. The agriculture sector has changed significantly over the years with the expansion of groundwater extraction. Agriculture now has a stronger market focus as compared to, and at the expense of, its traditional cropping methods—primarily through diversification from grains to higher value crops; expanding subsurface irrigation, taking advantage of the diversity of agro-zones in the country, and increased use of agro-chemicals. There is an increasing reliance on cereal importation. Exports are limited to fruits and lesser volumes of onions, okra and tomatoes. Due to the recent *tuta absoluta* pest (tomato larva) outbreak, all tomatoes produced are likely to be totally absorbed by the domestic market. However, even with diversification and expanded irrigation, Yemeni agriculture yields remain well below their potential (see **Figure 1**).

**Figure 1: Actual crop yields as a percentage of optimum<sup>5</sup>**



Source: Adapted by USAID CLP Project (2013) from MAI Agricultural Statistics Yearbook (2007)

<sup>4</sup> The Water Crisis in Yemen: Causes, Consequences and Solutions, Global Majority E-Journal, Vol. 1, No. 1 (June 2010), N Glass

<sup>5</sup> AREA crop requirement tables and MAI Agricultural Statistics Yearbook - 2007

Exacerbating these problems are decreasing size of average land holdings, reported as 1.5 hectares with larger landholdings in governorates to the west and north central, threats of climate change, and population increases at an estimated 3 percent per year.<sup>6</sup> Given the challenges the sector faces, productivity improvements to land and water use is the key to addressing employment issues, especially in rural areas and enhancing food security. To this end, an improved agribusiness approach to horticulture sector development is required.

## 1.2 CROSSCUTTING ISSUES

### 1.2.1 Gender

Less than one percent of agricultural landholders in Yemen are female; however, women play a major role in horticulture crop production activities and as much as 90 percent of livestock husbandry activities, in addition to major household roles. Women are estimated to provide 10 percent of the wage labor in horticulture.<sup>7</sup> Women are rarely involved with marketing due to cultural restrictions and limited influence over revenues generated through their contribution. There seems to be some changing attitudes towards the participation of women. Several of the micro-finance institutions (MFIs) provide loans to women and women community-based organizations such as water user associations (WUAs) coordinate with male WUA counterparts. Discussions with gender experts at the Social Fund for Development and the International Fund for Agricultural Development indicate that there are, in some areas, opportunities for women to become involved in horticulture marketing from kitchen gardening and coffee, often through male members of the household, but with a family agreement that the revenues shall be dedicated to household needs. Developing and replicating such models is time intensive.

CLP has been involved in kitchen gardening and food transformation and is working with gender experts and female extension agents to identify and disseminate more female friendly on-farm activities and promote women's participation in WUAs and women's cooperatives. CLP has trained over 2,500 women in kitchen gardening, food processing, and animal husbandry with overwhelming interest from the female community. Additionally, CLP has provided business and management training to the Taiz Women's Coffee Cooperative, which was well received, extremely beneficial, and can be replicated.

### 1.2.2 Climate change and water

It is estimated that some 40 to 50 percent of farm land is irrigated, the rest is rain fed. More than 75 percent of Yemen gets less than 600 mm of rain annually. The scarcity of water resources has been acknowledged and discussed as a major constraint to Yemen's development for over 20 years. It is estimated that agriculture consumes about 90 percent of the total water supply.<sup>8</sup> The lack of resources to upgrade on-farm distribution systems, poor irrigation scheduling, the lack of engineered systems, losses in earth canals and poor water application methods are key issues.

Despite shortages, farmers still overwhelmingly use traditional flood and furrow irrigation techniques. These methods are estimated to be only 40 percent efficient. Furthermore, spate irrigation structures and traditional terraces in hill areas are deteriorating, causing increased damage and crop losses, and farmers face competition from pump irrigation systems which are more dependable and profitable. The water issue is worsened by qat cultivation, which covers 22 percent of irrigated area, accounts for 60 percent of water use (3.4 billion m<sup>3</sup>), and consumes 85 percent of annual rechargeable volumes (2.5 billion m<sup>3</sup>).<sup>9</sup>

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6 Republic of Yemen World Bank, Land Tenure for Social and Economic Inclusion in Yemen: Issues and Opportunities, Report No. 54923-YE, 2009

7 World Bank, Land tenure for social and economic inclusion in Yemen: Issues and opportunities, Washington D.C., 2009

8 Yemen, Pilot Programme for Climate Resilience, Scoping Mission, World Bank, Jul. 2009;  
Yemen, Coping with Climate Change Impacts, Development of Options, GEF, Sept. 2009;  
Yemen, Community Resilience to Climate Change, Aide Memoire, World Bank, Jun. 2009

9 World Bank Report No. 54196-YE, Yemen Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications, 2010 provides excellent information on water, climate change and agriculture in Yemen

One of the main concerns of water scarcity is its impact on investment into the sector and importantly into water efficient alternatives. Data shows that the application and proper operation of complete drip irrigation systems for high value crops can generate water savings of 50 to 60 percent and yield increases of up to 60 percent. Government and donor intervention has had a positive impact on water management, but more technical and managerial solutions need to be promoted and adopted not only in water management but throughout the value chain to ensure these investments are complementary and result in increased productivity and market access. There is a rich database of water management recommendations in the literature. The basic recommendations include technical solutions for improving water efficiency, including: water harvesting, drip and low-head systems, repair canals and conveyance systems, more appropriate genetic material, capacity strengthening of WUAs, timing, promotion of supplementary irrigation, such as used with qat, and so on. Macro solutions can be supported but are outside the scope of the proposed approach.

### **1.23 Qat**

Qat is the single most important cash crop in Yemen. It is predominately grown by small landholders, and the bulk of the revenues generated are retained in the countryside. The country, which is largely self-sufficient in fruit and vegetables, has seen qat cultivation spread to cover one tenth of prime land—out-competing investment into vegetables, especially at higher altitudes. Qat can be harvested during most months of the year, in small or large quantities, according to the farmer's need for money, and farmers are paid cash the day of each harvest.<sup>10</sup> The qat value chain is demand-driven, demonstrating strong growth in volume and demand. Like illicit crop value chains in other countries, this licit value chain is an example of an integrated, agri-business focused, well-coordinated value chain for a highly perishable product. It is also a significant source of income for farmers, and accounts for a large percentage of agriculture production in Yemen.

On the down side, Qat production (44 percent of the total value of agriculture production) replaces cash and food crops and uses scarce inputs that high value horticulture need to expand and become more competitive. The crop is also agro-chemical intensive, has a high level of pesticide residues and a wide range of adverse social and health effects. Information in the National Agriculture Sector Strategy states that production is estimated to use more than 23 percent of irrigated land. Addressing qat in terms of expanding horticulture and reduction of water use is a complex issue. Investment into horticulture crops coupled with government policies for qat reduction are required if the horticulture sector is to expand.<sup>11,12</sup> The one positive aspect of qat, which is very market and demand driven, is that it has demonstrated an agribusiness, value chain approach that other sectors seek to replicate.

### **1.24 Small Enterprise Development**

Discussions with farmers indicate a desire to become more involved in improving their commercial approach to horticulture. Developing a semi-commercial or commercial approach to horticulture production requires improved physical inputs such as seeds, but also business support inputs. This is especially important in strengthening their organizational capacity to take advantage of input and output scale and gain access to financial services. To this end, business development services are said to become available through several donor projects, such as the International Fund for Agriculture Development (IFAD) and Social Fund for Development (SFD). There are several private providers that are capable, but presently widespread access to these services is not available.<sup>13</sup>

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10 Yemen: Towards Qat demand Reduction. The World Bank, Country Department III, Middle East and North Africa Region, Report No. 39738-YE

11 Qat Policy Review Workshop, Report for the Inter-Ministerial Committee on Qat, the Ministry of Agriculture and Irrigation, and the World Bank, 2008

12 Republic of Yemen - A Qat Strategy, Report for the World Bank, Ward, C. & P. Gatter (2000)

13 Detailed information on doing business in Yemen in the World Bank/IFC publication (70469), Doing Business, Economy Profile, Yemen 2013

## SECTION TWO

# SECTOR ANALYSIS

## 2.0 INTRODUCTION

This sector analysis helps understand how important value chain stakeholders and market channels are connected to target input and output markets. The analysis provides crucial links in the value chain and identifies overall chain trends, strengths, weaknesses opportunities, threats and bottlenecks. It highlights issues that need to be addressed, the potential for cooperation or an integrated approach among stakeholders, and identifies change agents and leverage points for policy and technical interventions.

The analysis also reveals gaps in information and business opportunities and provides a collective learning tool, which can improve decision-making, actions, and innovations to improve coordination and collaboration along the value chain, resulting in more efficient and equitable chain linkages.

While the sector has high potential for growth and a capacity to generate increased incomes at the household level, it equally has a number of constraints which, unless addressed, will remain a road block to sector development and improvement of resource management and livelihoods.

The sector analysis presents a SWOT analysis (i.e., strengths, weaknesses, opportunities and threats) followed by an assessment of key factor value chain inputs, production and support systems, market opportunities and value addition, including key findings.

## 2.1 HORTICULTURE SECTOR SWOT ANALYSIS

A SWOT analysis is a straightforward effective tool that provides an overview of the structure and characteristics of a value chain. It is used in identifying strengths and weaknesses, and for examining the opportunities and threats faced. The analysis can help determine if the information indicates elements will assist the sector in achieving sustainable growth (a strength or opportunity) or if something is an obstacle, which must be overcome or minimized (weakness or threat).

The information is then combined into the sector strategies and development of intervention plans in the following section. The results of the SWOT sector analysis developed by CLP are presented in **Table I**.

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**Table I: Horticulture sector SWOT analysis**

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### STRENGTHS

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- Strong domestic horticulture product demand.
- Topographical variations and different climatic zones that allow for producing a wide range of products (open field and greenhouse culture) with staggered peak seasons in different production areas.
- Investment opportunities for nurseries, irrigation systems and protected agriculture that are water and other inputs efficient.
- Broad age range of actors in the industry and employer of an estimated 45 percent of the population.
- Wide scope for improved input utilization (land use efficiencies; reduced agrochemicals; irrigation potential and reduced water use).

- New initiatives in sector (donor support and private sector) for private sector service support and investment in input markets and private sector overlap with MAI to register inputs.
- Awareness of the importance of utilizing Wadis (valleys) for water conservation and harvest source.
- Opportunity for solar power for water pumping and protected structures (analysis required on case-by-case basis).

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## **WEAKNESSES**

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- Fragmented, small and scattered land tenure (73 percent of tenures are less than one acre and 57 percent of land owners have more than three plots).
- Low productivity (due to fragmentation of land holdings, inappropriate inputs and water scarcity) resulting in stagnant labor wages.
- Prevailing traditional agriculture techniques, using low-quality and low-productivity seeds, limited access to improved suitable varieties.
- Limited availability and high cost of improved inputs, and quality.
- High production costs (greater than 50 percent of land earnings are absorbed by rent, irrigation and Zakat).
- Lack of awareness, inputs and training for integrated pest management.
- Cost of irrigation increasing as diesel subsidy decreases (irrigation can be 50 percent of production costs).
- Water scarcity due to depletion of ground water especially in the Western governorates.
- Half of cultivated area is rain fed and vulnerable to rainfall conditions.
- Inefficient traditional irrigation system (dominance of traditional flooding despite depletion of existing water in almost all water basins).
- Neglected management of the upper watershed catchments resulting in degradation of ancient systems of terracing and water harvesting.
- Lack of effective extension services.
- Lack of awareness, inputs and training for integrated pest management (pest control).
- No organized marketing and lack of coordination between production and marketing.
- Low sector-wide investment.
- Weak or non-functioning farmer organizations.
- Lack of market information and weak market structure.
- Limited capacity of cold storage facilities and refer trucks.
- Lack of vertical and horizontal (cooperative) integration in value chain.
- Limited, high interest, credit.
- The need for enhanced government support in areas of seed registration policy; technical support; research and development (R&D).
- Limited infrastructure.
- High post-harvest losses due to lack of training programs and poor harvesting techniques (poor handling, packaging and transport networks).
- Lack of quality control and grading systems undermines competitiveness against imported products and stifles innovation of value addition products.
- Lack of quality controls reducing competitiveness of agricultural exports.
- High packaging, transportation and freight cost for exporting agriculture produce.

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## **OPPORTUNITIES**

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- Technical assistance and training available (although limited).
- Appropriate and improved technology equipment available.

- Increasing domestic demand.
- Niche market crops.
- Value added components for crops.
- Solar concentrator integration.
- Reduced post-harvest loss and improved quality.
- Increasing access to investment and financing.
- Instill cooperative entrepreneurship across the sector.
- Promote government registration of appropriate varieties.
- Diversification from unprofitable crops.
- Overcome land tenure obstacles.

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## **THREATS**

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- Economic crisis and security.
- Importation of vegetables and competition from foreign imports.
- Competition with qat.
- Climate change.
- Urbanization and building on agriculture land.
- Weak institutional implementation of existing policies and regulations to support production of high value cash crops.
- Weak production strategy or targets for Yemen strategic products.
- No incentives to facilitate high value products for processing and value-added markets.
- Outbreak of crop diseases and weak mechanisms for surveillance and control.

## **2.2 KEY FACTOR ANALYSIS**

### **2.21 Inputs**

Inputs cover a wide range of activities and physical goods, including: (1) seeds and plant materials (especially high yielding and drought resistant seedlings and varieties), (2) crop protection inputs, (3) fertilizers; animal feed. (4) Veterinary medicines and services, (5) agricultural equipment, (6) machinery and irrigation systems, (7) extension and technical assistance, (8) information and communication technology, and (9) availability of financial services and credit.

Physical input availability and use in Yemen is more advanced for large commercial farmers but for small-scale farmers, poor and inconsistent quality and limited application practice based on science and best practices of input use, especially complementary input use, is the norm. In rural areas, prices for inputs remain high due to small scale demand and procurement (not organized through a farmer organization), multiple intermediaries, lack of or unaffordable credit and the like. That said, there are market intermediaries that purchase and deliver production inputs to farmers who can in return supply the agreed produce at a price discounted for input cost. Some input dealers could also extend credit to farmers but this is based on long-term personal and business relations.

In terms of service inputs, access to quality technical advisory services, improved technologies and upgraded food safety and standards certification (e.g., Good Agricultural Practice (GAP) and Hazard Analysis Critical Control Point (HACCP), International Organization for Standardization (ISO), pesticide and antibacterial residue certification) are limited in both public and private sectors, and when provided, it is done so by the donor community. Farmers need to begin evaluating compliance with grades, certifications, and standards to take advantage of broadening consumer taste markets and rising incomes in urban areas. Imports will gain a greater share of the market if domestic farmers cannot meet these challenges.

Obtaining appropriate, quality inputs for greenhouse production needs in a timely manner and at economical prices is difficult for protected agriculture (greenhouses, tunnels, etc.). Given investment costs for greenhouses, appropriate fertilizers, seeds, production supplies, specialized tools and irrigation equipment are essential for success. Local equipment is limited and locally constructed greenhouses need engineering assistance to adapt them to agro-zones and ensure cost effectiveness. Imported greenhouses are not inventoried, expensive and often not designed for specific agro-zones.<sup>14</sup>

For agricultural input companies whose success depends on raising farm productivity and having sustainable farm enterprises as customers, the transformation of smallholder operations into intensive, sustainable and diversified farm enterprises is their future business challenge. Agricultural input companies, whose entire business models are designed to provide quality accurate extension information as well as deliver technological innovations to farmers, have a unique and central role in delivering food security to Yemen. To this end, input dealers should be included in technical trainings. Furthermore, adapting innovative farming practices such as locally made, appropriately designed, less expensive greenhouses to the local context, improved genetic materials, and maximizing input utilization will greatly benefit by linking input dealers with farmers and university researchers.

## 2.3 PRODUCTION AND SUPPORT SYSTEMS

### 2.3.1 Production

Production constraints are significant and many—with water being a severe limiting factor. Wide variations in production methods and uncertainty regarding seed, fertilizer and pesticide inputs result in wide variations in production quantity and quality over differing agro-zones and individual farms. This has resulted from uniformly low level of specialized human resources and know-how. Inadequate production records, analysis and planning exacerbate these difficulties as does the lack of availability of water, soil, and plant tissue analysis services. As a consequence, farmers simply do not know why they have failed. Given the unavailability of seeds, for example, some growers select cheaper open-field varieties or save seed from open-field or hybrid plants to use in subsequent years. This practice can lead to much lower levels of production and product quality. Pesticide use—as a complementary input and application—is also a concern and needs to be addressed.

