Government of the Sultanate of Oman

Sustainable Agriculture and Rural Development Strategy towards 2040

SARDS 2040

"Unlocking the potential of agriculture and rural development for the well-being of the people of the Sultanate of Oman"

Final

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Abbreviations and Acronyms

AFDF	Agriculture and Fisheries Development Fund
AIS	Agricultural innovation system
CAPO	Chief animal production officer
CBO	Central Bank of Oman
CCD	Colony Collapse Disorder
CFS	FAO Committee on World Food Security
CVO	Chief veterinary office
DG	Directorate General
DGFR	Directorate General of Fisheries Research, MAF
DGALR	Directorate General for Agriculture and Livestock Research, MAF
DRRM	Disaster risk reduction and management
DRW	Department of Rural Women, Al-Raffd Fund
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
FYP	Five-Year Plan
GAP	Good agricultural practices
GCC	Gulf Cooperation Council
GDP	Gross domestic product
GEF	Global Environment Facility
GFN	Global Footprint Network
GHP	Good handling practices
GIAHS	Globally Important Agricultural Heritage Systems
GMP	Good manufacturing practices
GoSO	Government of the Sultanate of Oman
GTIS	Global Trade Information Service
HACCP	Hazard analysis and critical control point
IFPRI	International Food Policy and Research Institute
IMF	International Monetary Fund
IO	Intermediate outcome
IP	Investment Plan
IPM	Integrated pest management
ISO	International Organization for Standardization
KPI	Key performance indicator
M&E	Monitoring and evaluation
MAF	Ministry of Agriculture and Fisheries
MDG	Millennium Development Goal
MECA	Ministry of Environment and Climate Affairs
MFA	Ministry of Foreign Affairs
MHC	Ministry of Heritage and Culture
MHE	Ministry of Higher Education
MLA	Ministry of Legal Affairs
MNE	Ministry of National Economy
MOCI	Ministry of Commerce and Industry
MOF	Ministry of Finance
MOH	Ministry of Health
MOHO	Ministry of Housing

MOM	Ministry of Manpower
MOT	Ministry of Tourism
MRMWR	Ministry of Regional Municipalities and Water Resources
MSD	Ministry of Social Development
MTC	Ministry of Transport and Communication
MUNM	Municipality of Muscat
NCSI	National Centre for Statistics and Information
NGO	Non-governmental organization
OCCI	Oman Chamber of Commerce and Industry
ODB	Oman Development Bank
OFIC	Oman Food Investment Holding Company
OIE	World Organization for Animal Health (formerly *Office International des Epizooties*)
OMR	Oman rial (national currency)
PACP	Public Authority for Consumer Protection
PAEW	Public Authority for Electricity and Water
PAIPED	Public Authority for Investment Promotion and Export Development
PASFR	Public Authority for Stores and Food Reserves
PASMED	Public Authority for Small and Medium Enterprises Development
PDO	Protected denomination of origin
PGI	Protected geographic indication
PPP	Public-private partnership
R&D	Research and development
RCA	Royal Court Affairs
RD	Royal Decree
RF	Results Framework
SARDS	Sustainable Agriculture and Rural Development Strategy
SCP	Supreme Council for Planning
SDG	Sustainable Development Goal
SMART	Specific, measurable, achievable, relevant, time-bound (indicators)
SME	Small and medium enterprise
SQU	Sultan Qaboos University
SRW	Section of Rural Women, Regional Department, MAF
SWOT	Strengths, weaknesses, opportunities and threats (analysis)
TRC	The Research Council
TSG	Traditional speciality guaranteed
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USD	United States dollar
UTF	Unilateral Trust Fund
WHO	World Health Organization
WB	World Bank
WFS	World Food Summit

Executive Summary

The ***Sustainable Agriculture and Rural Development Strategy towards 2040*** **(*SARDS 2040*)** provides **strategic and programmatic guidance to policy and investment** in the Omani agriculture and rural sector. The strategy consists of a comprehensive set of measures needed to ensure that future agricultural and rural development activities are economically viable and environmentally sustainable, thus contributing to the overall well-being of the Omani people.

The development of the SARDS 2040 started in 2013 and entered its final stage in mid-2015. An Omani national team and an FAO team of experts worked closely to jointly develop the Strategy. The process unfolded in a participatory way, involving dialogue with all relevant stakeholders to ensure their full ownership of the Strategy and the development of realistic analyses and proposals.

What emerged are two coordinated documents, namely:

I. **SARDS 2040**, focusing on the strategic options for Omani agriculture and rural development between now and 2040, including a Results Framework for monitoring and evaluating progress towards SARDS 2040 objectives; and

II. its **Investment Plan**, which represents the operational arm of the Strategy, focusing on investments to be implemented to achieve SARDS 2040 results on a five-year basis.

I. Background

Over the past 15 years, Oman has experienced fast growth as a result of rising oil prices, sound macroeconomic policies, business reforms and investments in health, education and infrastructure. However, economic growth has fallen short of reducing Oman's dual dependence on hydrocarbon revenue and foreign labour.

In light of the above, the Oman Vision 2040 identifies the sustainable diversification of Oman's economy as a key strategic objective. **Economic diversification is imperative** for Oman, whose oil and gas resources will only last for one more generation at the current level of extraction. **But it is important that it is done sustainably**, ensuring further economic growth while preserving the environment and assuring a balance between economic and social development. In this context, agriculture and rural development can play an important role.