Time series increases in crop volume are attributed to increasing land area, not productivity. The World Bank estimates that agriculture productivity is 50 percent or lower than middle-Eastern and north-African countries which have comparable environments, and the World Bank estimates irrigation efficiencies average 40 percent for the country.<sup>15</sup> Larger commercial farms, primarily fruit, and lesser volumes of onions and okra producers, have achieved a scale and level of technology that makes export an option but products are generally lower quality and lower return than regional competitors. Semi-commercial and subsistence horticulture farmers, representing the majority in Yemen, are characterized as small-scale (average 1.5 ha), employing traditional growing practices and lacking improved technologies, inputs, knowledge on crop and resource management, and business and farm management skills, technical assistance, access to credit, transport and marketing infrastructure and the like; adversely affecting production quality and productivity. Farmer organizations, essential to strengthening vertical and horizontal linkages that underpin input and output scale for dissemination of extension assistance, improved productivity, competitiveness and returns are non-existent or non-functional.

Varied agro-zones and climate pattern should allow for year-round production of vegetables, but this is not possible in many areas because of the small and scattered patches of arable land, limited water resources, low yield per unit

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14 Protected Agriculture in the Republic of Yemen, Amin A.H. Al-Kirshi and Taher A.M. Abbas Agricultural Research and Extension Authority (AREA), Dhamar, Yemen, 2005

15 Acta Universitatis Agriculturae Et Silviculturae Mendelianae Brunensis, Production And Consumption Of Vegetables In Republic Of Yemen, Volume LIX, Number 4, 2011

area, and the poor roads between the production areas and marketing centers. CLP crop investigations indicate that irrigation pumping costs and labor account for up to 50 percent of production costs.

CLP's agriculture component has noted that basic crop records and input and production budgets are, for the most part, non-existent. This is understandable as farmers in most countries and levels of sophistication do not generally record or evaluate information to manage costs and plan production to take advantage of market opportunities. Moving forward it is essential for farmers in Yemen to become more competitive: knowing how to maximize input, contain costs, and react to market information will determine the competitiveness of the horticulture sector.

### 2.32 Land tenure

The rental of land for agricultural production is reported as more common. Under this scenario, a farmer provides all inputs and is required to give the land owner one third to one half of the sale price of the crop.<sup>16</sup> The World Bank reports that share tenancies—in which landlords contribute the land and the tenant provides the labor—crop sales are shared between landlord and tenant according to traditional formulae, but there are substantial differences among governorates.<sup>17</sup> Land is rented if it has access to water. Small-scale production is often a break-even proposition (at best) due to the high costs of pumping water and labor as well as requirements (in many cases) that a substantial percent of the crop revenues be given to the land owner.

### 2.33 Protected agriculture (greenhouses)

Protected agriculture, greenhouses, and tunnels offer small-scale farmers the opportunity to maximize land resources and integrate efficient operations such as water irrigation and water harvesting schemes. Presently, there are few models of success. Production constraints are significant and many. Poor growing and post-harvest practices, lack of knowledge on greenhouse management, business management, appropriate inputs, market linkages, and high investment costs are just some of the issues that adversely affect production quality and quantity.

The cost of electricity is high, or unreliable, limiting the ability of greenhouses to begin production early in the winter months in some areas, or get as many as three crops per season. Imported and locally-made greenhouse designs are not energy efficient in this regard nor are there designs that regulate heat, which is a problem in other areas. When there is a willingness to change greenhouse structures and design, there is at present a lack of knowledge and investment capital. Installing appropriate (new) and maximizing (existing, protected) agriculture structures with cost-effective solar technologies will reduce the risk associated with protected agriculture and provide incentive for greater investment. An example, solar concentrators are used for exhaust fans and also for generating heat to extend growing times, where applicable.

CLP has invested in eight greenhouse demonstrations in Yemen. Innovative farmers could adapt similar practices to their own context within their own resource limitations, and this has already begun. CLP has also provided training to hundreds of farmers and students at Sana'a University as well as management and post-harvest trainings. As a result, investment into greenhouses has begun, but given the complexity of greenhouse production adequate training takes a significant investment in time and commitment.

Given the challenges, protected agriculture can be successful both economically and environmentally. Of note is the intensive productivity illustrated in **Table 2**, cucumber and tomato production in protected agriculture (two crops per year) comparing per annum with open field; and the diversity of segmented, value-added markets this form of production opens up. An example of this is illustrated in the following greenhouse value chain diagram from Azerbaijan (see **Illustration 1**), which has many similarities with Yemen.

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16 World Bank, *Land tenure for social and economic inclusion in Yemen: Issues and opportunities*, Washington D.C., 2009

17 SPECIAL REPORT, *Fao/Wfp Crop And Food Security Assessment Mission To Yemen*. 2009

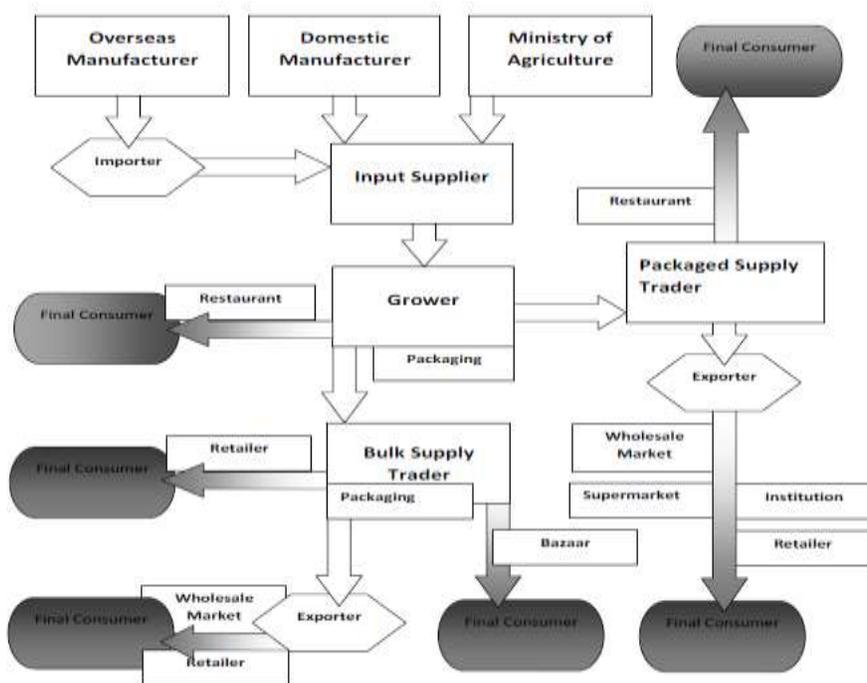
**Table 2: Comparing protected agriculture with open field production<sup>18</sup>**

Crop	Protected agriculture		Open field (t/ha per year)
	Mean yield/season (t/ha)	Total yield (t/ha per year)	
Cucumber	130	260	15
Tomato	185	370	30

Expansion of urban water harvesting and horticulture production for improved physical access to food security, and potentially for small-scale commercial operations of high-value vegetables, herbs and spices, is an option that warrants investigation. Small scale locally made greenhouses and tunnels can promote intensification and diversification primarily for household use but also for specialty crops such as ornamental plants including flowers, strawberry, parsley, ginger and lettuce.

There are economically viable and technically feasible small high tunnel or hoop house models 8x20 meters by 4 meters tall, one or two layers of polyethylene, for production of tomatoes and cucumbers. It is purely for production with no room for anything else. The area can accommodate 400 plants, best used with bag culture, it is easy to construct and can be quite productive for farmers with limited skills and land area.

**Illustration2: Complexity and opportunities in protected area cultivation<sup>19</sup>**



<sup>18</sup> Protected Agriculture in the Republic of Yemen, Amin A.H. Al-Kirshi and Taher A.M. Abbas, Agricultural Research and Extension Authority (AREA), Dhamar, Yemen

<sup>19</sup> Greenhouse Sector Action Plan, Chemonics International under Contract No. AID-112-C-08-00002, PSCEP Project, for the United States Agency for International Development, May 2009

### 2.34 Expansion of water harvesting and horticulture

Yemen has a rich history of water harvesting for flat land and terrace crop irrigation and domestic use. Initially composed of dams, surface wells, spate irrigation control structures, reservoirs and underground horizontal canals carried water from springs found at higher altitudes through underground tunnels by gravity. Additionally, grey water or water after household use was re-used for their irrigation to grow vegetables and fruit.

This analysis proposes similar gray water use described as multi-use systems. These systems also had traditional management and allocation system for users. With the advent of tube wells and diesel pump sets and changes in land tenure systems, traditional water harvest and management ways have been neglected. Incorporating traditional water management methods with new systems of harvest, conveyance and allocation will provide for greater availability of this scarce resource. There needs to be a balance between traditional and modern methods when building irrigation structures to obtain maximum benefit from local expertise that have proved its efficiency. This approach can encourage the introduction of water efficient irrigation systems like drip irrigation in order to limit groundwater depletion and employing traditional systems such as the construction of small and medium dams and barriers to collect and redirect this water towards improving vegetation in neighboring areas while at the same time recognizing traditional management systems.

### 2.35 Post-harvest

Across the horticulture sector inadequate post-harvest practices and lack of improved technologies and technical assistance and training in handling, sorting, grading, packing, transport and packaging result in significant losses, limit value added market opportunities and reduced wholesale prices.

IFAD estimates annual post-harvest losses to amount to 200 metric tons (MT) valued at approximately USD 265 million. Post-harvest improvements offer significant potential for increasing the incomes of the over 150,000 smallholders engaged in producing horticultural products.<sup>20</sup> CLP investigation reports losses varying from 3 to 25 percent depending on product perishability, with leafy greens most perishable. GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) indicates post-harvest losses are estimated to be quite high (20 percent for cereals, 45 percent for tomato, 60 percent for papaya, and 38 percent for bananas).<sup>21</sup> Products are often sold in sacks or crates and not weighted. Subsequently, middlemen often require farmers to overfill containers, damaging products, and farmers often put better quality products on top and poorer quality underneath creating mistrust between vendors and buyers. Furthermore, little value addition is done on farms.

Wholesale traders grade various products for size, color, shape and quality into three categories: (1) **grade one**: good or marketable fruits, (2) **grade two**: very small size called Khrta and (3) **grade three**: unmarketable fruits, which are insect infected, discolored or have other defects. They then repackage them to obtain higher prices, but excessive handling often reduces the quality of produce. Interestingly, Khrta grades are transported to the market free of charge and usually purchased by the restaurants for 50 to 70 percent less in price than the best quality. At the peak harvest period when the price is low restaurants preferred to buy the first grade.

At the retail level, supermarkets and smaller shops report they have consumers that would pay premium prices but they cannot procure the quality of products required indicating there is a general disconnect in market information along the value chain.

Other indications of post-harvest challenges include traders peeling off the outer layer of yellow onions which substantially reduces shelf life due to drying. Produce managers at super markets report that they have no training and will go to other markets to see how produce is handled to try to reduce losses; traders and farmers delivering

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20 The International Fund for Agricultural Development, REPUBLIC OF YEMEN ECONOMIC OPPORTUNITIES PROGRAMME, Programme Final Design Report/Main Report, 2009

21 (PSDP) Study on Identification and Benchmarking of Promising Sectors in Yemen, Private Sector Development Project (PSDP), GIA Ye / GTZ

more than ordered to supermarkets in an attempt to sell perishable products that are harvested in over-ripe condition and for which they are charged disposal fees when products are not sold; stores selling half a cabbage as farmers do not produce smaller cabbages, which results in additional losses; and potatoes turning green, due to exposure to light, resulting in reduced prices to consumers.

Improved product planning and coordination and technologies and training for on-farm and rural collection market value addition, based on market information, would greatly reduce losses and provide greater returns to upstream value chain participants.

### **2.36 Processing**

Value-added commercial processing of horticulture products is limited to fruit juices. Packaging and storage services (cold and cool) are at an early stage of development. Grades and standards that would separate processing quality products are rarely applied, and inputs for required processing-quality varieties are extremely limited. Farmer organizations required to amass and contractually obligate to provide sufficient volumes of raw horticulture product for processing operations are not seen as reliable, are few in number, and limited to the fruit sector. Where urban populations require processed foods in large quantities, mechanized processes with high output capacities are generally efficient and economic, but raw product availability and competition for imported products makes this unfeasible.

CLP discussions with retail markets have identified a demand for traditional Yemeni ready-to-eat or limited-preparation products for urban consumers. However, competition with local food services would be difficult to overcome and further technological development at the level of small- and medium-scale enterprises is required.

Efforts have been made to strengthen household vegetable and fruit food transformation (preservation) to enhance food security. These are decorative in character but offer some economic opportunity at local levels where labeling, container size, and food safety requirements are not required.

In the 2012-2016 National Agriculture Strategy, the Government of Yemen envisions horticulture processing as a means of expanding market opportunities and increasing incomes. Government investment is required to study and support viable activities through improved advisory services, quality assurance programs (e.g., HACCP), and incentives for the private sector horticultural products that will provide additional markets for seasonal surpluses of production, and packaging availability and support to the packaging industry, if needed.

### **2.37 Transport and infrastructure**

Infrastructure between major population centers is generally good. Secondary roads are often unpaved and vary in condition. Poor packing often results in losses for products transported distances over secondary roads. Transportation expenses are high, availability is inconsistent. Transportation without refrigeration capacity is the norm. This increases losses attributed to transportation, but it is unsure if investment into refrigerated trucks can be economically justified as farmers and middlemen prefer to time harvest to wholesale demand, even though this often results in losses. Truck transport availability is low and farmers do not consolidate loads. Middlemen often own several trucks. One sits in the wholesale market while the other is picking up products often carrying only the empty crates back with them to rent to farmers. Better coordination would offer opportunities to back haul other products reducing overall costs.

There are several well developed seaports and air transport (not now an option) is historically more expensive than other producing countries but available. However, the recommendation is to focus on domestic market opportunities transitioning to export after improving domestic competitiveness and thorough economic analysis of export opportunities.

Most commercial horticulture farmers rely on intermediaries for transportation, which provides for a significant number of employment opportunities for landless. Organizing farmers to consolidate loads and coordinate with value chain stakeholders, such as transporters, has met with some success, but the lack of farmer organizations precludes replication.

## 2.4 MARKET OPPORTUNITIES & VALUE INPUTS

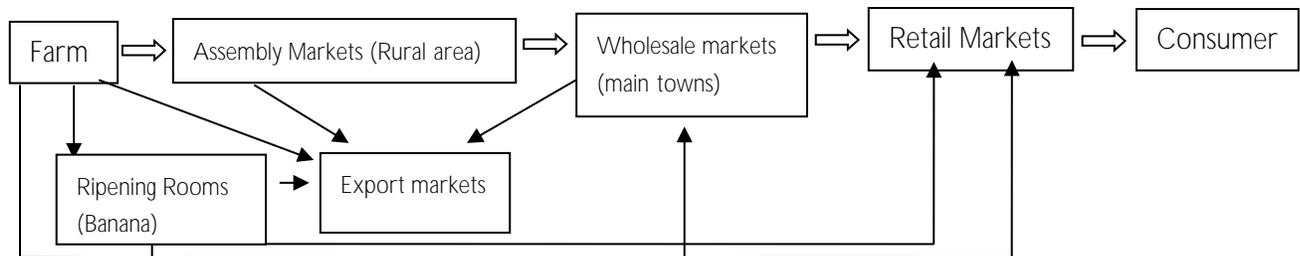
### 2.41 Market information

Market information is limited and often inaccurate. What little information does exist is created on an operation-by-operation basis. Market information is shared in ways that frequently reduce market opportunities rather than take advantage of collaboration with other farmers. The primary means for communicating market information is by cell phone, which works well on an individual basis but on a broader basis this results in a poorly organized supply chain with vertical integration at the sector level due to poor communication downstream.

A previous donor funded market information collection and dissemination system program managed by the MAI closed down after funding was withdrawn. This is the case with most similar market information systems worldwide. Although investing in a market information system using the latest information and communication technology (ICT) systems may appear appealing, serious evaluation of system sustainability should be undertaken.

Strengthening farmer organizational capacity to receive, evaluate and disseminate market information among members and to an organization’s market planning committee would allow for better crop planning and harvesting and facilitate scale transactions with greater negotiating power. The absence of farmer organizations is obvious in the following basic horticulture value chain schematic (**Illustration 3**).

**Illustration 3: Markets, basic domestic value chain**



Source: USAID Community Livelihoods Project, 2013

In 2007, IFAD reported the growth in the value of horticultural product exports had been increasing by about 17 percent per year in recent years, and by 40 percent annually between 2004 and 2007, reaching USD 42 million in 2007, driven primarily by bananas, mangoes and onions and to a lesser degree okra and tomatoes.<sup>22</sup> More recently, qat production, security concerns and an increasing domestic market demand have reduced vegetable exports, which are now less than 1 percent of agriculture exports and characterized by low quality and price.

### 2.42 Exterior markets

Seventy five percent of export is cross border trade with Saudi Arabia (formal and informal), primarily through the Harad border crossing, with some products transiting to Syria, and most of the remaining 25 percent through the port of Hudaydah.<sup>23</sup> Much of this is low quality and occurs during seasonal supply gluts. Cross border market linkages

<sup>22</sup> The International Fund for Agricultural Development, Republic of Yemen Economic Opportunities Programme, Final Design Report Main Report, 2009

<sup>23</sup> Horticulture Market Development in Yemen, USAID Yemen Agricultural Support Project (YASP), ARD, 2007

exist but there can be significant delays, informal fees, insufficient cold chain facilities, and increasing standards that make perishable products risky even for large-scale farmers. Given the increasing domestic demand, and market segmentation in terms of value added opportunities, it is considered the best option to focus on domestic market opportunities. If in the future viable external opportunities avail themselves to farmers, farmer organizations and marketers will be in a more favorable position to make such decisions.

MAI reports that it “lacks the capacity to neither provide exporters with adequate information on export markets, nor can it effectively campaign for improvements in trade conditions with export markets.”<sup>24</sup>

### **2.43 Domestic markets**

The present domestic market system is briefly defined as a small number of large-scale farmers that sell harvested and packed products directly to wholesale market traders or agents (deal makers), and a traditional marketing system. The traditional system is composed of various channels: individual small-and-medium-scale farmers that sell in local markets or to middlemen who buy the crop in field and then supply all harvest, packing, and transport. Middlemen buying harvested, packed products from farmers transport them to rural assembly or wholesale markets; individual farmers transport crops to markets; and, small-scale high-value farmers, with or without greenhouses, sell small volumes to upscale markets such as supermarkets and retailers with premium retail markets or small volume nostalgic (Asian and Indian) markets. In general, extensive field interviews with farmers and intermediaries indicate markets and buyers (middlemen, agents, traders, etc.) are price makers—and farmers are price takers.

Other forms of market intermediaries such as integrators and contract farming arrangements exist on an informal level. Of note in this scheme is there is very little product sold to processors, few organized groups and associations of farmers amassing quantity and taking advantage of scale sales and products collected by middlemen, sold to wholesale markets and then transported back to areas where products were originally produced and sold in small shops to local and village consumers.

### **2.44 Wholesale markets**

Major wholesale markets are primarily operated by private holders, often with tribal linkages. Usually located in cities close to the consuming areas such as Sana'a, Taiz, Hodiedha, Aden and Mukallh, wholesale markets have several local names such as Makazy or Halakah, the owner's name, or the zone's name.

In Sana'a, two wholesale markets have been established at Al-steen, Northern Street, about five km from each other. The Ali Mohseen is for vegetable products and the Thahban'a is for fruit commodities.

Buyers who want to purchase both commodities need to spend more time and additional costs to get products from separate markets. Markets are frequented by agencies, middlemen, farmers, traders, retailers, exporters and related services. Input markets and dealers are found on the outskirts of the market.

Ali-Mohseen wholesale market for vegetables commodities consist of five large metal sheds or hangars, which belong to the investors who built them. Investors rent spaces to the others such as agencies and traders. Within each individual hangar random and mixed activities can be found which results in crowds and traffic jams. Given the lack of organization it will be difficult for improvements or re-organizing the current situation due to the multi-sub-rental system for the sites at the market.

Products are exposed to multi-handling processes upon arriving to the market until delivery to the final buyers, which results in quality deterioration and quantity losses. Sizing, grading as well as re-packing is conducted in the market which results in product quality deterioration, rubbish, and a poor hygiene situation environment. Final buyers include retailers that have their own business out of the market or inside the market, traders located at the same market or

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24 A Promising sector for Diversified Economy in Yemen: National Agriculture Sector Strategy 2012-2016

outside the market at Sana'a and other provinces, exporters, catering contractors to supply hotels and embassies, big families and restaurants.

Traders in wholesale markets communicate with buyers and sellers by cell phone and prices are set based on many factors including other markets, quality, volume, seasonality, and tribal relationships. Traders have some latitude in raising and lowering prices (100 to 200 YER per box) or as products deteriorate. Most of traders' clients are repeat businesses and lend to traders ordering products and reducing losses. There is a confidence between tribal member farmers and tribal agents that the farmers will not be cheated, and on the positive side farmers are guaranteed payment under this scenario and always have a market although the price may not be optimal.

The farm to market spread is quite varied and there is little data available. Estimations of net profit are 62 percent for farmers, 25 percent for traders wholesalers, and 13 percent for exporters and retailers.<sup>25</sup> Given uncertain production costs, it is difficult to determine farmers' net returns with any accuracy.

Note on Agencies: Agencies are intermediary businesses well known in the fruits and vegetables value chains at the assembly and wholesale market points.

### Agencies:

- Provide the farmers short-term seasonal loans or credit without direct interest in the form of cash or agricultural inputs such as pesticides, fertilizers, seeds, fuel, etc.
- Provide gathering points at the market where the farmers can exhibit products and meet with buyers. Such points are fully controlled by the agency.
- The gathering point can also be used by the farmers as a waiting station for 1-3 days in the event farmers cannot find the right buyer or acceptable prices.
- Guarantees or assures immediate payment to the farmer after agreement with the buyers while the buyers may get delayed payments.

The agency receives commissions or services fees from both farmers and buyers, which may differ depending on the market. The general commission system which is applied at the market is described in **Table 3**.

**Table 3: General commission system**<sup>26</sup>

Market type	Farmers' Commissions	Buyers' Commissions
Whole sale	5%	50-100 YER per box depend on crop type
Assembly (Laheg Governorate)	3%	3%
Assembly other governorates	5%	50-100 YER per box depend on crop type
Mango	6%	0%

Notes: 2% of total 6% is given to the middleman the market owner receives the remainder – 4%

- Middlemen are generally employed or associated with the agency working on monthly salary or what payment they receive from the buyers (e.g., 50-100 YER/box).

<sup>25</sup> The International Fund for Agricultural Development, REPUBLIC OF YEMEN, Economic Opportunities Programme, Programme Final Design Report Main Report, 2009

<sup>26</sup> USAID Community Livelihood Project, 2013

- In some assembly markets the owner of the market acts as a lone agent while in the wholesale markets the agencies have rental offices and floor space to facilitate their activities.

#### **2.45 Retail markets**

Retail market outlets, especially in urban areas, are increasingly sourcing different grades or qualities from wholesale markets, where value addition occurs. These stores also trade in imports mostly of better quality than domestic production.

A number of super stores and supermarket chains have been developed in the main towns such as Sana'a, Aden, Taiz and Hodeida with a fruit and vegetable section which either belongs to the supermarket or is rented to another party. Additionally, there is an increasing number of upscale outlets and centers specializing in providing fresh fruits, vegetables, dates and honey; and increasing number of hotels, institutions, large families and the like.

These new retail and market outlets place more emphasis on quality and trying to match consumer needs for non-traditional or exotic crops which result in forming direct contact with the farmers. However, most of these outlets do not want to buy directly from farmers as they do not provide the quantity, quality, timeliness or prices. This is a worldwide issue and can only be addressed by individuals selling niche products with buyers they have developed relationships over time or organized groups of farmers, which will take serious effort and time to develop.

There is an opportunity for traditional and non-traditional products such as bitter melon, lettuce, broccoli, colored peppers, saffron, spices, pakchoi and the like and although markets for these products are low volume and would benefit only a small percentage of the horticulture farmers, they would make excellent demonstrations in terms of improved inputs and crop management practices that could be disseminated to other farmers.

There is a large, fast-growing domestic market, and demand is likely to continue to move up-market to higher value foods as urbanization continues and incomes gradually rise.<sup>27</sup>

Of note is the market system proposed by Coral Management Consultants Partnership Limited (CMCPL). In discussions with CMCLP, their staff proposed market system mirrors as the one described in section three. Many greenhouse and open field growers have expressed interest in participating in a new market system as they see the limitations in the existing one. This approach is innovative and does not necessarily disrupt the existing system but investment into developing the legal and operational structure need to be made, as it would with any business-like endeavor. The CMCPL proposal is similar to the proposed market system in section three, which is based on best practices and successful implementation in a number of countries.

#### **2.46 Labeling and food safety**

Labeling in general is substandard or non-existent. Product origination data is often unclear or in the hands of the middlemen. The lack of market information inhibits farmers from understanding the criteria for higher value production standards and the possible price increases that may accompany quality gains. As a result of these variables, capital investments for expansion become less of a strategic business decision and more of a gamble, hindering any investments.

Food safety and controls are lacking and responsibilities for food control are fragmented across various agencies. Laboratories have inadequate infrastructure and equipment and staff have insufficient skills and experience to adequately address food testing requirements. The weak capacity of the food control system in Yemen negatively affects public health and also hinders opportunities to promote economic development through trade in agricultural products. The main markets for coffee, honey and fruit and vegetables from Yemen are the Middle East (notably

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<sup>27</sup> World Bank Report No. 54196-YE, Yemen Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sectors and the Policy Implications, 2010

Saudi Arabia) and countries in Asia. No information is available on specific local service provider constraints hindering access to these markets.<sup>28</sup>

Awareness, recognition and application of basic good practices for hygiene and safety among farmers and industry are key to providing the foundation for a strong standards system. This requires targeted training on internationally recognized systems, such as Good Agricultural Practice (GAP) and Hazard Analysis Critical Control Point (HACCP), which, in turn, would also reduce post-harvest losses.

The CLP market investigation revealed an increasing awareness of the impact that agro-chemical use has on human health, and a segment of the consumer market would pay more for products that were certified to be produced under monitored conditions. Integrating this opportunity into production and marketing plans would require farmers to adopt alternative crop practices that would both reduce production costs and open a premium niche market.

## 2.47 Support institutions

Government, formal education and research institutions provide limited benefits to farmers and policy support from the government in business contract enforcement, food safety, trade laws, food safety, and establishing and enforcing grades and standards to maximize the potential of the fruit and vegetable sector is lacking. MAI has relationships with donor programs, MFIs and formal banks aimed at increasing access to finance but it is unclear to what extent they will be effective in promoting sector growth.<sup>29</sup>

Extension services in Yemen are greatly under-resourced and extension workers and technical specialists do not receive adequate updated skill training, and government extension service providers are not active participants in value chain efforts. There is a lack of academic depth of knowledge and available R&D (e.g., research, extension, cooperative formation, credit availability, post-harvest technologies and grades and standards, etc.) resources in the sector that limits research into and transfer of new technologies and methodologies that could otherwise be responsible for improved and innovative technologies, seed varieties, growing practices, etc. Another impediment to providing effective extension is the lack of farmer organizations.

Working through organizations and lead farmers lowers costs and enhances knowledge dissemination.<sup>30</sup> The private extension services provided by para-vets and qat farmers are examples that could be replicated in the horticulture sector, and the approach in **Section 3** highlights this.

In Yemen, extension services for women need to rely on dedicated female extension agents. Where possible, projects have recruited and trained local women. Once trained, their retention by programs has not been a problem.<sup>31</sup> CLP has worked with women in the coffee sector and horticulture in kitchen gardens and food transformation. This will continue in future activities.

The few services that exist are provided by donor organizations that employ consultants, and, to a lesser extent, Yemeni experts who usually operate their own businesses and are not able to provide continuous services required by farmers. Entering extension services are input dealers who seek to expand business opportunities but whose business models are not designed to deliver technological innovations or appropriate knowledge and advice to farmers. Strengthening agro-dealers to modify their business models to provide quality inputs and accurate technical assistance will provide a significant contribution to increasing productivity and reducing costs. Water management is the responsibility of government. Efforts being made to address water and water shed management should include government.

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28 Overview of SPS Needs and Assistance in Yemen, Standards and Trade Development Facility, Background paper, November 2008

29 (PSDP) Study on Identification and Benchmarking of Promising Sectors in Yemen, Private Sector Development Project (PSDP), GIA Ye / GTZ

30 A Promising sector for Diversified Economy in Yemen: National Agriculture Sector Strategy 2012-2016

31 IFAD, Thematic Study on Rural Women Development in Yemen: Lessons Learned from IFAD, Government and other Donors' Experiences with Gender Issues, Rome, 1997

Agricultural extension is recognized as an essential mechanism for delivering information and advice as an input into farming and a means towards promoting profitable, sustainable farming practices such as the use of efficient irrigation systems. This is especially true for the more complex horticulture crops.

Recommendations for strengthening farmer support and capacity of government and private services include investment in: (1) strengthening support providers such as lead farmers, (2) farmer organization technical capacity building, (3) input vendors and local service providers to provide accurate extension information, (4) farm and village-level demonstrations, (5) linking education to on-the-ground, market-led requirements of local growers, and (6) development of curriculum or vegetable crop production programs, including greenhouse culture, through partnerships with universities and the establishment of water, soil and plant testing laboratories at universities.

#### **2.48 Access to finance and investment**

Reports indicate a strong demand for credit and finance in Yemen but financial products are often not suited to borrowers, awareness of financial assistance is low and collateral rates high.

There are a number of MFIs in Yemen, many promoted by the SFD including the Al-Amal Microfinance Bank (AMB). MFIs serve men and women however it is often the case MFI lending is more suited to short-term commercial needs than agriculture, given its risk and required loan period. On a positive note AMB recently stated they would cost share investments for protected agriculture in coordination with CLP clients that have received technical training. One formal bank, Yemeni Cooperative Agricultural Credit Bank, has historically disbursed less than 1 percent of its portfolio to agriculture loans.<sup>32</sup>

Banks require bankable projects with mitigated risks such as those with access to reliable physical inputs, extension services, market linkages and sufficient collateral backed up by sound business plans that demonstrate future cash flow, and a high probability of success. The environment to provide these requisites is weak and several government sponsored/subsidized programs have experienced poor repayment rates.

Though there are no legal restrictions on women's access to financial services or credit but it is commonly felt that financial matters should be handled by men. Between 2002 and 2004, male borrowers from the Yemeni Cooperative Agricultural Credit Bank outnumbered female borrowers by ten to one.<sup>33</sup>

There is an extensive informal credit system in Yemen which is more readily available to farmers. The informal system may be based on tribal, which provide credit or cost-share arrangements or interpersonal business relations between farmers and input suppliers or collection and wholesale market agents. The agent/agency system is well institutionalized in value chains. Agents provide the farmers short-term seasonal loans or credit without direct interest in the form of cash or agricultural inputs such as pesticides, fertilizers, seeds, fuel, etc. and deduct costs plus fees at the harvest time.

Linking farmers and their organizations to credit is crucial for high-value high investment horticulture crops. Yemeni MFIs and formal banks are developing farmer friendly credit products and these efforts should be supported. Working with input dealers and market intermediaries to strengthen their capacity to provide extension accurate information will reduce client farmer risks and expand credit embedded in their services. Providing credit awareness and training to farmers will enhance their ability to access credit.

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32 FAO, Study on risk management in rural and agricultural finance in the Near East and North Africa (NENA) Region, Working Document 29, 2011

33 The International Fund for Agricultural Development, Republic of Yemen Fisheries Investment Project Final Design Report, 2011

## 2.49 Farmer organizations

Yemen has a number of cooperatives registered under the Agricultural Cooperative Union (ACU) and various other farmer and water user organizations (cooperatives, WUAs, common interest groups, farmer groups, associations, etc.) however functioning farmer organizations are rare and there are few successful examples of those that do not rely primarily on external support. There are no formal active associations or other cooperative groups are known to operate among the greenhouse vegetable growers in the country<sup>34</sup>.

Organizational capacity strengthening is essential in all aspects of value chain strengthening. Organizations offer a means to disseminate new technology and to bargain collectively for production inputs, expand, and reduce transaction costs associated with, market access and negotiate better prices, and, importantly manage infrastructure projects and resources such as watersheds.

Establishing new organizations where they already exist is not recommended. Building off existing ones such as cooperatives, or other best fit models, or expanding the scope of Water Users Associations promotes collective entrepreneurship, does not duplicate activities and creates less confusion among members. Additionally, building off existing programs such as Water Sector Support program (WSSP) or National Irrigation Program (NIP) is a more efficient use of resources and helps develop institutional capacity.

### 2.4.10 Private sector and enabling environment

Private sector composition in the agriculture sector is diverse and includes commercial and semi-commercial farmers, farmer organizations, input dealers, local traders, micro and small agro-enterprises and micro-finance institutions. In some areas of Yemen markets have developed for agricultural services, inputs and products and a varied range of private sector actors play an increasing role in driving and supporting agricultural development including services such as access to improved inputs and production technologies, technical support and market linkages. In rural production areas in Yemen private sector linkages are characterized as weakly integrated where private sector actors provide basic inputs, informal credit and buy and sell products in local markets as market intermediaries. In addition, the participating members can share machinery and other resources in a cost-effective manner.