Agriculture can significantly contribute to sustainable development as more enabling policies, new technologies and innovations, better capacities and professionalism of farmers increase agricultural productivity and the value of domestic production, while reducing its environmental footprint (primarily water and energy). These changes will increase agriculture's contribution to the gross domestic product and employment and could position the sector to improve Oman's trade balance (either through import substitution or export enhancement). **Rural development**, which is largely based on activities either directly or indirectly related to agriculture, can contribute to **reducing social and economic imbalances in regional development,** creating value added through the development of synergies between farm and off-farm activities (such as tourism, craftsmanship and agrofood processing) and empowering rural populations (primarily youth and women).

In short, investing in sustainable agriculture and rural development represents a defining window of opportunity for the country in the coming 25 years. The Omani people will definitely benefit from this sector's contribution to sustainable environmental, social and economic development.

II. Situation analysis

The situation analysis carried out to develop the SARDS 2040 emphasized that the Omani agriculture and rural sector faces a complex set of strengths, weaknesses, opportunities and threats.

In terms of **strengths**, Oman features a relative abundance of natural resources, diverse natural environments and rich agrobiodiversity, all of which can offer investment opportunities in agricultural production and rural development. At the same time, its important cultural and historical heritage is a potential source of investment in the rural tourism and ecotourism industry, both for domestic and foreign tourists. There are also sector-growth **opportunities** offered by: the virtually unlimited regional market for high-value agricultural products (primarily horticultural products); its optimal geographical position within the global trade flows, particularly interesting for the development of a vibrant logistics industry; the complementarity of the Omani growing season vis-à-vis the richest destination markets (such as the European Union, Japan, etc.); and a very positive image of the country abroad, which offers opportunities for branding and product differentiation.

In terms of **weaknesses** and **threats**, climate change is of course a major threat to the development of the agriculture and rural sector. In Oman, the current structure of incentives is leading to inefficient and unsustainable agricultural practices resulting in water depletion, soil salinization and the overgrazing of rangelands. At the same time, an overdependence on unskilled, immigrant labour coupled with poor post-harvest care and weak value addition and marketing are leading to high post-harvest losses, the low value of domestic production and a disconnect between domestic production and other phases of the agrofood value chains. Finally, yet importantly, the agriculture and rural sector is confronted with the lack of organization among economic agents at different stages in the value chains; poor institutional coordination among different stakeholders, both vertically (central vs. local entities) and horizontally (ministries, agencies, municipalities); the existence of some uncoordinated – and sometimes even conflicting – policies; and the need to strengthen management capacities in design, implementation and monitoring and evaluation (M&E) at ministry level.

III. Rationale

In order for the agriculture and rural sector to achieve **a more proactive role** in the development of the Omani economy and society, a strategy must look into **building on the sector's strengths and opportunities, while addressing its weaknesses and threats**. This is exactly what the SARDS 2040 proposes to do.

The agriculture and rural sector has the potential to contribute to solving some of the country's most important challenges over the next 25 years by enhancing sustainability, increasing economic returns, promoting job creation, empowering rural communities and reducing regional imbalances. The SARDS 2040 proposes to unlock this potential by pursuing three major thrusts:

- enhancing economic efficiency, profitability and competitiveness of agriculture and rural activities → **Go commercial**;
- improving environmental sustainability and resilience to natural disasters and crises (including climate change shocks) → **Go sustainable**; and
- reducing regional imbalances between rural and urban areas and promoting social inclusion by empowering local communities and providing livelihood opportunities in rural areas → **Go territorial**.

These thrusts represent the three main dimensions of sustainable development: economic, environmental and social. A fourth dimension, which is key for achieving the Strategy's objectives, is the institutional environment. Policies, institutions, social capital, regulatory and legal frameworks and investment climate enable the fulfilment of the other three dimensions.

IV. Vision

These four dimensions are therefore the pillars that will lead to the realization of the SARDS 2040 vision of:

"A sustainable and profitable agriculture and rural sector contributing to the achievement of food security and Oman's overall development objectives."

The SARDS 2040 qualifies the type of agriculture and rural development Oman is striving for, as well as its contribution to the country's Vision 2040 and ultimately the well-being of the Omani people.

V. Pillars

The four pillars bring together different perspectives in an innovative way to achieve the country's vision. While the pillar on **economic competitiveness** is a standard component in other sector or subsector strategies, **rural development** is rather new in the policy context of Oman. It aims to foster the local economy by building on synergies between agriculture and other sectors, such as industry and tourism, and empowering local communities, thus contributing to reducing the socio-economic development divide between different regions. The pillar on **environmental sustainability** is imperative in a context characterized by extreme natural resource scarcity and high vulnerability to climate change. Last but not least, the pillar on the enabling environment represents the overall **institutional framework**. Without addressing the issues under this pillar, it will be difficult to maximize the impact of interventions carried out under the other three.

VI. Structure

Each pillar is organized into one or more **programmatic areas of intervention**. These areas cluster programmes pursuing similar objectives (**outcomes**), namely:

a) Pillar A – "Enhancing the competitiveness of agriculture" pursues two outcomes, one per each of the main agriculture subsectors:
   - Outcome 1 – "Crop sector competitiveness increased"; and
   - Outcome 2 – "Livestock sector competitiveness increased".

b) Pillar B – "Improving environmental sustainability" of agriculture and rural activities pursues two outcomes, one referring to the relationship between agrofood activities

and the environment and the other to resilience to natural disasters, including climate change:

- Outcome 3 – "Sustainable management of natural resources in agriculture enhanced"; and
- Outcome 4 – "Resilience of agriculture and rural livelihoods to climate change and natural disasters improved".

c) Pillar C – "Promoting rural development" pursues one key outcome:

- Outcome 5 – "Rural communities empowered and rural livelihood opportunities improved".

d) Pillar D – "Creating an institutional environment enabling SARDS 2040 interventions" also pursues one key outcome:

- Outcome 6 – "Enabling institutional environment for agriculture and rural development strengthened".

VII. Content

Each of the above programmatic areas of intervention is broken down into organic sets of interventions aimed at a common result. These correspond to **programmes**, each of which pursues an **intermediate outcome** (IO). As a result, there are 21 IOs for the SARDS 2040. Below is a synthesis of each programmatic area of intervention.

Outcome 1

Outcome 1 – "Crop sector competitiveness increased" is pursued through three IOs, namely:

- IO 1.1 – Technical and organizational innovations promoted, high-value varieties developed, crop yield and nutritional quality increased;
- IO 1.2 – Post-harvest losses reduced, product market quality improved, product value added developed and market opportunities enhanced; and
- IO 1.3 – Stringent food safety and biosecurity measures for crop products enforced.

The overall objective is to increase crop sector competitiveness. Considering the binding resource constraints (primarily water), this will be achieved **not by increasing the scale of domestic crop production, but by increasing efficiency and adding value through technical and organizational innovations**. A focus on high-value crops, efficiency (primarily in water use), loss reduction (primarily through cold chain technology), widespread adoption of good agricultural practices and related certifications, support to farmers and other operators in the value chains to form collective action organizations, value addition through packaging and processing, product differentiation (primarily geographical indications), branding and higher standards in biosecurity and food safety will drive this competitiveness.

Priority should be given to establishing post-harvest infrastructure in key production areas (e.g., in Al Batinah) and supporting farmers to meet required quality standards and to access this infrastructure. Assisting farmers and other operators within the value chains in organizing themselves is an essential step for increasing efficiency and should be prioritized. These interventions should later be expanded to the rest of the country.

Interventions under Outcome 1 should also be coordinated with efforts to achieve Outcome 3 (Sustainable management of natural resources). Target groups should be farmers engaged in improved water resources management (e.g., in a given aquifer of Al Batinah or in the modernization of *aflaj* irrigation systems).

Outcome 2

Outcome 2 – "Livestock sector competitiveness increased" is pursued through four IOs, namely:

- IO 2.1 – A more productive, market-oriented and sustainable red meat and dairy industry developed;
- IO 2.2– National poultry industry competitiveness and sustainability enhanced;
- IO 2.3 – Apiculture practices and technologies, organization of producers, value addition and marketing enhanced; and
- IO 2.4 – Stringent food safety and biosecurity measures for animals and animal products enforced.

The overall objective is to enhance the competitiveness of the livestock industry. This will be pursued through **adding value to existing livestock production and increasing its potential without compromising the environment**. Key interventions include: (i) organizing producers through cooperatives or other forms of economic associations throughout the value chains, primarily in the milk (cattle and non-cattle) collection systems that provide to existing plants; (ii) providing post-harvest infrastructure (e.g., cold chains) to improve milk collection networks and dairy plants, or infrastructure associated with slaughterhouses; (iii) introducing high value-added technologies (e.g., special cuts, use of sub-products, specialized technical assistance to farmers on breeding and feeding); and (iv) improving biosecurity and food safety procedures (e.g., hazard analysis and critical control points [HACCP]) throughout the country.

Geographical priority on animal production, animal health, feed production and processing should be given where there is potential for the sector's development and where the need to improve environmental sustainability is the greatest. As such, priority should be given to the Dhofar mountains because of the specific sustainability issues related to rangeland management, with a special focus on product differentiation (e.g., camel and local goat products). Poultry production shares a similar approach but not the same geographical focus, as it will need to identify land where biosecurity and the environment are not at risk.

Interventions under Outcome 2 should be coordinated with efforts to achieve Outcome 3 (Sustainable management of natural resources) and Outcome 4 (Resilience of agriculture and rural livelihoods to climate change and natural disasters) with specific reference to measures that aim to reduce the ecological footprint of livestock-intensive plants.

Outcome 3

Outcome 3 – "Sustainable management of natural resources in agriculture enhanced" is pursued through four IOs, namely:

- IO 3.1 – Income per unit of water used in agriculture maximized;
- IO 3.2 – Capture, re-use and storage capacity of water for agriculture increased;
- IO 3.3 – Soil management improved; and
- IO 3.4 – Agrobiodiversity conserved.

The overall objective is to **make farming practices more sustainable, specifically the use of natural resources, primarily water**, which is the binding constraint on agriculture. This will be done through interventions that enhance the efficiency of water resources management (the target is to remain within the water budget) and increase water productivity in agriculture (maximizing the value per unit of water). This programmatic area of intervention also includes the conservation and improvement of soils and the conservation of Omani agrobiodiversity.