The private sector faces constraints in such areas including finance, infrastructure, employee skills, markets with low purchasing power and a negative investment climate. At the macro level the business enabling environment discourages investment and risk taking; licensing and business registration procedures often are time-consuming and costly; transport, communication, power and water infrastructure are underdeveloped, and, poverty and security challenges are pervasive. These factors result in high operating and overhead costs, limited business and growth opportunities. A particularly weak link in value chains, farmer organizations, which, if strengthened, would provide organized demand and stimulate on-and-off-farm market opportunities.<sup>35, 36</sup>

The importance of the private sector complementing the public sector in agriculture development is well understood. Like many countries Yemen has seen an overall reduction public sector, and varying donor interest, in investment into agriculture. As a key component of the approach in section three considers the importance of farmers having access to improved and increased agricultural inputs and the importance of aligning the interdependent supply and demand sides. On the demand side farmers need to be sure cost-effective quality inputs are available and know how to effectively use them to increase profits and improve livelihoods. On the supply side effective demand must be high enough to prompt the private sector to invest in establishment of viable agro-dealer input businesses that profitably scales up in terms of product offering and out to underserved areas and members of society.

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34 A Promising Sector for Diversified Economy in Yemen: National Agriculture Sector Strategy 2012-2016

35 World Bank, Doing Business in Yemen, 2013

36 (PSDP) Study on Identification and Benchmarking of Promising Sectors in Yemen, Private Sector Development Project (PSDP), GIA Ye / GTZ

Private sector participation should be encouraged to help fill this void. The private sector is recognized as a critical stakeholder and partner in economic development, a provider of income, jobs, goods, and services to improve livelihoods and market transactions serve as an important mechanism for efficient, coordinated economic exchange. An example of this is the private sector's increasing role in adapting PA systems, e.g. establishing greenhouses and providing extension for some greenhouse growers as well as making essential materials (higher-yielding and zone specific seeds, irrigation system components and fertilizer) available.

## **2.5 MARKET SUMMARY OF SECTION ONE ANALYSIS: KEY FINDINGS AND RESPONSES**

The following is a summary of main weaknesses in the value chain and response to address the weaknesses.

### **2.51 Inputs**

Lack of quality, timely availability, cost-effective physical inputs and their proper use is a result of unorganized demand and supply for small-scale farmers. This limits their ability to maximize productivity, implement effective resource conservation practices and take advantage of market opportunities that require specific inputs. It also results in misuse of agro-chemicals.

Lack of private sector input dealers and suppliers' technical training and business models designed to provide quality accurate extension information as well as deliver appropriate, cost-effective, quality and timely inputs and technological innovations to farmers limits input business growth and area served.

Activities:

- Conduct input (physical and support service) gap analysis (physical inputs: crop seed/genetic material, fertilizer, irrigation, mechanization, credit, etc.) linked to improved technical packages and agro-zone specifics to ensure input dealers have appropriate stocks or ability to access them
- Train input vendors on appropriate use of inputs through strengthened supplier scope and scale of distribution networks, promote embedded support services such as extension and credit. Develop linkages to farmer organizations for timely ordering and cost-effective procurement; integration of market information and market standards knowledge.
- Provide business development services to input dealers to strengthen their business capacity to access credit to stock appropriate inputs; train dealers to provide accurate information to farmers on both inputs and use to profitably expand their business into lesser-served areas;
- Utilize demonstration sites to promote new and innovative inputs especially water efficient systems and low impact crop protection methods

### **2.52 Production**

Widespread traditional crop production practices and lack of improved technologies, inputs, knowledge on crop and water and resource management, and business and farm management skills, adversely affect production quality and productivity and adaptation to agro-niches and incorporation of market information in productive practices.

Activities:

- Promote systematic development and standardization of integrated (agriculture and nutrition) technical packages; train a cadre of change agents to facilitate standardized training; build on traditional and innovative farming practices (knowledge dissemination via media tools - written and broadcast) and institutionalize sustainable agriculture practices tailored to agro-ecologies and social needs.
- Invest in field testing and economic analysis of high value specialty crops, such as spices, ornamental plants, jasmine, chili peppers green beans, soybeans, and ginger, which can be grown on small plots of land

- Train specialized change agent trainings and develop village and farm-level demonstrations on seed, high value crops, intergrated pest management, GAP, irrigation, mechanization, post-harvest nutrition, health, etc.
- Invest in sustainable agriculture demonstrations installed on government farms, lead farmers, fairs, schools and Village Model Farms such as a package of technical innovations for protected agriculture, water harvesting and conservation methods and efficient irrigation
- Promote female extension workers to deliver gender-specific extension information on integrated kitchen gardens and nutrition
- Identify, propagate and make available higher yielding varieties of seeds, and multiplication methodologies, adapted or resistant to adverse conditions; promote cultivation practices such as selection of crops and cultivars with tolerance to abiotic stresses, crop rotation and multi-cropping practices

### **2.53 Urban Water Harvesting**

Expansion of urban water harvesting and horticulture production offers opportunities for household physical and financial access to food security, increased off-farm employment and opportunities for input dealers, utilization of water resources that are now unexploited, and potentially local market and niche crop commercialization.

Activities:

- Promote cost-effective small-scale roof-top rainwater harvest and irrigation systems adapted to local conditions; support enterprise development of fabricators and installers; organize urban growers; work with input dealers to stock requisite inputs and provide accurate extension information.

### **2.54 Water**

Water is main limiting factor of growth and sustainability to horticulture sector

Activities:

- Promote traditional water harvesting systems
- Renovate inefficient conveyance systems and water efficient irrigation schemes and practices
- Develop and broadly demonstrate a package of technical improvements to conserve water at farm level and to improve irrigation efficiency;
- Investigate and field test drought tolerant crop species
- Promote farmers associations of stakeholders at basin and local level and better schedule irrigation timings

### **2.55 Post-harvest**

Across the horticulture sector inadequate post-harvest practices and lack of improved technologies and technical assistance and training in handling, sorting, grading, packing, transport and packaging result in significant losses, limit value added market opportunities and reduce wholesale prices.

Activities:

- Introduce efficient post-harvest techniques and facilities as demonstrations
- Promote post-harvest infrastructure loans for famers' organizations
- Provide training for farmers, market intermediaries, transporters, produce handlers
- Study niche market opportunities and varieties that meet consumer tastes and are less perishable
- Conduct a series of trainings and demonstrations at farm, village and market levels on household food transformation - solar drying, pickling and canning, curing onions, potatoes, squash, garlic and the like

### **2.56 Processing**

Value-added commercial processing of horticulture products is non-existent and packaging and storage services (cold and cool) are at a minimal stage of development. Lack of government/technical support, raw product supply, investment security and competition from imports makes commercial processing unlikely.

Basic food preservation for household food security or seasonal surplus could offer opportunities for local markets if linked to protected agriculture or organized group where volume and standards and marketing could be done on a feasible scale.

Activities:

- Investigate the potential of substituting domestically produced vegetables for imported raw product for processing opportunities
- Scale up household food processing for home consumption and explore local markets for sales opportunities
- Develop and promote food safety standards
- Convene round table meetings between farmers groups/coops and commercial agribusiness and lead firms to share market information and develop vendor/buyer relationships and financial arrangements to explore contractual farming for processing
- Investigate benefit/cost of expanding cold and cool chain network

### **2.57 Infrastructure**

Infrastructure between major population centers is generally good. Secondary roads are often unpaved and vary in condition, which, due to poor packing, often results in losses. Transportation expense is high and availability is inconsistent. Most commercial horticulture farmers rely on intermediaries for transportation, which provides for a significant number of employment opportunities for landless.

Activities:

- Coordinate with Agriculture Development Network stakeholders to focus infrastructure investment in production pocket areas where roads preclude horticulture investment or result in substantial losses;
- Organize farmers to consolidate loads and coordinate with transporters to reduce costs

### **2.58 Market Information**

General market information is limited and often inaccurate. Intermediaries and farmers communicate primarily through cell phones however on a broader basis the result is a poorly organized supply chain with vertical integration at the sector level lacking due to poor communication downstream. Previous donor funded market information collection and dissemination system programs closed down after funding withdrew. The lack of market information inhibits farmers from understanding the criteria for higher value production standards and the possible price increases that may accompany quality gains.

Activities:

- Strengthen farmer organizational capacity to receive
- Evaluate and disseminate market information among members and market planning committee for improved crop planning and harvesting and facilitate scale transactions with greater negotiating power
- Explore use of AM radio for market information dissemination

### **2.59 Export Markets**

Yemen's horticulture exports are limited, most of which is cross border trade with Saudi Arabia, low quality and occurs during seasonal supply gluts.

Activities:

- Given weak export competitiveness, increasing domestic demand, and market segmentation in terms of value added opportunities the focus is on domestic market opportunities with focus on import substitution

### **2.5.10 Domestic markets**

Domestic horticulture markets are dominated small scale farmers and a traditional marketing system channeling products through market intermediaries with little direct selling. Very little product is sold to processors, there are few organized groups/associations of farmers amassing quantity and taking advantage of negotiating power or scale sales and products collected by middlemen, sold to wholesale markets.

Activities:

- Establish a broad network of production pockets, market planning committees, lead firms, rural collection centers, central hub and wholesale markets
- Train market intermediaries to coordinate input and output with market planning committees and market outlets
- Strengthen farmer organizations to work collectively to take advantage of volume sales and negotiating power

### **2.5.11 Secondary markets**

There are few rural collection markets. Major wholesale markets are primarily operated by private holders employing agents or renting space to traders and are characterized by lack of organization, congestion, poor sanitary conditions and where products are exposed to multi-handling processes which results in quality deterioration and quantity losses. Retail markets are usually traditional shops, cart vendors and the like but there is a developing corporate retail trade with number of super stores and supermarket chains and an increasing number of well upscale markets for high end market segments.

Many farmers have expressed interest in participating in a new market system as they see the limitations in the existing one. Section three details an approach based on coordinating a system of production pockets of organized farmers linked to input and output markets by market planning committees and local entrepreneurs that coordinate market information and transactions between organizations and collection centers, regional hub markets and terminal or wholesale markets.

### **2.5.12 Food handling, safety and labeling**

Food handling, safety and labeling in general is substandard or non-existent and negatively affects public health

Activities:

- Promote targeted training on internationally recognized systems, such as Good Agricultural Practice (GAP) and Hazard Analysis Critical Control Point (HACCP) to improve food safety and reduce post-harvest losses
- Conduct training on value addition and Q/C systems; branding and traceability
- Develop a schedule of prices for quality

### **2.5.13 Extension**

Government extension workers, formal education and research institutions provide limited benefits to farmers and establishing and enforcing grades and standards to maximize the potential of the fruit and vegetable sector is inadequate.

Activities:

- Provide comprehensive training and refresher courses to farmers, change agents, input dealers, lead farmers and other relevant agriculturalists on best practices and innovative technologies to improve productivity especially in agro-niche and controlled environments
- Facilitate farmer-to-farmer visits, demonstration of diversification, intensification of inputs, technologies and practices at ROYG and private farms, bazars, fairs, schools, VMFs
- Provide technical capacity strengthening for organizations on farming system to promote adoption of new input technologies
- Provide quality awareness to consumers and test market better quality products and promote institutionalizing of grades and standards

#### **2.5.14 Credit**

Reports indicate a strong demand for credit and finance in Yemen but financial products are often not suited to borrowers, awareness of financial assistance is low and collateral rates high. There is an extensive informal credit system in Yemen which is more readily available to farmers.

Activities:

- Support Yemeni MFIs and formal banks to adapt products to farmers and service providers', such as input dealers, needs
- Strengthen the capacity of input dealers and market intermediaries to integrate credit provision with their products and services
- Link credit providers to literacy training activities to enable wider range of farmers and organizations to access credit
- Provide training on innovative credit mechanisms such as women-friendly financial products such as non-collateral-based lending, asset leasing, or embedded financial services in buyer contracts
- Train formal banks to develop new credit products to target formal lending for non-MF loans (processors, marketers, transporters, supply chain distributors with needs to great for MF)

#### **2.5.15 Organizations**

Yemen has various farmers and water user organizations (cooperatives, WUAs, common interest groups, farmer groups, associations, etc.) however functioning farmer organizations are rare and there are few successful examples of those that do not rely primarily on external support.

#### **2.5.16 Private Sector**

Private sector composition in the agriculture sector is diverse and some areas of Yemen organized markets have developed for agricultural services, physical inputs and output products. In most rural production areas in Yemen private sector linkages are characterized as weakly integrated where private sector actors provide basic inputs, informal credit and buy and sell products in local markets as market intermediaries. The public sector's limited resources inhibit investment from farmers, input suppliers and ancillary businesses.

Activities:

- Develop market focused, such as production pockets of farmers, not resource focused organizations through technical and administrative trainings
- Promote business plan development with a sustainability plan that strengthens horizontal and vertical linkages within the value chain, and consolidate input and output needs taking advantage of scale
- Coordinate with the public sector on a strategy that focuses scarce resources on development drivers such as roads and market infrastructure to open up opportunities for the private sector to invest in businesses

that would serve farmers and stimulate collective entrepreneurship. For example, coordination among input dealers, farmers and government would facilitate identification of value chain needs and push for collective approach to solve the problem such as seed dealers and farmers carrying out validation trials to registration of new genetic materials

## SECTION THREE

# STRENGTHENING THE VALUE CHAIN

**Section 3** is subdivided into three parts. The first part, *Key Concepts Overview* explains concepts underpinning the proposed approach to strengthen the value chain. Key concepts are taken from proven best practices in agriculture development and address the major constraints identified in the above analysis. The second part, *Outline of Approach and Project Objectives*, illustrates the framework and lists the goals and activities of the four main technical components, which are presented final part: an *Approach to Strengthen the Value Chain*.

## 3.0 KEY CONCEPTS OVERVIEW

For example, one of the major impediments in Yemen's horticultural value chain development is the lack of organized groups of farmers. The first key concept, *Production Pockets*, offers a proven method for organizing farmers as stakeholders in value chains and strengthening their horizontal and vertical linkages in the chain. It emphasizes collective entrepreneurship as a means of requisite accessing inputs and output market opportunities. *Production pocket input/output intermediaries* fill a void in the present value chain by facilitating access to all forms of inputs in an organized, planned manner bridging between input dealers and extension service providers who are not conducting business in the area but whose markets will expand and business grow by serving a new set of organized farmers. These intermediaries also fill voids in market information (quality, volume, demand, prices, etc.) primarily through *Market Planning Committees* that represent production pocket farmers in organizing input demand through intermediaries and coordinating volumes, value addition, transport and the like to output market channels they are in communication with. Given the lack of extension workers *Village Demonstration Farms*, and the like, are utilized for dissemination of improved technologies and inputs. Demonstrations are sited in strategic locations such as schools or farms of farmer leaders in specific agro-zone conditions. Furthermore given the need to improved access to extension services and technologies, especially given complexity of horticulture crops training and developing a cadre of local *Change Agents* to ensure requisite know how is available. *Smart Subsidies* are employed to promote sustainable solutions that risk averse farmers may not want to invest in until they are convinced the activity adds value. For example smart subsidies may be used as cost share for packing houses with local market planning committees and production pocket farmers. *Lead Firms* are established companies that have extensive forward or backward linkages with other businesses in value chains such as traders, established farmer organizations, exporters, processors and input supply companies. Working through these firms will improve the participation of farmers in markets through helping lead firms understand how better to structure their relationships with farmers they source from or sell to. *Instituting an Agricultural Development Network or Steering Committee* will link stakeholders along the value chain and improve overall project communication and coordination bridging farmer reality with policy implications, research needs and initiatives and best practices from other similar experiences. Such a network can also be used as an early warning mechanism for example to provide timely awareness of events such as the spread of tuta absoluta.

### 3.0.1 Key Concepts Underpinning the Approach

**Production pockets:** Production pockets are groupings of farmers in similar agro-zones where a crop has a particular comparative advantage, connected by basic infrastructure allowing inputs to enter and product to be transported out, and where weak marketing infrastructure hampers economic return. Technical packages (integrated set of crop specific technology transfer services that cover all aspects of production through market) have been developed and there is regular training on production technologies particularly on selected products and marketing aspects including value adding post-harvest activities such as packaging, grading, etc. The groups can be basic, commercializing or commercial. Levels of organization can be formal or informal depending on what exists and what

works best but farmers have a group attitude, take a group approach to producing and marketing, employing innovative ideas and desire to shift to more market oriented agriculture in the form of collective entrepreneurship.

**Production pocket input/output intermediaries:** Production pocket input/output intermediaries (private individuals that may either work independently, for the farmer organization, markets or input dealers and facilitate value chain input and output linkages) play an important role in linkages to markets. They help to consolidate farmers production, provide or coordinate transportation, inputs, technical assistance, finance or other services to farmers they source from. Often these tasks are beyond the ability of a farmer organization to manage successfully or beyond their ability to take the financial risks involved with obtaining pre-finance, storage, transportation, stocking inputs, buying products, and finding downstream buyers who will buy the products. When these factors are taken into account it is often the case that the cause of high margins to intermediaries and low prices to farmers is more due to market inefficiencies such as poor roads, long distances between farms and markets, lack of adequate storage and transportation facilities, fees paid to officials, etc. than exploitative behavior. Incorporating intermediaries with a long term vision into market systems will reduce the total number of actors in value chains and accompanying transaction costs resulting in increased returns to farmers.