Nevertheless, the most important issues are water use and management. Therefore, intervention priorities are set with reference to aquifers and regions where: (i) agricultural production is largely concentrated and there is a clear trend of groundwater depletion and seawater intrusion; (ii) farmers are well organized, making efforts to strengthen water users' groups as well as dialogue platforms between different water users easier; and (iii) opportunities for product value addition are greater. Hence, the Al Suwayq zone of Al Batinah could be the first possible intervention area, along with some *aflaj* irrigation systems, where changes in production, irrigation techniques and organization of farmers through collective action organizations show potential to improve local livelihoods and contribute to better water management.

Increasing water productivity sustainably is addressed through the production improvements necessary for achieving Outcomes 1 and 2. The interventions under Outcome 3 should be coordinated with Outcome 5 (Rural development) as far as *aflaj* conservation is concerned (IO 5.2), and Outcome 6 (Enabling institutional environment) for the institutional reforms required to use land more efficiently.

Outcome 4

Outcome 4 – "Resilience of agriculture and rural livelihoods to climate change and natural disasters improved" is pursued through two IOs, namely:

- IO 4.1 – Climate change adaptation and natural disaster risk management integrated into agricultural and rural development policy, investment and programmes; and
- IO 4.2 – Climate change mitigation and agricultural footprint improved.

The overall objective of Outcome 4 is to **improve the resilience of agricultural and rural livelihoods to climate change and natural disasters**. The required interventions are related to planning; improved institutional frameworks for coordination and collaboration; and knowledge development on climate change adaptation, mitigation and disaster risk management and resilience. Most of these activities fall under the mandate of the Ministry of Environment and Climate Affairs (MECA), the Ministry of Regional Municipalities and Water Resources (MRMWR) or institutions other than the Ministry of Agriculture and Fisheries (MAF). In this domain, the key role of MAF is twofold:

(i) promote policy dialogue and inter-institutional coordination to ensure that the role of agriculture and rural development is mainstreamed into national strategies and action plans; and (ii) contribute to field and research operations to ensure climate change, disaster risk management and resilience are mainstreamed into its extension services and the dissemination of technologies and techniques for agricultural production, processing and marketing (i.e. throughout all SARDS 2040 interventions).

The adoption of climate change mitigation measures in the agriculture sector and rural areas is an important component of this outcome. Efforts should be made to improve energy efficiency use, adopt renewable energy resources and coordinate with efficiency-enhancing interventions under Outcomes 1 and 2.

Outcome 5

Outcome 5 – "Rural communities empowered and rural livelihood opportunities improved" is pursued through two IOs, namely:

- IO 5.1 – Rural economic activities diversified and livelihood opportunities improved; and
- IO 5.2 – Local cultural heritage and traditional social values preserved and valued.

The overall objective of Outcome 5 is to **promote the empowerment of rural communities – primarily youth and women – as well as the development and diversification of farm and non-farm economic activities in rural areas to increase income-generation and employment opportunities**. This would contribute to a more balanced regional development by reducing the divide between rural and urban areas. Pursuing this objective requires the adoption of a **territory-based approach** rather than the traditional sector-focused, production-oriented approach.

Considering that Oman has no previous experience with a territory-based approach, a **pilot rural development programme** will be launched in Jebel Akhdar. This area is considered the most appropriate because of its potential to generate immediate benefits (valorisation of local high-value agricultural produce and synergies that can be developed between on-farm and off-farm activities in the area, such as ecotourism business opportunities) and lessons for scaling up to other rural areas in the country.

Two conditions are key for the success of the programme, namely: (i) effective collaboration of all involved stakeholders (e.g., MAF, Ministry of Heritage and Culture [MHC], Ministry of Tourism [MOT], Ministry of Commerce and Industry [MOCI], Ministry of Housing [MOHO], MRMWR, MECA, etc.); and (ii) engagement of the local community from the early stages to better identify territorial opportunities and needs, pinpoint target groups and actors (especially leaders to work with), develop participatory capacity development plans with local stakeholders and strengthen their capacity to organize in order to professionalize farmers and develop local partnerships (public and private) to design and execute interventions.

Outcome 6

Outcome 6 – "Enabling institutional environment for agriculture and rural development strengthened" is pursued through six IOs, namely:

- IO 6.1 – Institutional and regulatory framework enhanced and enforced;
- IO 6.2 – Economic environment enhanced;

- IO 6.3 – Provision of inclusive financial services improved;
- IO 6.4 – Knowledge base for agriculture and rural development strengthened;
- IO 6.5 – An effective innovation system for competitive and sustainable agriculture implemented; and
- IO 6.6 – Social support to agriculture and rural development enhanced.

The overall objective of Outcome 6 is to **improve the institutional and economic environment for agriculture and rural development**, thus enabling a more effective implementation of SARDS 2040 interventions. The interventions under Outcome 6 are needed to increase the likelihood of the entire Strategy's success and aim to improve its ability to stimulate private investment.

In order to achieve the expected results, the following priorities should be addressed: (i) institutional reform and enforcement of the regulatory framework, namely enforcement of the water law in a given region and facilitation of entrepreneurial activities through regulatory reform of labour, land and association laws; (ii) reform of the current system of generalized subsidies in favour of a system of 'smart' incentives directly linked to the achievement of SARDS 2040 objectives; (iii) expansion of the provision and outreach of inclusive financial services (credit, insurance); (iv) enhancement of the reliability of sector statistics and other information tools for decision-making; (v) awareness raising to increase public support for the implementation of the various aspects of the SARDS 2040; and (vi) support to the development of policy dialogue platforms to discuss issues of mutual interest between the public sector, the private sector and non-governmental organizations.

Most of these interventions have limited financial implications besides the mobilization of technical expertise, as most are related to policy dialogue and institutional coordination. However, the success of the outcome depends on high political engagement and a systematic, proactive effort by the MAF.

VIII. Approach

The SARDS 2040 and its Investment Plan (IP) adopt **a programmatic results-based approach**, in which each programme has a broader scope and is more integrated, compared with the standard project-based approach of current Omani planning procedures. It also strives to be 'people-centred'.

Each programme clusters interventions with shared goals within a common framework to ensure a higher level of coordination and effectiveness. The SARDS 2040 programmes can be classified according to the following **four typologies**:

a) ***sector/subsector*** **programmes** adopting a value chain approach, such as programmes contributing to Outcome 1 (Crop competitiveness) and Outcome 2 (Livestock competitiveness);

b) ***thematic*** **programmes** adopting a more cross-cutting, issue-oriented approach, as can be seen through programmes contributing to Outcome 3 (Natural resources management) and Outcome 4 (Resilience to climate change and natural disasters);

c) ***regional*** **programmes** adopting a territory-based approach that requires an even more comprehensive method of addressing all issues within a given area, such as programmes contributing to Outcome 5 (Rural development) or specific regional

programmes such as the conservation of the Dhofar mountain rangelands and the promotion of sustainable agriculture in Al Batinah; and

d) ***institutional environment*** **programmes** that aim to reform the existing institutional and regulatory setting (including policies and laws) and improve the investment climate and dialogue between stakeholders, such as programmes contributing to Outcome 6 (Enabling institutional environment). The breadth of this typology affects the whole country.

IX. Priorities

The SARDS 2040 proposes a coordinated and comprehensive set of interventions to carry out the envisioned changes over a period of 25 years. Therefore, a **sequencing** of the interventions must be identified. There are a few interventions whose expected IOs are essential for the overall success of the SARDS 2040 because of the urgency of the issues to be addressed and/or their leverage effect on other programmes.

The key interventions that can make the difference, thus identified as **top priorities for the next five years** in the SARDS 2040 IP 2016-2020, are the following:

a) **create an enabling institutional environment including a conducive regulatory setup** for the development of agribusiness and agrofood production (IO 6.1); reform the current structure of incentives, moving from generalized subsidies towards 'smart' incentives (IO 6.2); improve the provision of inclusive rural financial services (IO 6.3); enhance the knowledge base for decision-making in agriculture and rural development (IO 6.4), while also conducting selected studies/surveys to acquire the information/data and knowledge not existing yet in the country; and support the creation of platforms for policy dialogue between private and public stakeholders;

b) **address the issue of sustainable water management in agriculture**, starting from the country's most important agricultural region, Al Batinah (IO 3.1, most interventions under Outcome 1 and some interventions under Outcomes 2 and 4);

c) **improve food safety and biosecurity standards** in crop (IO 1.4) and animal (IO 2.4) value chains: this is essential if competitiveness is to be enhanced; and

d) **pilot an innovative and integrated rural development approach in Jebel Akhdar** (which covers Outcome 5), assess it and eventually scale it up to other areas in the country.

X. Risks

The most important **risks at strategic level** include:

- **vulnerability to economic and political risks** stemming from uncertainties in world markets – primarily oil and gas markets – and the turbulent political situation in the region. This calls for renewed efforts towards a fast and firm economic diversification, reduced economic dependence on imports and a pragmatic foreign policy to increase the country's resilience to external shocks;
- **lack of political support and time inconsistency of policy**, which may impede essential coordination among all relevant stakeholders and undermine the continuity of actions required by the long-term change envisioned by the SARDS 2040. All efforts should be made to ensure the needed political support and direction at the

highest level (His Majesty the Sultan and the Supreme Council for Planning [SCP]); and

- **lack of support by the society at large** due to a poor understanding of the role agriculture and rural development could play in a modern society. Continuous awareness raising, communication campaigns and dialogue with farmer and rural-based organizations as well as civil society organizations are key to changing this situation and favouring a new social contract between consumers and agrofood producers for broad political support for agriculture and rural development.

XI. Results Framework

The SARDS 2040 also includes a Results Framework (RF), which is **a tool to manage, monitor and evaluate** Strategy interventions effectively and ensure greater **accountability** in implementation.

For each level of the results chain, the RF includes the relevant indicators, baseline value and year, targets for 2020 and 2040, means of verification (including the data source, key provider institution, other contributing institutions and frequency of data collection), risks and assumptions.

The SARDS 2040 RF is based on **43 key indicators**, including 7 indicators at impact level, 6 indicators at outcome level and 30 indicators at IO level. Efforts were made to select indicators that were specific, measurable, attainable, relevant and time-bound.

However, data were not available for all of the RF indicators. In fact, only 21 of the 43 indicators currently have a baseline, and targets have been set for only 19 of the 43 indicators.

From an operational viewpoint, this means that one of the key activities to be carried out during the first 12 to 24 months of SARDS 2040 implementation is **to fill the information gap,** investing in **surveys** or **studies** to establish a baseline for those indicators without one. These activities will be part of the **M&E system** of the SARDS 2040 and the IP. A specific monitoring and reporting plan will need to be developed within the first six months of SARDS 2040 implementation, specifying actions, responsibilities and a time frame for reporting and communication.