On the input side, it is important to work and create linkages with input suppliers and output buyers through these entrepreneurs. These rural entrepreneurs may be a member of the production pocket but most likely will be local go-getters that coordinate between rural production pockets and input suppliers that are in more urban areas and markets. An example of this is the role of the para-vet in the livestock sector.

Training these intermediaries along with other input suppliers, local services providers and the like is essential, so that along with sale of inputs they can offer information on planting methods and timing, pest management and production of different crop varieties. Such technical knowledge needs to be offered as embedded services since the farmers have limited access to other means of getting information that is critical for managing the crop production process. On the output side they will work with farmers and pocket Market Planning Committees (MPC) passing on market information, grades and standards, prices and the like up the value chain and facilitate aggregating volume and transport to destination markets. Best practices demonstrate that these entrepreneurs often become full time input and output intermediaries earning a commission for their efforts, ensuring sustainability in value chains.

**Market Planning Committees.** Smallholder farmers are severely disadvantaged when it comes to accessing markets because of their weak bargaining power and poor access to market information. To overcome this, small holders can be organized into production pockets and create Marketing and Planning Committees (MPCs) within these pockets. These MPCs will receive varying levels of sophistication of organizational capacity training, business and strategic planning training and develop marketing plans. These committees are elected by production pocket participants and may communicate directly with markets or through intermediaries. As described above these are individuals that act as agents for the farmers as well as provide supporting services to the farmers such as sale of agricultural inputs, credit, technical assistance, crop planning for marketing opportunities and representing farmers to government and development programs. Alternatively, MPCs may develop local collection centers and coordinate with downstream markets or end buyers usually negotiating prices for the pocket members. Pocket members are not required to sell through MPCs but it is rarely the case that they can play the role of market intermediary (see above).

### **Village Demonstration Farms**

Village Demonstration Farms (VDF) are demonstrations at the village level integrating nutrition and technical services, technologies, innovations. VDFs may be sited on village land such as a school or at the farm of a lead farmer who receives a partial subsidy for using his farm as a training site for local farmers. VDFs may apply for cost share **smart subsidies**.

## **Change agents**

Change Agents are the institutionalized linkages between farmers, farm families, and downstream value chain and farming system services, knowledge, inputs and markets. Change agent is a general term for an array of value chain actors providing services. Change agents include Extension Agents (EAs), local service providers, input suppliers, market intermediaries and distributors, lead farmers, lead firms, traders and the like. Strengthening change agents is fundamental to sustainable food security.

## **Smart subsidies**

Smart subsidies promote sustainable solutions such as developing the capacity of private sector input (physical, finance, packing shed, TA, etc.) providers so they offer improved products and services to farmers and SMEs in a sustainable manner; promoting awareness of these products and services among farmers and SMEs and contributing to an improved enabling environment. Smart subsidies may also be granted to farmers or farmers' groups for investment into, for example, post-harvest or water harvesting infrastructure or women's groups for food transformation activities. Subsidies will be applied strategically to build the capacity of market players to interact more productively. Note that activities do not need to be sustainable themselves but once they are over they should leave behind sustainable market relationships and improved services and products.

## **Lead firms**

Lead Firms are established companies that have extensive forward or backward linkages with other businesses in value chains such as exporters, processors and input supply companies.

## **Lead firms and market systems approach**

The fundamental market system approach taken recognizes that all actors (farmers, traders, processors, input suppliers, etc.) play an important role in value chains and that all these actors need to make a profit in order for their activity to survive. This is done through “win-win” relationships. To this end, this approach supports close collaboration and positive inter-firm relationships as a team effort with each member playing a role in value chain strengthening. Lead firms are established companies that have extensive forward or backward linkages with other businesses in value chains such as traders, established farmer organizations, exporters, processors and input supply companies.

A commodity marketing and value chain strengthening approach will work well with existing, established lead firms, that are active in targeted project areas, and assesses how to increase and improve the participation of farmers in markets through helping lead firms understand how better to structure their relationships with farmers they source from or sell to.

Selection of lead firm partners is done carefully and based on their existing interventions with value chain partners. The objective is to look at the larger market system, understand its constraints, the functions of the existing players (facilitating the development of new players if there are no existing ones) and work with them to develop sustainable market-based solutions to grow the market; expanding the pie rather than sharing the same size pie. The alternative is non-lead firm actors taking on functions that were previously carried out by others gaining only modest benefits and not really understanding the costs involved.

## **Criteria for selecting lead firms**

- Innovators and drivers of growth in the industry
- Provide, or will, embedded support services such as pre-financing, technical advice and/or inputs, including market information, in order to ensure a quality product that meets market standards

- Have existing commercial linkages and a strong demand exists for the products or services
- Compete successfully in end markets for their products or services
- Have sufficient financial strength to make investments or dedicate resources to business operations
- Have the potential to change the institutionalized standards in the industry that reward farmers for using sustainable growing practices, volume or quality that will result in improved and/or expanded relations with and higher returns to farmers
- Willing and able to make long term commitments and sustain its relationship with farmers after the project ends
- Have an acceptable track record and reputation as businesses
- Have potential to influence other firms and actors in the value chain
- Have potential to increase the amount of product purchased directly from farms and cooperatives or farmers groups
- Have potential to expand sustainable market opportunities including value addition through strategies such as certifications

Examples of activities that can create large-scale and sustainable benefits with farmers:

- Assisting lead firms to structure mutually beneficial arrangement for procurement operations with small-scale farmers and farmer organizations
- Working with traders to develop new market places closer to farmer production pockets or targeted markets
- Working with organized groups to provide market access and market information
- Embedding services such as credit and training into relationships, producing more and better quality products that fairly compensate farmers

### **Agricultural Development Network/Steering Committee (ADN)**

Transitioning subsistence farmers to semi-commercial/commercial market-led agro-enterprises to provide physical and financial access to improved livelihoods is one of the pillars of a food security approach. It is well understood that this is not a short-term process but one that will require long-term strategic planning and investment not only in the agriculture sector but all supporting sectors such as infrastructure, nutrition, education and social mobilization. Multi and bilateral donors have and continue to support this effort which, more recently, has evolved to include food security as one of the pillars to addressing poverty, hunger and under nutrition.

It is well-known that the transition to commercial agriculture is composed of a complex set of activities within agriculture and its sectors, and with overlap to other sectors and society as a whole. This results in a complex value system, not individual value chains, and supporting services which must be managed to act interdependently to achieve the goals set out by the ROYG in a timely and efficient manner.

This study identifies one of the core problems for agribusiness development in Yemen as a lack of effective value chain linkages (vertical and horizontal) among input providers, farmers, traders, processors, and service providers. This has resulted in disordered marketing channels, low quality products, high input costs, price fluctuations and post-harvest losses. Within this scenario information flows tend to be top-down and narrow, restricted to single disciplines, limited geographical areas and individual organizational philosophies. The outcome is weak linkages and communications which constrain value system development and functionality.

What is needed is a demand driven approach in which stakeholders are aware of their mutual linkages and organize themselves in such a way that they can benefit from such linkages in a network where the key players themselves make investment decisions related to technology and infrastructure improvements; and, where vertical and horizontal linkages result in improved input and output channels and increases in value addition, competitiveness and innovation are the outcome of the joint efforts of stakeholders.

An Agricultural Development Network/Steering Committee (ADN) composed of individual farmers, change agents, public (National, Governorate and District ROYG offices) and private organizations (cooperatives, non-governmental organizations, community-based organizations, input and output buyers and vendors, etc.) involved in overlapping areas of food security (farming, nutrition, health, education, research, input sales, training, extension, credit, market information and other key agents of commercialization and infrastructural support) should be organized.

This network, based on the vertical and horizontal linkages in value systems, will bridge farmer reality with policy implications, research needs and initiatives and best practices from other similar experiences. All participants will be aware of, or able to comment on, the advantages and disadvantages of the range of technological, biological, socioeconomic and administrative options available for agricultural development and value system strengthening. And, through the network stakeholders will be better able to access the resources to realize the value system work required to meet the goals of all involved as well as facilitate social mobilization and the participation of all.

The physical location of ADNs will be in District Centers (or governorates) where access and facilities exist. Donor funded projects can work with ADN partners to develop the proper organizational structure and operating procedures and provide capacity development in training and leadership. Ideally, the leadership should come from the private sector with participation of the ROYG and development partners on Board and Committees or through public-private partnerships. Membership can engage a wide range of value system stakeholders.

## 3.1 OUTLINE OF APPROACH AND PROJECT OBJECTIVES

### Component 1: Improved agricultural productivity

**Goal:** Farmers have access to improved and increased agricultural inputs through aligning independent supply and demand that stimulates private sector input dealers to expand appropriate products and services to rural horticulture farmers and their organizations

**Activities:**

- Increase the quantity and improve the quality of inputs
- Increase the availability of cost-effective fertilizers, vaccines and mechanization equipment
- Improve access to credit and finance
- Support more productive and cost-effective irrigation

### Component 2: Improved capacities of agriculture extension workers, services providers, farmers and nutrition workers

**Goal:** Agro-zone specific technical packages are disseminated by a cadre of trained change agents through various agents (MAI extension agents, input dealers, farmer organizations, lead farmers and the like) in a cost effective, efficient manner to maximize rational use of complementary inputs and productivity

**Activities:**

- Formalization of existing and enhanced technical extension packages
- Organizing farmers groups and cooperatives
- Training private sector service providers and ROYG extension agents
- Support for creative agricultural and nutrition solutions

### Component 3: Improved and sustainable agriculture production and post-harvest technologies and practices

**Goal:** Farmers adopt proven methodologies that reduce input costs, environmental degradation, post-harvest losses and climate change risk while maximizing labor input, productivity

**Activities:**

- Adoption of sustainable agricultural practices and improved resource management
- Adoption of sustainable agriculture practices at the farm and household level
- Improved post-harvest processes

### Component 4: Improved market efficiency

**Goal:** Improved market system efficiency and market access and profitability of small holders through integrating activities in components one through three with improved market information flowing to production pockets where organized groups that meet buyer standards sell collectively through more direct market channels

**Activities:**

- Establish a broad network of market centers and MPCs
- Establish ICT-enabled market information systems

## 3.2 APPROACH TO STRENGTHEN THE VALUE CHAIN

### 3.2.1 Overall Strategy

The goal is to increase incomes and improve nutritional status of farmers and farm families in Yemen's horticulture sector. To accomplish this goal farmers and farm households need access to inputs, training, innovative technologies, market information and markets. A development project can facilitate these needs by focusing its sustainable horticultural efforts on high value products for which there is a market demand and for which there are high nutritional returns for home consumption. With the increase in earned income from these high value products, households can invest in higher quality and quantities of inputs for home and production-related activities as well as invest in paid Change Agent services for all value adding activities such as market information and linkages, credit, soil preparation services, transportation of products and the like.

It would be desirable to establish an *Agriculture Development Network (ADN/Steering Committee)* at the National, Governorate and District levels to serve as a platform for project implementation, local capacity building and the long-term sustainability of project approaches. The ADN links value chain actors together in a demand-driven rather than supply driven approach, to facilitate more efficient and coordinated use of public and private resources and reduce investment risk through coordination of Lead Farmers, Production Pockets, Market Intermediaries, Market Planning Committees and Market System Development.

The approach proposed in this study can, by extension, strengthen other value chains and is able to be replicated and scaled up to reach a broader geographic area of beneficiaries by strengthening coordination among Yemeni public, private and civil society sectors as well as utilizing local public media outlets to broadcast locally-relevant market information and nutrition messages. A key element for scaling up is to have tailored Production Packages for the diverse populations and agro-zones in the targeted governorates. Smart Subsidies, Village Demonstration Farms, Innovative Technologies, input and output supply chains with embedded services linked to Change Agents can ensure sustainability of project activities.

The basis for the approach is built on value chain assessments and CLP's proven experience. The approach seeks to support USAID's Feed the Future framework integrating increased productivity and improved nutrition.

### 3.2.2 Approach to Integrate Agriculture and Nutrition

The Agriculture Development Network (ADN) serves as the primary platform to facilitate integration of agriculture and nutrition interventions in order to ensure increased agriculture production and improved nutritional status of women and children among the same targeted households. Particularly at the district level, ROYG officials from health, agriculture departments, as well as the national-level district officials, can coordinate with development partner staff to identify priority villages and value chain interventions, so that integrated agriculture and nutrition activities can target the same households to maximize impact. Change agents can all be cross-trained in nutrition and agriculture skills. To the extent practical, demonstration sites for model farms, Village Demonstration Farms (VDF) and literacy classes can be co-located, to encourage beneficiaries to broaden their skills development through a diffusion effect. Agriculture and nutrition extension curricula can be integrated into literacy classes, utilizing change agents as guest lecturers that encourage improved household agriculture resource allocation between consumption and sale. An example of how this links to agriculture is in terms of beneficiaries' ability to be subjects of credit. To do so they need some degree of literacy.

The following outputs and accompanying activities in the value chains can be implemented in parallel to a value chain approach to production of nutritionally-dense vegetables and animal source foods. Sales of high-value vegetables can increase the income available for families to purchase nutritious foods. Furthermore, Development interventions should prioritize water resource management to ensure investments in water harvest, use and access have both

agriculture and nutrition benefits. An important component of the approach is to engage families in food security sensitization through community mobilizers. Community mobilizers work with families to seek approval from male members of the households for women to utilize some of the revenues generated from female agriculture efforts for investment in family nutrition and health. Agriculture and nutrition component efforts, coupled with literacy skills development and sensitization will increase women's confidence (through literacy) and respect (from bringing in additional income) within their family and can lend to greater decision-making power over resources to spend to improve their families' welfare.

### **3.23 Coordinating activities and leveraging resources to achieve project objectives**

ROYG resources are scarce. Development projects should coordinate with government officials to prioritize scarce investment funds to support the project approach. Through the ADN, the emphasis on investment in public goods (roads, water systems and market infrastructure) can serve as an improved enabling environment for private sector investment at the district-level, which is largely absent at this time. District and village-level ADNs are also the ideal platform for integration of CLP's education and health components with the four project components of the approach. An example of this is using credit application documents in literacy and numeracy classes giving beneficiaries greater access to finance and credit. Lead implementing partners should integrate the Feed the Future components by leveraging the human and financial resources of public and private sector, ADN participants and change agents in order to have broad-based impact as well as to ensure long-term sustainability. Upon conclusion of development intervention, Yemeni organizations (ADN project implementers, and national and district level ROYG agencies) should have increased capacity to sustain a program approach themselves, and change agents will be professional, compensated service providers that continue to support marginalized households for income and nutrition improvement.

### **3.24 Four Goals**

#### **Component I: Improved Agricultural Productivity**

**Access to improved and increased agricultural inputs.** This proposed approach to farmers receiving improved and increased agricultural inputs aligns the interdependent supply and demand sides. On the demand side farmers need to be sure cost-effective quality inputs are available and know how to effectively use them to increase profits and improve livelihoods. On the supply side effective demand must be high enough to prompt the private sector to invest in establishment of viable agro-dealer input businesses that profitably scales up in terms of product offering and out to underserved areas and members of society.

**Increase the quantity and improve the quality of inputs.** Development partners should coordinate with the input vendors and individual farmers to introduce high yielding, drought and disease tolerant seed where farmers have semi/commercial/commercial operations and develop distribution networks in order to increase seed replacement ratios (SRR) for high producing seeds with local attributes. Change agents can train farmers to select, store and use open pollinated seeds where investment into higher yielding seeds cannot be justified. The change agents can train households on open pollinated seed farming, production and storage of seeds for traditional product markets as well as to facilitate the procurement and distribution of hybrid vegetable seed for small scale farmers with suitable agro-ecologies and market demand.

A development project should convene workshops with farmers, input vendors and traders to establish and support private sector industry development for open pollinated seed and vegetable plantlets to allow low income farmers to have access to these improved inputs through locally-based seed multiplication and greenhouse vegetable plantlets for locally adapted, high yielding, resilient varieties. Vegetable varieties may include those for local dietary diversity and households' income generation.

**Increase the availability of cost-effective fertilizers and farming equipment.** In addition to coordinating with input dealers and MAI to increase efficiency of fertilizer supply and distribution systems, a development partner should support training on production technologies for local and naturally available resources such as organic liquid fertilizer and composting especially, in less accessible rural regions, to reduce reliance on chemical fertilizers while at the same time improving soil tilth. Through change agents, a development project can encourage the stocking of mechanized equipment, such as tillers, water efficient irrigation and fertigation components and greenhouse structural and production products such as tunnels and growing bags to promote intensification and diversification and increase the utilization efficiency of costly inputs. This will also create employment opportunities through sales of equipment and servicing. A development partner should also promote alternative energy for greenhouse production and, where economically viable water pumping and irrigation working with vendors to inventory or access the most effective equipment. Improve access to credit and finance

Credit access can be enhanced through collaboration with the range of banks, MFIs and programs, such as EOF, to provide financing both **within** sector relationships – such as embedding credit in input services; and **to** the sector – providing access to financial services to cooperatives and value addition activities often considered too large to be served by microfinance institutions and too small, risky and remote to secure financing from conventional banks through collateral incentives such as the USAID DCA program expected to begin in the near future or CAC Bank, Yemeni Cooperative Agricultural Credit Bank, which may lend for protected agriculture and irrigation systems under improved value chain environments.