XII. Investment Plan

While the SARDS 2040 is a policy document that defines the strategic vision and objectives to be pursued over the next 25 years, **the Investment Plan (IP) is its operational arm in the medium term**. It comprises a framework to **orient public investments**, **stimulate private sector and agribusiness development** and **guide public project implementation** and **M&E**.

The IPs are based on a five-year time frame, aligned with the planning time frame adopted by the Sultanate of Oman. The first IP covers the period 2016-2020 and is aligned with the country's 9th Five-Year Plan.

The IP 2016-2020 is **results-based**. All of the related investments, whether carried out by the public or the private sector, ultimately contribute to achieving the impact, outcomes and IOs of SARDS 2040.

XIII. Agriculture and rural areas by 2040

The process of transformation envisaged by the SARDS 2040 aims to: (i) expand and further develop **commercial farms**; (ii) transform **small-scale, diversified holdings**, making them more efficient and market-oriented; (iii) support the multi-functional **traditional agriculture** that provides public goods (landscapes, biodiversity, cultural values and identity); and (iv) rehabilitate the Dhofar rangelands, making the management of **pastoral systems** more sustainable and linking animal husbandry to the market. In a sentence, the SARDS 2040 helps farmers realize their potential as **responsible and successful agricultural entrepreneurs** and organize them as well as other operators in the value chains.

At the end of the process, the agriculture and rural sector will be more **balanced**, **sustainable** and **dynamic**, while the countryside will be less "agricultural production–based" and more "rural activities-based" (both on-farm and off-farm), with farms producing not only agricultural commodities, but high-quality, high-value produce and services (multi-functional farms).

XIV. SARDS 2040 and Vision 2040

Agriculture and rural development's contribution to the society's well-being goes well beyond the mere **economic contribution** in terms of GDP, encompassing also **social and environmental dimensions**. This is already happening in the Omani countryside, and will be even more so in 25 years from now because of the changes that economic growth brings about as well as the development pattern implied by the Vision 2040.

It is expected that SARDS 2040 will accommodate and support this evolution, **increasing the livelihood opportunities** of rural households and **contributing to a more balanced and sustainable regional development**. In doing so, the SARDS 2040 is aligned to Vision 2040 and is able to contribute significantly to all aspects considered therein.

XV. Conclusion

The next 25 years represent **a tremendous window of opportunity** to make a change, not only for the agriculture and rural sector but also for the development of the whole country.

In order to seize this opportunity, **strategic and programmatic guidance for policy and investment** is required at the economy level as well as the sector level.

The former is represented by the country's **Vision 2040,** while the latter by the **SARDS 2040**, the tool devised by the Sultanate of Oman to contribute to this change through agriculture and rural development.

1. Introduction

Oman was the first Gulf Cooperation Council (GCC) country to launch a long-term economic development strategy – the so-called Vision 2020 – in 1995.[1] Building on the Vision 2020 experience, Oman's Government is currently drawing up a new long-term economic strategy – provisionally known as Vision 2040 – that is being developed at the highest level[2] and to be launched by mid-2018. Vision 2040 is built on nine pillars,[3] representing both strategic objectives and key areas for government action in the coming years.

Key in this strategy is the attempt to diversify Oman's economy in a sustainable way. Moreover, sustainable development – that is, ensuring economic growth while preserving the environment and achieving a balance between economic and social development – is the operational principle of any sector policy that should be aligned to the Vision 2040. Oman's primary sector[4] can significantly contribute to sustainable development, as more enabling policies, new technologies and better capacities can increase agricultural productivity and the value of domestic production while reducing its environmental footprint (primarily water and energy). These changes could increase agriculture's contribution to the gross domestic product (GDP) and employment and possibly improve the country's trade balance (either substituting food imports or increasing exports). At the same time, rural development, which is largely based on activities either directly or indirectly related to agriculture, can contribute to reducing imbalances in regional development, and create more value added through synergies between farm and off-farm activities, such as tourism, craftsmanship and agrofood processing that are blossoming in rural areas.

In light of the above prospects, the Ministry of Agriculture and Fisheries (MAF) requested the Food and Agriculture Organization of the United Nations (FAO) to assist in the formulation of the national *Sustainable Agriculture and Rural Development Strategy towards 2040* (SARDS 2040) as part of the Unilateral Trust Fund (UTF) Programme between the Government of the Sultanate of Oman and FAO.[5] This request was reiterated during the visit paid by Oman's Minister of Agriculture and Fisheries to the FAO Director-General at FAO headquarters on 10 June 2015. Since then, through the

[1] The Vision 2020's overarching goals include ensuring economic and financial stability, boosting private sector participation, diversifying the economy away from oil and other unsustainable resources and investing heavily in the Omani workforce, among others.

[2] The Secretariat General of the Supreme Council for Planning is looking at the development of the Vision 2040, assisted by an independent committee made up of ministers and other senior policy-makers.

[3] The Vision 2040 pillars include creating wealth through economic diversification and private sector partnership (i.e., boosting non-oil economic growth by expanding existing small and medium enterprises and Omanization programmes); developing technical and entrepreneurial capabilities; building world-class infrastructure and urban systems; ensuring equitable regional development; enhancing family and community well-being; upholding Omani culture and identity; preserving environmental sustainability; improving governance effectiveness; and safeguarding national security.

[4] The primary sector includes agriculture, forestry, aquaculture and fishery. In this document, however, we will focus only on agriculture *latu sensu,* that is, cropping, livestock breeding and rural development, as the fishery sector is dealt with by a specific fishery strategy, currently being developed by the Government of Oman with the support of the World Bank.

[5] The project agreement for the development of the SARDS 2040 (UTF/OMA/011/OMA) was signed on 30 March 2013.

support of FAO's Regional Office for the Near East and North Africa, the FAO Investment Centre's Service responsible for the Near East and North Africa region has assisted the MAF in elaborating the SARDS 2040.

The SARDS 2040 is a policy document that provides strategic and programmatic guidance to policy and investment in Oman's agriculture and rural sector. It consists of a comprehensive set of measures needed to ensure that future agricultural and rural development activities are economically viable and environmentally sustainable, thus contributing to the overall well-being of the Omani people.

The development of the SARDS 2040 started in 2013 and entered its final stage in mid-2015. An Omani national team and an FAO team of experts (Annex 1) worked closely to jointly develop the Strategy. The process unfolded in a participatory way through a series of four missions undertaken between August 2015 and April 2016 (Annex 2), consulting more than 100 key stakeholders (Annex 3) who discussed the seven background papers prepared by the FAO experts (Annex 4) and carried out a deep situation analysis of the country's agriculture and rural sector, thoroughly discussing and agreeing on any aspects of the proposals included in the SARDS 2040.

What emerged were two interlinked documents, namely:

a) SARDS 2040, focusing on the strategic options for Omani agriculture and rural development between now and 2040, including a Results Framework (RF) for monitoring and evaluating progress towards SARDS 2040 objectives; and

b) its Investment Plan (IP), which represents the operational arm of the Strategy, focusing on five-year investments to be implemented to achieve SARDS 2040 results.

The SARDS 2040 document is organized as follows:

a) a synthetic analysis of the broader context within which the Omani agriculture and rural economy are embedded (Chapter 2), an assessment of the challenges and opportunities agriculture and rural development face (Chapter 3) and an overview of the key institutions and policy frameworks relevant for the SARDS 2040 (Chapter 4);
b) an overview of the rationale and structure of the SARDS 2040 (Chapters 5 and 6), discussing the principles and rationale that guided its development, its vision and its articulation in intervention areas and expected results (impact, outcomes and intermediate outcomes);
c) a brief description of the SARDS 2040 RF (Chapter 7) and its IP (Chapter 8), emphasizing the relationship between the SARDS 2040 and these two tools, as well as some recommendations (Chapter 9) relevant for implementation, such as priorities and modalities.

The annexes include:

- background information on the SARDS 2040 development process, such as the composition of the two teams (Annex 1), the missions (Annex 2), the list of stakeholders involved in developing the SARDS 2040 (Annex 3) and the reference to the seven background papers prepared for the SARDS 2040 (Annex 4); and
- the SARDS 2040 RF matrix (Annex 5), which is an essential component of the Strategy and the key tool for monitoring its implementation.

2. The Broader Context

This chapter provides a summary of the major implications for the design of the SARDS 2040 that stem from the analysis of the broader context[6] – social, economic, environmental – within which the Strategy will be located. The chapter discusses what can and should be done from the sector's viewpoint to contribute to the pursuit of the Sultanate's overall development objectives until 2040.

2.1. Socio-demographic Dynamics

Increasing population. The United Nations (UN, 2015) and the National Centre for Statistics and Information (NCSI, 2015a) both show that by 2040 the Sultanate's population will have reached 5.5 to 5.6 million people, an increase of nearly one-fourth of today's population. This will result in an increased demand for agrofood products, which, if not accommodated by the national production system, will need to be fulfilled through imports, with obvious consequences for the country's trade balance.

Ageing population. Despite the fact that Oman has a very young population (median age of 29 years), demographic projections show that by 2040, the population will be much older (median age of 37 years), with older age classes (65+) accounting for almost 10.7 percent of total population and an old-age dependency ratio of 14.6 percent (NCSI, 2015a; UN, 2015). This will translate into a different demand for agrofood products, geared more towards the needs of a population whose composition is changing.

More urban population. The urban population, which currently accounts for 77.6 percent of the Omani population, will keep growing, reaching 84.8 percent of the total population by 2040, increasingly concentrated in large cities (NCSI, 2015a; UN, 2014). This calls for a stronger and more efficient marketing system, linking agricultural production and food consumption, as well as interventions promoting rural development – such as infrastructure, employment generation activities, etc. – to enhance livelihood opportunities for people living in rural areas. This will contribute to a more balanced regional development.

2.2. Economic Growth

More diversified economy. The Omani economy still depends heavily on hydrocarbons, with oil and gas still contributing approximately 50 percent to GDP and amounting to 90 percent of total government revenues (CBO, 2015). Considering that oil and gas reserves will only last for 15 and 24 years, respectively, at the current level of extraction (BP, 2015), diversifying the economy is not an option but a necessity. By 2040, the Omani economy will no longer be a hydrocarbon-based economy. What needs to be defined is which development path to pursue between now and then. Vision 2040 identifies sustainable and inclusive development as the key path for development. In this perspective, agriculture and rural development can play a key role because of its huge untapped potential. In pursuing agriculture and rural development, the country will also

[6] The interested reader is referred to the background paper no. 7 (Romano, 2016) for a more detailed analysis.

contribute to environmental sustainability (reducing the agricultural ecological footprint), social inclusion (reducing regional disparities, creating jobs in less developed areas, etc.) and overall development (developing synergies with tourism and craftsmanship, linkages with processing and value addition).