**Support more productive, efficient and cost-effective irrigation.** Through the ADN, a development project should facilitate public-private partnerships to increase access to water systems by improving conveyance and system efficiencies. Building on the lessons learned from the CLP project, there should be increased support for access to water services (for agriculture as well as for nutrition) utilizing water harvesting and multiple-use services approaches. A multiple-use services approach combines appropriate technologies with consumer-oriented water service delivery that takes people's multiple domestic and productive water needs as the starting point for planning, financing, and managing integrated water services. To ensure sustainability of water systems, the project must invest significant human and institutional capacity building for male and female water user associations around democratic governance, planning and management, system operations and management, building beneficiaries' willingness and ability to pay for water services, and complementary training for beneficiaries on hygiene and income-generating benefits from water systems. Multiple-use services can be integrated with water harvesting technologies and benefit both urban and rural horticulture farmers.

To improve existing water access systems, managed locally with multiple-use services and water harvesting approaches, the ADN can identify priority villages and multiple-use services sites based on technical feasibility and community demand, as well as form new or strengthening existing user groups for ongoing operation and management of the systems. A development project can train water user associations (WUA) and village members to identify water service options, potential costs, finance models, and requirements to user groups to establish commitment. User groups will be trained on integrating agriculture activities with water resources management, and financial and technical management of multiple-use schemes, with emphasis on inclusion of women. In collaboration with villages and other water management programs, a development project should design and construct multiple-use systems. Depending on the financial model selected, community members may provide labor, local materials, and/or cash and monitor construction. Coordination with local public and private partners is essential to strengthen local capacities, ensure quality control, and identify institutional and financial best practices for scale up of multiple-use services and water harvest systems. Furthermore, any new development interventions should leverage the work of

existing projects such as SFD, which has installed numerous water harvesting systems, integrating these existing systems into horticulture development activities.

## **Component 2: Improved capacity of agriculture extension workers, services providers, farmers and nutrition workers**

**Improvement and validation of existing and enhanced technical extension packages.** Agricultural and economic situational analyses conducted by the CLP and other organizations, and nutritional assessments conducted by the government and organizations such as WFP in target districts can identify sustainable farming intensification and diversification systems that are technically feasible, economically viable, water sensitive, nutritionally beneficial and designed around the learning needs and styles of local groups. Development partners and national-and-district-level ADNs should standardize core food security-based intensification and diversification technologies and management practices to increase yields from high value agriculture and traditional crops. These technical packages can integrate female-friendly sustainable agriculture and post-harvest practices, as well as nutrition and hygiene education. Packages can be adapted at local levels to comply with local nutrition needs, market demand, cultural practices and local agro-ecologies. Community outreach awareness can reinforce and strengthen extension services by improving communication between farmers and the government. Understanding the importance of proper training and the communication of accurate extension information, technical packages with accompanying training curricula will be developed for training, and refresher courses provided to government extension workers and change agents, especially input dealers. Change agents will receive expert classroom and hands-on instruction and periodic refresher courses. An attendee feedback loop will be instituted to ensure extension materials address farmers' needs. This will ensure farmers are receiving the best information possible from change agents.

**Organizing farmers groups and cooperatives.** Change agents can work through, preferably existing, cooperatives, farmer groups, and community based organizations (such as women's WUAs) as efficient and cost-effective vehicles to maximize reach of extension services, aggregate demand for agriculture inputs and outputs, communicate market information and the like. Change agents, and development project staff can support administrative and technical capacity building and strengthen horizontal linkages to facilitate a scale of demand and supply necessary for cost-effective farming. Vertical linkages will be strengthened to facilitate flow of knowledge, market information, technologies as well as to reduce the traditional reliance on personal relationships and transform them into market-driven business relationships for contractual and credit formalities.

**Training private sector providers and ROYG extension agents.** A development intervention should work closely with the ROYG's district-centered extension agents (MAI extension agents, para-vets and lead farmers) to build sustainable and expanded extension outreach through training of local service providers, input vendors and community volunteers as change "sub" agents – focusing especially on underserved areas. These ROYG extension agents and change agents can coordinate and consult on the development of highly visible farmer demonstration farms, Village Demonstration Farms (VDF) and farmer field days. These events may showcase new and improved technologies and innovations such as integrated pest management, integrated nutrient management (INM), irrigation and water harvesting, protected agriculture systems, and pre-and-post-harvest practices for handling, storage, packing and food transformation. Change agents will be cross-trained in agriculture and nutrition, as well as for climate change risk reduction through crop rotation, intercropping, efficient supplementary irrigation and the like. Additionally, intern programs for women change agents will ensure participation of ambitious female extension workers, along with EAs to refine or modify locally-tailored production packages for diverse agro-climatic conditions, women farmers and holistic farm management preparing them for future employment.

**Support for creative agricultural and nutrition solutions.** Employing agriculture innovations the project can incorporate innovations in the use of bio-fertilizer, organic or low input agriculture, greenhouses and nurseries, multiple-use services, and rain harvesting. An example of this is linking women's groups to private enterprises and government research organizations to implement grants funds to develop improved harvesting, handling, packing and value addition for home-based activities like food transformation and kitchen gardening.

### **Component 3: Improved and sustainable agriculture production and post-harvest technologies and practices**

**Adoption of sustainable agriculture practices and improved resource management.** As developed in the CLP, interventions should deploy a package of sustainable, complementary activities based on partner and support activities including EOF and SFD that promote new technologies to maximize efficiency of inputs such as seeds and expands land area under improved technologies and management practices. Change agents can conduct field-based demonstrations to institutionalize among male and female farmers the proven methodologies that reduce input costs, environmental degradation and disaster risk while maximizing labor input, productivity and profits.

#### **Adoption of sustainable agriculture practices at the farm and household Level**

A development partner can support change agents to introduce and institutionalize:

- Higher yielding varieties of seeds will be more resistant to adverse conditions
- Cultivation practices such as timing and selection of crops and cultivars with tolerance to abiotic stresses
- Integrated pest management for the economic and environmentally friendly control of a pest in production and post-harvest cycles
- New technologies such as no till farming, crop rotations and inter-cropping improve production while protecting and enhancing the land resources
- Integrated Nutrient Management which reduces the use of chemical fertilizers emphasizing cost-effective bio-fertilizers
- Mechanization employs appropriate mechanical and hand technologies like two wheel tractors for production through harvest uses (soil preparation, water pumping, thrashing, etc.), small power tillers and low cost hand operated crop sprayers and dusters
- Water management and utilization practices such as rehabilitation of canals that efficiently irrigates greater land area; water harvesting to maintain cropping intensities and enables off season crops production; and, multiple-use services that efficiently fulfills community and farm water needs for drinking, livestock and crops.

**Improved post-harvest processes.** It is important to train change agents and build local capacity of farmer organizations to conduct commodity systems post-harvest assessments in different agro-climatic zones identifying cost-effective technologies for farms and communities. Harvesting at appropriate stages, reducing field temperature and controlling temperature throughout the supply chain, sorting, cleaning, grading and packing in plastic containers will extend shelf life and improve quality for market resulting in non-marketable produce to be consumed by families. Furthermore training at assembly and wholesale markets can improve physical layout reducing congestion and improving sanitation and operationalize a series of basic steps to improve produce handling and reduce losses. On retail level training on detail such as proper retail display of tomatoes will reduce losses and maintain quality and price. Small-scale post-harvest storage technologies and facilities onion storage and home-based product transformation (solar drying, pickling and canning) will preserve quality of marketable products and provide year-round access to foods and potentially increased revenue generation for households.

To further promote adoption of sustainable agriculture and post-harvest processes, interventions should build the capacity of local radio stations to develop radio shows on different topics on agriculture and nutrition with change agents as guests and for call-in question and answer programs.

The project can also utilize co-investment in smart grants/subsidies for post-harvest infrastructure and complementary activities such as community packing sheds, containers and technologies such as low energy cool storage methods like the low cost evaporative cooling chamber known as the "Zero energy cool chamber" or ZECC constructed from locally made clay bricks and sand in India that can be connected to multiple-use services with water recycled back into agriculture.

#### **Component 4: Improved market efficiency**

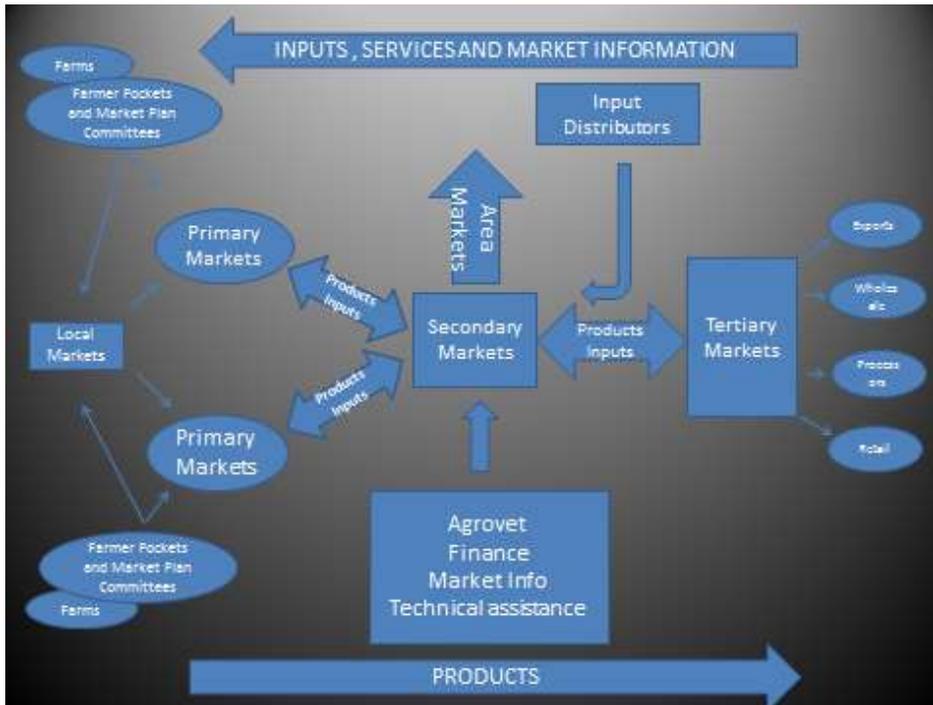
Analysis shows that within the value chain there are common weaknesses in terms of production through post-harvest that can be addressed by the value chain strengthening framework elaborated in Component 1 above; e.g. all farmers require improved quality, cost-effective inputs access to improved extension, water management strategies and improved post-harvest training and technologies. In brief – productivity (the ratio of agricultural outputs to agricultural inputs) needs to improve. Additionally in terms of physical access of household food security there are common activities such as kitchen gardens, livestock husbandry and improved nutrition that underpin all value chains. Kitchen gardens provide nutritious dietary diversity and project beneficiaries raise livestock as a cash reserve strengthening HOUSEHOLDS food security through consumption and meeting cash needs such as family emergencies or using proceeds for procurement of inputs for other crops.

Horticulture markets are for the most part domestic and show growth trends, although most growth is a function of increased production area not productivity. Export markets exist, for example onions, but the beneficiary focus can be on the domestic market. Horticulture marketing channels are diverse, complex and involve many actors. They are a fragmented loose chain of highly specialized tasks. The focus for this market is on creating and developing relationships with many actors in a series of market outlets with linkages back to farmers production pockets: inputs (finance, extension, market information, etc.) flowing up the chain and products flowing down. Of note is that the horticulture market system, production pocket and MPC approach, can easily support livestock input and output activities which are inherent in rural areas.

Markets and marketing strategies within the value chains are distinct in character and vary depending on market sophistication, volume, the type of outlet a seller has access to, buyer composition, product standards and the like. To this end, market strategies will differ. For horticulture products, it is important to promote the production pocket and market planning committee (MPC) model described below.

**Establish a broad network of market centers and market planning committees (MPCs).** Market system efficiency can be improved by expanding successful, proven models focusing on economic corridors. Rural *collection centers*, or primary markets will be supplied by production pockets of farmers. The centers may be as simple as local village market location, an existing store or a temporary shed but are an important facet of enabling smallholder producers to access markets and alleviate the high cost of transporting their produce to distant markets while getting a better price for their products.

#### Illustration 4: Inputs, Services, and Market Information



Depending on the geographic distribution, collection centers may be linked through Market Planning Committees or intermediaries to district-or-governorate-level *secondary markets* reducing market volatility through coordinated production planning, quality control methods and storage to aggregate larger volumes for scale transactions and perform primary value addition through sorting, grading and packing. Secondary markets can supply urban centers or downstream wholesale or terminal markets. Building the capacity of MPCs for business and strategic short, medium and long-term planning to determine the investment and services is required to make the secondary market sustainable.

The ADN could coordinate with governorate, district governments and private sector entities to facilitate procurement of land and extend existing infrastructure facilities, leverage donor and complementary projects to source funds for equipment, and convene discussions with *tertiary markets* (*wholesale or terminal markets*) traders to expand their operations to the *secondary market*. Secondary markets can be strategically located between collection markets and wholesale or terminal markets. This will streamline wholesale traders operations by reducing transaction costs, facilitating contractual agreements and accessing to raw product for downstream market outlets and processors. Markets can be managed by representatives of government, market planning committees and traders assisted by the project to develop business and operating plans, market rules and policies, a transparent accounting system and clearly defined powers of authority.

Secondary and tertiary markets also serve as service centers housing local service providers, input vendors, input suppliers, intermediaries and the like. Change agents and input suppliers can use these markets as demonstration sites to promote innovative technologies and inputs. Ancillary services such as vehicle repair, packaging materials and post-harvest services can be available and help pay for market operations costs.

Initial working capital for new secondary market operations may come from an auction of user space with minimum bids based on cash flow models. Operating revenues could come from users' fees and a range of ancillary services such as equipment repair, custom farming services, tea shops and storage.

Markets will also provide opportunities for enhancing value-added income generation. For example processing mechanization at the market could support the emergence of by-product transformation enterprises in animal feed and bio-fertilizer. Other enterprise opportunities include small-scale, women-owned and operated product transformation enterprises to package nutritious items such as fortified flour, dried fruit and honey for local markets. Nutritional requirements, appropriate food fortification components and processing techniques can be identified in collaboration with the ROYG Ministry of Health and contracted experts. Markets can link raw product to higher-end market segments such as upscale retail shops and supermarkets, hotels and energy companies that need reliable sources of vegetables.

**Establish market information system.** Accommodating the needs of farmers, change agents, input vendors and traders' secondary markets can serve as the organizing platform for a radio and mobile phone-delivered market information system. For example MPC members are provided with telephone contacts that give current pricing from different markets, which help farmers to obtain the best price for their crops. This system could communicate locally-collected and disseminated market information through a daily agriculture market report. These reports would advise market actors on collection days, locations, daily prices, extension services and weather. An existing horticulture project could work with its communication and business development strategy components to develop business plans for markets and input vendors to support advertisements and link to any national market information services that may be established.

### 3.25 CONCLUSIONS

The primary constraints to profiting from high value crop production is lack of farmer knowledge on market opportunities, risk-aversion to trying something new, and poor access to inputs and innovative technologies. Addressing these constraints is made more challenging when scarcity of water, competition with qat and current socio-economic conditions is factored in.

The CLP agriculture team has employed a value chain approach to assess the current state of the horticulture sector and developed a framework to strengthen linkages between value chain actors with emphasis on the importance of collective entrepreneurship among farmers, the role of the input vendors and service providers, change agents, reduction of post-harvest losses and a market system that offers more options for farmers, market intermediaries, traders and retailers.

The desired result of the proposed approach is a functional value chain in which key stakeholders (e.g. farmers and farmer organizations, input and service vendors, marketers, private sector entrepreneurs and government) are aware of their interdependent roles, make a deliberate effort to improve them, and organize themselves in such a way that they can benefit from such linkages in the network, including other stakeholders such as research and extension providers. If these linkages are coordinated and managed effectively the horticulture sector will develop into a sustainable demand driven agribusiness that continues to contribute to food security and employment.

## ANNEX 1: Illustrative Activities and Results to Achieve the Four Goals

### **COMPONENT I**    **Goal:** Establishing Sustainable Private Sector Input Supply Chain

**Physical Inputs:** Facilitate access, knowledge and use of physical inputs through strengthened supplier scope and scale of distribution networks, embedded support services such as extension and credit. Develop linkages to key organizations for timely ordering and cost-effective procurement; integration of market information and market standards knowledge.

<i>Farmers receive improved and increased agricultural inputs</i>		
No.	ACTIVITIES/TASKS	OUTPUTS AND RESULTS
1	Establish sub-network of input suppliers through ADN/Steering Committee [and various sub committees such as value chain, investment, etc.] to facilitate communication and stakeholder relations regarding input supply chain	1) Viable alliance between chain Lead Firms (input suppliers and buyers) identifies demand and supply constraints; 2) Input distribution networks provides access for underserved areas and population; 3) Representation for women; 4) ROYG investment creates enabling environment; 5) ADN functions as a central point to identify needs, coordinate solutions for supply chain
2	Input (physical and support service) gap analysis (physical inputs: crop seed/genetic material, fertilizer, irrigation, mechanization, credit, etc.)	Physical and support service input action plan developed for districts
3	Map out District agriculture and nutrition activities and input needs and coordinate with suppliers to identify timing, quality, availability gaps	Coordinate with distributors and input suppliers to stock or have access to associated farm system inputs such as quality seeds, irrigation equipment, etc.; Complementary farming system inputs available
4	Coordinate enabling environment support activities and investments with ROYG and private sector	Justification and course of action for government investments that support value chains defined and moved to appropriate next steps
5	Coordinate a series of technical trainings for input dealers with project, ROYG, input dealers, distributors and the like to ensure accurate information and appropriate inputs are provided to farmers	Work plan includes training of wide range of input distributors and suppliers on physical inputs and proper application for project activities

6	Demonstrate new ideas to farmers and water users groups through agro-vet/input suppliers demonstrations at fairs, bazars	Input dealers/suppliers promote inputs and broaden their markets; farmers aware of better quality inputs; discussions between farmers/organizations and input suppliers
7	Integrate media communication activities with communication strategy for technology support for extension and market information; develop media packages; advertisement funding strategies linkages to technical packages	Input availability and technical information on input innovations, availability, trainings broadly disseminated through various media
<b><i>Seeds are an essential element in increasing productivity and achieving food security: New crop varieties and quality seeds are the most viable options to improve agricultural production and food security in a sustainable way.</i></b>		
8	Review seed value chains, identify demand, gaps and develop responses	Seed supply chain gaps, training needs, investments identified and plan of action developed
9	Training and extension demonstrations on open pollinated seed production/multiplication, storage, distribution/marketing improved for open pollinated vegetables	Expanded number of farmers and coops producing quality seeds in remote areas; high producing varieties vegetable seeds appropriate for local agro-ecologies and resistant to climate change, pests, etc. available; crop productivity increased, SRR increased, farmer feedback improves extension system
10	Training, demonstrations and extension technical assistance on installation and management of coffee nurseries	More productive seeds and genetic planting material improve productivity, increases demand and sales of and sustainability of input dealers; High quality, drought resistant coffee seedling available to farmers  Varieties of highly productive, agro-zone adapted genetic material available to coffee farmers
11	Coordinate with seed import companies to provide agro-ecologic adapted vegetable seeds adapted to similar regions	Increased availability of high producing, agro-ecology adapted hybrid seeds for Yemeni farmers and organizations

<p><b>Fertilizer</b> – Demand for one input is interrelated with demand for other inputs. When farmers use a combination of hybrid seeds and fertilizer, their yields increase more higher than if they had used neither or just one of the inputs exclusively. Increase in variety of and access to different fertilizer options increases impact of complementary inputs (seeds, etc.) and results in improved soil, crop productivity, lower production costs and increased income</p>		
12	Value chain and gap analysis for fertilizers to identify crop needs, calculate demand and alternative fertilizer options	Fertilizer demand and options included in planning and coordinated with input suppliers/distributors; increase in availability of organic and inorganic fertilizers; new bio-fertilizer development methods identified and incorporated into technical packages
13	ROYG, Sana'a University and private sectors firms conduct research into bio-fertilizers	New bio-fertilizers are developed, costs reduced, private/public sector collaboration, improved perceptions of ROYG and USAID
14	Train change agents, fund demonstrations and develop media-based extension tools for optimizing use of fertilizer and seed	Increased dissemination of knowledge to farmers and spill over to greater population results in more rationale fertilizer use, lowers input costs
<p><b>Irrigation and mechanization</b> – Water management (harvesting, drip irrigation, multiple-use services, etc.) and efficient irrigation techniques and technologies reduces water demand; expands crop area under irrigation; improves the effectiveness of complementary inputs; and increases productivity. Mechanization and farm power technologies reduce labor and increase productivity in production through post-harvest and processing activities</p>		
15	Value chains and gap analysis for irrigation techniques, technologies and input equipment and mechanization equipment	Existing equipment inventory and prices identified; equipment for innovative technologies made available; suppliers embed services such as credit and training in agreements with farmers; farmers risk lowered
16	Train input distributors and suppliers (and local service providers/input dealers) on irrigation and mechanization technologies for new installations and upgrades; integrate trainings, irrigation and mechanizations as part of technical packages; trainings to irrigation system components and replacements parts for equipment such as pumps	Increased productivity and lower costs through more effective use of integrated input package; protected water resources; increased SME business opportunities for services such as pond/tank construction; increased availability of spare parts; increased volume sales justify input suppliers expansion into underserved areas  Local service providers/input dealers supply inputs and know-how for installation, use and maintenance of small scale low head drip irrigation and multiple-use services, for high value cash crops and livestock
17	Coordinate irrigation demonstrations at farmer days, fairs and other events	Greater awareness of innovative irrigation equipment
18	Promote transition from traditional to more productive and efficient irrigation systems (treadle	Farmers have access to cost-effective inputs and TA; increase productivity/profit

	pump, drip, multiple-use services) through volume sales to farmers' organizations	
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**Training in Business Development Services** creates more efficient and profitable input supply enterprises expanding to underserved areas and populations; greater enterprise opportunities for women

19	Establish irrigation training and working capital for revolving fund in women's WUA groups to enable purchase of micro-irrigation inputs	Irrigation inputs available to women farmers' groups; increased productivity/profit, reduction in women's labor; increased business for input dealers
20	Provide business development strategy/training on business, strategic and marketing plans, finance/credit for business expansion and strategies for embedding credit in suppliers' sales terms	Sustainable businesses practices and services such as finance increase business survival rates
21	Trainings on media advertisement and printed, trainings on nutrition and health inputs	Increased awareness through advertisements of inputs increases adoption

**Credit** – Greater access to micro finance and formal credit increases financial access for all stakeholders through expansion of products and services, area and populations served; adoption of new technologies promoted by farmers receiving credit; business expansion for input dealers; and, formal loans for markets, processors, transporters and the like available to enterprises whose finance needs are too large for micro-credit

22	Improve credit technology infrastructure through ICT upgrades/innovations	Lower transaction costs expand services to underserved areas for banks
23	Link credit providers to literacy training activities to enable wider range of farmers and organizations to access credit	Women and men understand application process, terms, obligations, responsibilities and can apply for credit
24	Credit training for business 1) training to men and women's orgs (bundling and unbundling credit in inputs supply transactions, 2) input dealers (embedding credit in sales and applying for formal credit to expand)	Organizations access credit through scale, group backing and innovative methods; input dealers expand business and inventory; traders include credit for farm upgrades for honey and coffee
25	Training to develop new credit products for banks to target formal lending for non-MF loans (processors,	Value adding processors, physical markets, etc. expand activities through formal credit

	marketers, transporters, supply chain distributors with needs to great for MF)	
26	Broadcast information on district, regional and national sources of funding and conditions of finance and access	Increased awareness and access to credit availability and requirements
27	Training on innovative credit mechanisms - - women-friendly financial products such as non-collateral-based lending, asset leasing, or embedded financial services in buyer contracts (long list available)	Women have greater access to credit through innovative methods

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## **COMPONENT 2**    *Goal:* Capacity of Change Agents Improved

**Technical Packages** – systematic development and standardization of integrated (agriculture and nutrition) technical packages facilitates standardized training, builds on traditional and innovative farming practices (knowledge dissemination via media tools - written and broadcast) and institutionalizes sustainable agriculture practices, which are tailored to agro-ecologies and social needs.

No.	ACTIVITIES/TASKS	OUTPUTS AND RESULTS
1	ADN convenes workshops to identify extension needs and promotes training standardize approaches/methodologies and tailor specifics for District requirements	Training, technologies, demonstration, requirements for implementation of integrated vegetable technical packages and extension methods identified,
2	Location-specific horticulture crops value chains analyzed, input and training and technology, organizational capacity needs and female-friendly practices identified	Integrated technical packages adapted to agro-ecologies, farmer asset availability; certificate-level exam developed for change agents
3	Traders (coffee and honey) participate in developing honey and coffee technical packages	Traders knowledge on technical and training needs to meet value added buyer standards included in honey and coffee training and technical packages
4	Field testing and economic analysis of specialty crops, such as spices, ornamental plants, jasmine, chili peppers	Technically feasible and economically viable specialty crop technical packages developed especially for small scale production

	green beans, soybeans, tobacco, sesame and cotton, which are high value crops that can be grown on small plots of land.	
5	Implement training assessment methodology and feedback loop to ensure technical package, methods and materials effective	Training materials and methods periodically updated
<b>Organizations</b> are cost-effective, efficient vehicles for extension training; benefits of input/output scale and efficiencies, group training (male/female farmers groups, coops, etc.)		
6	<p>Identification of business management and strategic/business planning, consolidation of input/output needs, negotiation and contractual mechanisms offered by farmer organizations and greater input/output market power;</p> <p>Organizational capacity/business development strategy trainings at district levels for farmers, input dealers and change agent, local service provider organizations</p>	<p>Improved business management and strategic and business planning strategies facilitate buyer/vendor relationships with input suppliers and output markets; benefits of scale and efficiencies lowering costs and opening a wider range of market opportunities and commercial relationships</p> <p>Business models strengthened</p> <p>District level firms operate more efficiently and profitably</p>
7	Identify women-specific agriculture training needs	Women-specific training materials and content support women's development
8	Organize and train production pocket membership; and market planning committees	New production pocket farmer clusters organized and MPCs trained
9	Technical capacity building training for existing coops, local agribusinesses and market planning committees	Local organizations improve membership services to farmers; increase sales
10	Focused business development strategy training for MPCs on negotiating and contractual formalities	MPCs facilitate pocket clusters contractual agreements with wholesale buyers
<b>Change agents</b> are the institutionalized linkages between farmers, farm families, and downstream value chain and farming system services, knowledge, inputs and markets; strengthening change agents is key to sustainable food security		
11	Provide Water User association training to male and female association members	Strengthened WUAs use and manage water resources more effectively

12	Governorate and district training development plans integrate nutrition with agriculture	Governorate and district MAI training centers update curricula and integrate holistic technical package information
13	General agriculture trainings (TOT/lead farmers, EAs, vets, etc.) integrates nutrition and agriculture s	General cross-trained change agents provide assistance to wide range of beneficiaries and direct subject matter specialists as needed
14	Specialized change agent trainings and demonstrations – seed, high value crops, post-harvest, integrated pest management, irrigation, mechanization, nutrition, health, NTFP	Cadre of subject matter specialists address more technical needs for farm/community/business/value addition expertise and train trainers and ROYG specialists  Districts able to provide quick response to pests, diseases, etc.  Inter-district specific expertise available within TBD districts
15	Special gender-specific kitchen gardens and nutritional training package developed	Districts provide trainings to women’s groups in Village Model Farms and gender-specific trainings
16	Sustainable agriculture demonstrations installed on government farms, lead farmers, fairs, schools, Village Model Farms	Demonstrations managed by change agents in districts; information disseminated on farmers field days
17	Develop extension mass media communication tools – printed and broadcast media	Communication tools for technical packages available to change agents for trainings and dissemination at fairs, bazars, organizations, trainings, demos, etc.

2

<b>Creative Agricultural and Nutrition Solutions</b> – innovations driven by both farm and technical research provide solutions to feed security issues		
18	Develop linkages between ROYG/Sanaa Univ. and private research with farmers, farmer organizations and communities to identify innovative practical solutions for food security requirements	Innovative technologies and services for farm-level cost-effective technologies that enhance food security technologies and  Network of organizations, enterprises, and individuals formed; innovations disseminated
19	Innovation grants provided to private sector local service providers and communities to implement innovative solutions using multiple-use services/ irrigation w/watershed management and climate	Investment into innovative food security activities with local service providers and communities buffer against natural disasters, climate change and market fluctuations and provide financial access to food security for women

	change adaptation	
20	Water harvest and multiple-use services trainings and demonstrations set up in district sites	Irrigation multiple-use services demonstrations and trainings to include kitchen gardens, bee keeping and livestock husbandry

### **COMPONENT 3** *Goal:* Improved and sustainable agriculture production and post-harvest technologies and practices adopted at farm level

**Sustainable agriculture practices and resource management** - increases productivity and profitability, maximizes input efficiency and guards against climate change and natural disaster impacts through management of water and soil resources and best practices. Change agents train farmers on proven activities below.

No.	COMPONENT 3: ACTIVITIES/TASKS	OUTPUTS AND RESULTS
<i>Change agents utilizing demonstrations and technical packages train farmers and farmer organizations on improved agricultural practices and technologies for vegetables, livestock and honey including:</i>		
1	Higher yielding varieties of seeds, and multiplication methodologies, adapted or resistant to adverse conditions	Increased access and improved yields of adaptive and resistant seed varieties; crop diversification; increase in yields
2	Cultivation practices such as selection of crops and cultivars with tolerance to abiotic stresses, crop rotation and multi-cropping practices	Improved crop management and increased productivity
3	Intergrated pest management for the economic and environmentally friendly control of a pest in production and post-harvest that includes bio-pesticides	Reduced losses to pests and diseases and lower production costs; reduced use of agro-chemicals
4	Technologies such as no till farming, diversified crop rotations to improve production while concurrently protecting and enhancing the land resources and carbon sequestration compensation mechanisms	Increased productivity and resource management, reduced input costs

5	Integrated Nutrient Management (INM) a decision support models for the use of chemical fertilizers but with a special emphasis cost-effective bio-fertilizers such as compost and bio-gas slurry	Lower input costs, soil management, greater use of bio-fertilizers
6	Farm Power and Technology (FTPM) Mechanization introducing appropriate technologies of machinery and attachments, hand tool technology, low cost hand operated sprayers and dusters for application of plant protection chemicals	Increased crop production intensity; improved land and soil condition; reduction in labor
7	Water management and utilization through, rehabilitation of canals efficiently irrigate greater land area, water harvesting for maintain cropping intensities and produce off season crops	Increased access to irrigation, more efficient irrigation, extended cropping seasons; rehabilitation of canals efficiently irrigate greater land area, water harvesting for maintaining cropping intensities and increasing off season crop production
8	Multiple-use services to meet community and farm water needs for drinking, livestock and crops for efficient use of water resources; and, CAI exploring the potential for solar-irrigation schemes for irrigation and multiple-use services	Multiple-use services utilized to meet community and farm water needs for drinking, crops and livestock water sources developed – at demonstration sites Solar-irrigation schemes for irrigation and multiple-use services
9		
10	Adoption and use of low-cost and appropriate hive and bee keeping technologies and provide training to the beekeepers	Bee keepers increase production, quality and revenues; more women involved in bee keeping;
11	Change agents facilitate farmer-to-farmer visits, demonstration of diversification, intensification inputs, technologies and practices at ROYG and private farms, bazars, fairs, schools, VMFs	Farmers see innovations first-hand and adopt cost-effective new technologies
12	Change agents provide technical capacity strengthening for organizations – farming system trainings and to	Organizations extend training to members and install demonstrations of new technologies; members adopt of new practices increasing productivity and profitability; membership

	promote adoption of new input technologies;	increases; custom farming services established for members and non-members
<b>Post-harvest</b> - storage technologies and facilities like dry storage for potatoes and onions; raised drying beds for coffee; handling and packing of vegetables; processing and storage of honey and bee products; and home-based product transformation like improved curing of garlic and onions, solar drying, pickling and canning add value to tradable products and provide year-round access to nutritious foods for HH.		
13	Implement commodity systems post-harvest assessments for horticulture, coffee and honey value chains	Cost-effective post-harvest processing and storage technologies for farms, communities, coops identified and installed at demonstration sites; cost share grants offered
14	Training and demonstrations on community and farm-level storage, sorting, grading and packing for markets; and grants submitted for co-investment	Reduced loss and improved quality results in greater economic returns; increased shelf life and quality for honey and coffee  Grants install post-harvest value adding infrastructure and equipment; community grain storage facilities improved
15	Trainings and demonstrations on post-harvest infrastructure and complementary activities such as community packing sheds, containers and technologies	Reduced losses, improved quality result in greater economic returns for farmers and farmer organizations
16	Trainings and demonstrations on food transformation - solar drying, pickling and canning, curing onions, potatoes, squash, garlic	Increased access to nutritional food for HH
<b>Agriculture Mechanization</b> - increase profitability and productivity through utilization efficiency of costly inputs, reduce post-harvest losses, create employment opportunities		
17	Post-harvest technical information disseminated through radio and video presentations, project-developed technical handouts and billboards	New media tools developed and broadcast under private sector sponsorships; new technical handouts disseminated through farmer organizations, fairs, etc.
18	Coordinate mechanization demonstrations at events like bazars; lead farmer, VMF, RROYG farm sites for production through processing activities;  Coordinate with input dealers' broadcast to advertise	Advertisements and demonstrations increase awareness of benefits of mechanization leading to wider adoption of mechanization resulting in netter input utilization efficiencies, reduced labor, crop costs, post-harvest losses and builds credibility in suppliers

	testing and demonstrations at bazars, lead farmer demos, coops and events in coordination with change agents	
19	Train manufactures, traders and vendors to develop embedded finance mechanisms for mechanized products	Greater awareness and adoption of mechanization
20	Link with other development organizations to promote vocational education training for custom farming services, repair and maintenance; and manufacture of implements locally such as bee hives and coffee hullers	New enterprises provide farmers with effective services, yields increased, employment created; greater innovation from local manufacturers

4

## **COMPONENT 4**    *Goal:* Improved Market Efficiency

Establish a broad network of market centers and Market Planning Committees and Lead Firms

No.	COMPONENT 4: ACTIVITIES/TASKS	OUTPUTS AND RESULTS
1	<p>Farmer pockets formed and farmers trained to establish collection centers.</p> <p>Market planning committee members selected and trained above develop recordkeeping system to track crops, volumes, timing, etc. and committee functions</p> <p>Needs analysis for collection centers completed</p>	<p>Collection centers formed</p> <p>Market Planning Committees develop linkages between production pockets and intermediaries, markets and Lead Firms</p> <p>Infrastructure needs identified; cost share grants applied for through CAI funds and EOF</p>

	Discussions between MPCs and ROYG, governorates, district MAIs, traders and organizations to establish collection centers	Local governments, Lead Firms, traders and organizations provide land and services for collection markets; collection centers established
2	Project market intermediaries identified and trained; (market intermediaries coordinate input and output with MPCs and market outlets)	Linkages established to ensure proper inputs and input timing available to farmers; linkages with buyers provides market information and quality standards to farmers and volume, timing and quality availability to buyers
3	Collection centers mapped	Networked collection markets have improved market input/output potential that is attractive to input sellers and output buyers
4	Business development strategy assists in business/marketing/ strategic/ operating plans for hub markets	Business/ strategic, marketing and operational plans developed for hub markets; grant applications for infrastructure and set up funds
5	Establish market network of farmers production pockets for collection centers; identify input requirements and link to input suppliers	Organized groups producing high-value crops aggregate volumes and qualities attractive for buyers  Inputs are purchased from group and premium rates; greater volume quality sold resulting from post-harvest activities
6	Round table meetings between farmers groups/coops and Commercial Agribusiness lead Firms share market information and develop vendor/buyer relationships; contractual farming; and financial arrangements (see credit)	Increased demand for raw and semi-processed product for markets; contractual with Lead firms agreements entered; hub markets agreed upon
7	ADN coordinates discussions with wholesale traders; based on volume of collection centers identifies needs for expanding to central hub markets - and alternative plan developed for funding and training for local market buyers and intermediaries to trade in collection markets -	Conditions agreed upon for wholesale traders agree to expand downstream to hub markets; business, strategic and operations plans developed  – alternative model with greater market deal maker role and additional training for collection markets developed
8	Discussions between MPCs, traders and villages to	Land and services provided for hub markets

	establish central hub markets	
9	Value added post-harvest strategies promoted through farmer organizations	Farmers receive better prices for sorted, graded and quality packed products
10	Market information system linked to market communication platform; farmer organizations trained on negotiating prices	Markets networked with market and technical information via mobile phone platform; technical circuit riders address farmers needs through communication with market intermediaries; farmer organizations linked to multiple buyers and obtain competitive prices
11	Training on value addition and Q/C systems; Develop common standards and promote them to farmers; Promote branding and traceability; Develop a schedule of prices for quality and quantity	Collection and hub, and apex markets have value added and QC systems
12	Operating plans and market rules developed and apex management committee trained	Business and operating training for market stakeholders
13	Central market hub sites established through criteria selection with ROYG, traders and district governments; connection infrastructure with aggregation markets, infrastructure, input/output supply and demand, etc.	Central hub markets operate providing input/output/extension services to collection markets and market suppliers
14	Business and strategic plans developed and market planning committees established and trained - (rent to local service providers and projects)	Equipment, training, utility needs identified – revenue sources explored for ancillary businesses; central hub markets function as source of TA, demonstration, input sales,
15	Discussions between wholesale market traders, service providers and input dealers and District governments	Land and services provided for apex collection markets  Wholesale traders operate out of apex markets
16	Business, strategic and operating plans	Grant applications for apex collection market operating equipment and set up markets serve as

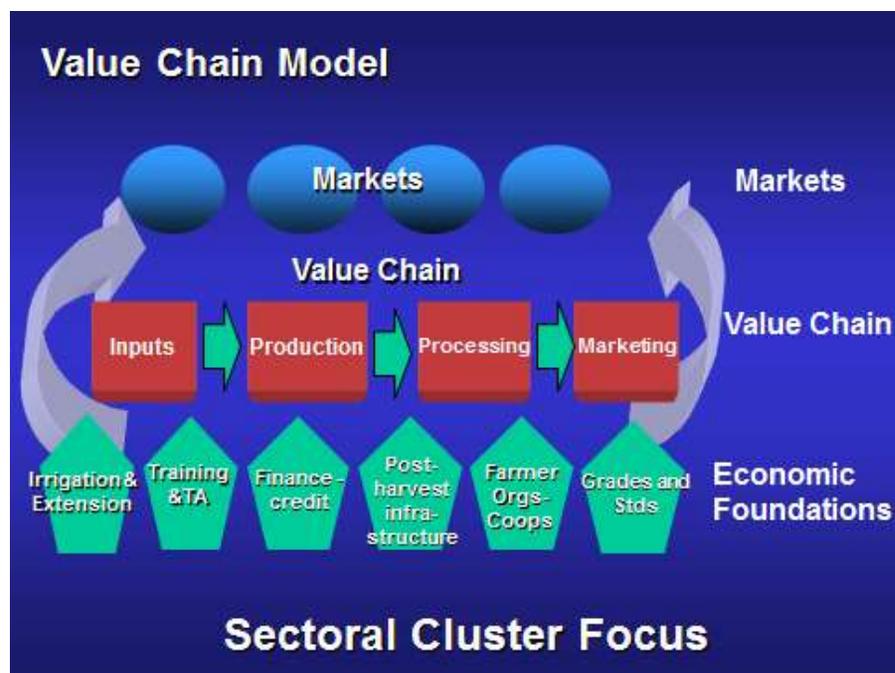
		storage
17	Business and operating training for market stakeholders	Operating plans and market rules developed and apex management committee trained
18	Advertising campaign for market traders and vendors	enterprises rent space from apex markets
19	Develop communications plan, train radio stations in program development and advertisement sponsorship	Radio stations broadcast daily agriculture report and market information
20	Business development strategy for processors developing to scale up processing innovations that source out of project supported farmers and women's groups	Grant funds applied for coffee, honey and other high value product processing and direct marketing
1-5	<b>Assessments and Planning</b>	
1	Establish Agriculture Development Network/ Steering Committee - project and district sub-committees with public and private value stakeholders	Establish one national- and district-level steering committees Note: Number of district levels to be determined
2	Agro-ecology, value chains, nutrition and social sector analysis and gap assessment	Strategies and needs integrated into district implementation plans
3	Value chain private sector stakeholders coordinate strategic investment needs with ROGY and project	Public goods investments included in district strategic development plans
4	Develop radio and TV in advertising plan	District radio stations enter agreements with sponsors
5	Develop extension communications campaign	Integrated agriculture and nutrition mass media campaign for district stations

## ANNEX 2: DEFINITIONS & RESOURCES

### SIMPLIFIED VALUE CHAIN SCHEMATIC

As shown in **Illustration A1** below, the core of the value chain is composed of input suppliers, producers, processors, and marketers. An actor in the chain can carry out more than one function such as an input dealer that provides inputs, credit, and technical assistance, or rural collection markets that add value through grading and packaging.

**Illustration A1: Value chain model**



Source needed:

### ECONOMIC FOUNDATIONS

The value chain is supported by critical economic foundations that help determine the degree of productivity and competitiveness of the organizations or companies in the sector. Economic foundations include physical infrastructure (roads, electricity, and telecommunications); availability of financing;

availability and skill level of human resources; research and development (R&D); agricultural extension; and the regulatory and business environment in the region, including factors as diverse as seed import registration and security.

The depth, quality and responsiveness of these economic foundations enable businesses in the value chain to reach higher levels of productivity and competitiveness. For example, improvements to road infrastructure, better access to credit and financing, and broader technical assistance (R&D and extension)—are all critical determinants of economic growth in the horticulture sector.

## METHODOLOGIES

This report is a result of desk research, consultations with key stakeholders, and direct observations in the field by staff of the USAID Community Livelihoods Project (CLP). Stakeholder consultations were conducted with farmers in Yemen, staff at the Yemen Ministry of Agriculture and Irrigation, sector specialists, and private sector value chain actors, including input dealers, market intermediaries, credit providers, and other key stakeholders. In addition, where relevant, best practices observed in other countries are drawn upon.

Additionally, the CLP team evaluated the market system, market opportunities, and market segmentation. This activity included interviews with importers, market intermediaries and middlepersons, collection and wholesale market participants, supermarkets, and subject matter experts in the government and donor communities as well as field interviews with cooperatives and extension workers.

In addition, the document utilized the following two reports to inform various sections:

- The World Bank Group's two-part study on climate change modeling and downscaling, and climate change and variability impacts assessment in water and agriculture sectors: *Yemen, Assessing the Impacts of Climate Change and Variability on the Water and Agricultural Sector and the Policy Implications*, Report No. 54196-YE, April 22, 2010, and *A Promising sector for Diversified Economy in Yemen: National Agriculture Sector Strategy, 2012-2016*, Republic of Yemen Government, Ministry of Agriculture and Irrigation

## ANNEX 3: ESTIMATE OF MACRO-ECONOMIC IMPACT OF PROPOSED VALUE CHAIN APPROACH

The following table illustrates potential profit increases resulting from a value chain approach with a particular focus on the importance of post-harvest handling and marketing.

	Base scenario	Yield (plus 10%)	One half marketed	Price (minus 10%)	Price (plus 10%)	100% Sold	Marketing costs (minus 10%)
<b>Yield (ton)</b>	1.8	1.98	1.8	1.8	1.8	1.8	1.8
<b>Quantity sold (%)</b>	80%	80%	50%	80%	80%	100%	80%
<b>Quantity sold (ton)</b>	1.44	1.584	0.9	1.44	1.44	1.8	1.44
<b>Price per ton (USD)</b>	1002	1002	1002	901.8	1102	1002	1002
<b>Sales (USD)</b>	1443	1587	902	1299	1587	1804	1443
<b>Production costs</b>	924	1016	924	924	924	924	924
<b>Marketing costs</b>	333	367	333	333	333	333	300
<b>Total</b>	1257	1383	1257	1257	1257	1257	1224
<b>Margin</b>	\$ 186	204	-355	41	330	546	219
<b>% change of base scenario</b>		10%	-290%	-78%	77%	194%	18%
<b>Positive changes over base scenario</b>		\$ 19			\$ 144	\$ 361	\$ 33
<b>Total change for 20 leebna</b>	100%	\$ 196					
	50%	\$ 98					

Increasing yields through improved technologies and lower input costs and their increased efficiencies makes the potential for overall positive change greater than the table illustrates. For example, information gathered by the CLP team estimates up to 40 percent of the production cost was irrigation-related, primarily labor and diesel fuel. Installation of drip systems and improvements in surface water systems would serve both management of a scarce resource and reduced costs. Importantly, most significant changes are dependent on collaborative entrepreneurship among farmers and improved horizontal and vertical linkages within chain actors such as input dealers and market intermediaries –a value chain approach.

In each scenario one factor is modified showing the impact on the margin. The following numbered points correspond to the Excel chart columns.

(1) This is an estimated **base scenario** for 20 leebna (889 square meters) of open field tomatoes. The intent of the table is to highlight three important post-harvest factors that influence profit: (1) farm gate and market prices, (2) volumes sold and (3) costs. The table summarizes costs and returns with margin to cover certain fixed costs (bank charges, salaries, etc., and rent has been included in production costs) and profit. Production and marketing costs (e.g., packaging, transport and commission) are estimates based on CLP field investigations and vary widely among farmers, markets and geographic areas.

(2) Increasing yield by 10 percent resulting from a 10 percent increase in production and marketing costs shows a 10 percent increase in gross margin. This is for illustrative purposes. It is understood that production efficiencies could be gained without additional costs.

(3) Reducing volume sold (50 percent marketed) resulting from loss of market to oversupply, lack of buyers, post-harvest loss or poor demand has a dramatic effect on margin, in this scenario a 290 percent decrease compared to the base scenario. This illustrates the importance of production planning, understanding and using market information and trading in an organized market system.

(4) Impact on margin (decrease 78 percent from base) when prices are down 10 percent results when, for example, many costs are fixed, farmers are not in a position to negotiate or there is over supply, low demand, or poor quality, etc.

(5) Situation where prices are increased by 10 percent due to quality, low supply, high demand, etc. results in 77 percent increase in margin.

(6) Selling 100 percent demonstrates the greatest impact (194 percent increase over base margin) and may result from improved market linkages, increased demand, improved post-harvest practices and quality, better marketing plans, etc.

(7) Marketing costs will vary greatly per product and market but reducing costs by 10 percent results in 18 percent increase over base margin scenario. Marketing as an organized group taking advantages of scale can reduce marketing costs.

### **Important points from this table are:**

1. If farmers cannot sell all their production, profit can be significantly reduced. Coordinated and planned production based on market information can help mitigate this risk;
2. An increase in price has a significant effect on improving profit because production and marketing costs are generally fixed. The reverse is also true where a small decrease in price can have a significant impact on profit. Growing crops that are in demand, producing better quality and negotiating more effectively with traders are good ways to ensure higher prices;
3. Marketing costs (e.g., marketing commissions, transport, packaging) are important factors. Working collectively farmers may be able to reduce these costs.

## ANNEX 4

# Success story: USAID greenhouse inspires farmers to innovate

Inserted into PDF version of this report: <http://www.usaid.gov/results-data/success-stories/greenhouses-inspire-farmers-yemen-innovate>

## GREENHOUSES INSPIRE FARMERS IN YEMEN TO INNOVATE

### Demo site showcases green technologies

“Greenhouses are the best. If I had more money, I would make my land full of greenhouses.”

Farmer Mahdy Saleh Al Nagar, 25, is one of several Yemeni farmers inspired by innovations at the Sawan demonstration site in Sana'a. The site currently showcases a greenhouse that can produce up to 10 times more vegetables than a traditional field while using 92 percent fewer pesticides than other greenhouses.

The greenhouse also includes a solar panel that powers a humidity-regulating fan, water pump and a highly efficient drip irrigation system that conserves water by 70 percent. To demonstrate further sustainable water solutions in a place where they are most needed, USAID recently completed construction of a rainwater-harvesting system on the site as well.

The site was established in early 2012 with USAID support. It was the first of 13 demonstration sites established from April 2012-April 2013 in Yemen's major cities to showcase improved and environment-friendly agricultural production techniques.

Nagar had a greenhouse built in December 2012 with money he raised by selling family heirlooms. To his amazement, he started harvesting cucumbers just 40 days after planting the seeds in the greenhouse.

“It was not even possible to grow cucumbers in our farm before, apparently because of climate change. The last time my grandfather planted cucumbers was in 1990,” said Nagar. By his own calculation, he is now happily making \$85 (about 18,000 Yemeni Riyals) every three days.

Nagar is having a second greenhouse built and intends to grow strawberries once it is up and running. “I knew about greenhouses before, but didn't know how to plant inside them. The USAID-supported demo site provided that knowledge and also demonstrated great ways to save water,” he said. “Greenhouses are the best. If I had more money, I would make my land full of greenhouses.”

Four of Nagar's neighbors, all members of the Sawan Farmers' Union (the intrepid Nagar is not even an official member), have also built greenhouses in Sawan. Meanwhile, farther south of Sana'a, in Dhamar governorate, 25 new greenhouses were installed in 2013 by a farmer trained earlier at the Sawan demonstration site.

USAID's support to Yemen includes activities that allow farmers to earn income in innovative ways that support the environment by conserving precious water resources and using solar energy.

Last updated: July 29, 2013



Members of the Sawan Farmer's Union meet with USAID to tour their greenhouse project, which produces 1,000 percent more **vegetables than a traditional field.**

CLP

**United States Agency for International Development**  
USAID/Yemen  
Sana'a, Yemen