Better environment for doing business. Omani policy-makers have continuously tried to improve the economy's regulatory environment for business development. Overall, Oman is doing fairly well with regards to basic requirements, but the situation can be further improved in what the World Economic Forum (Schwab, 2015) calls "efficiency enhancers"[7] and "innovation and sophistication factors".[8] By and large, the environment within which business players operate imposes high transaction costs, does not effectively stimulate their participation in the economy and often does not provide an appropriate incentive structure to reward positive behaviours (sustainability, efficiency, technological, institutional and social innovations). This calls for renewed efforts to further speed up the process of reforms in the economic regulatory setup and to render the 'doing business' environment more competitive.

More affluent and educated society. As the economy grows, the society also changes, becoming more affluent and educated. Consequently, consumer demand will change, both generally and specifically in terms of food. Wealthier and better educated people will not only increase their demand, but will have an enhanced capacity to appreciate high-value goods – including high-value agricultural products – and multi-functional agriculture, i.e. producing not only commodities, but also services and public goods such as landscapes, biodiversity, etc. This calls for a different agrofood system, focusing more on value addition and processing to respond to the needs of a more affluent and better-educated society.

More equitable country. Economic growth is often an uneven process. If not guided, it is likely to create more economic, social and territorial inequalities. Agriculture and rural development can play a key role in reducing these inequalities because investing in this sector is at least twice as effective in reducing poverty than investing in non-agricultural activities (WB, 2007). Moreover, rural development takes place in areas generally poorer than non-rural areas, thus contributing to a better-balanced regional development.

2.3. International Trade

Country more integrated in global flows. Oman is a very open economy already well integrated into international flows, with an exports and imports ratio to GDP amounting to 120 percent (WB, 2015a). The integration in international trade flows is expected to further increase by 2040 bringing about greater competition but also greater opportunities. It is expected that the country's merchandise trade will be less dependent on hydrocarbons and, generally speaking, on commodities, and much more on services and customized goods. In this context, agriculture can play a key role both in terms of increasing exports and substituting imports.

Specifically, competition in international markets is moving from a cost-based competition (commodity-based trade) towards a quality-based competition (reputation-based trade). Omani agriculture is very well equipped to play this game, thanks to an

[7] This dimension includes the following six pillars: higher education and training; goods market efficiency; labour market efficiency; financial market development; technology readiness; and market size.

[8] This dimension includes only two pillars, business sophistication and innovation.

extraordinary environmental and genetic diversity that can be the basis of the development of high-quality agricultural produce to meet domestic and foreign demand. Furthermore, Oman is perfectly positioned to increase exports to most developed markets in the northern hemisphere (European Union and fast-growing East Asian markets), due to the complementarity of the growing season between the Sultanate and those markets.

Country possibly more attractive for foreign direct investment (FDI). Even though Oman already attracts FDI, there is room for increasing FDI and changing its destination. So far, the main sectors attracting FDI are oil and gas (49 percent), financial intermediation (16.6 percent) and manufacturing (15.2 percent) (CBO, 2015). In order to increase the share of FDI to the agrofood sector, improving the 'doing business' environment is essential (Drzeniek Hanouz et al., 2014; Schwab, 2015; WB, 2015b). Specifically, the most important issues to be addressed with reference to the agrofood sector include labour regulations, workforce quality (education, training and work ethics), innovation capacity and bureaucratic obstacles to starting a business.

2.4. Environmental Sustainability

Limited natural resources (water, land) and more competition for their use. Even though Oman is relatively well endowed in terms of natural resources, it already consumes twice as many resources than the country's 'biocapacity' (GFN, 2015).[9] Some of these resources (such as water and land) are already under pressure and will be even more so with population and economic growth. Immediate action is needed to bring the use of resources back onto a path of sustainability.

Agriculture contributes more than 22 percent to the total ecological footprint[10] (GFN, 2015). In the case of groundwater, agriculture already extracts 30 to 50 percent more than the natural recharge (Ward, 2016), causing the lowering of the water table and the salinization of the aquifers and soils. Therefore, living within its natural resources budget is an essential objective to set for the country, improving the efficiency of resources use, increasing the profitability per unit of resources used and switching as much as possible from non-renewable to renewable energy.

More environmental risks and uncertainties. Although climate change projections carry uncertainty, it is likely that Oman will experience decreased and less predictable rainfall as well as higher temperatures (estimated at 0.2°C warmer each decade) (Al-Charabi and Al-Yahyai, 2013; Zaman, 2014). There is likely to be a consequent increase in aridity, as lower rainfall and higher temperatures will result in increasing evapotranspiration, producing hotter summers and shorter winters. Possibly the most serious risk is the increasing frequency of extreme events: droughts, cyclones and more violent storms. Agriculture is both a target of and a contributor to these changes. As such, it is a core component of any serious preparedness, adaptation and mitigation strategy to make agriculture and rural livelihoods more resilient to natural shocks.

[9] The biocapacity is the capacity of ecosystems to regenerate what people demand from them, that is, the ecosystems' capacity to produce biological materials used by people and to absorb waste material generated by humans under current management schemes and extraction technologies.

[10] The ecological footprint is a measure of how much area of biologically productive land and water an individual, population or activity requires to produce all the resources it consumes and to absorb the waste it generates, using prevailing technology and resource management practices. It is usually measured in global hectares.

2.5. Food and Nutrition Security

Turbulent region and increasing global insecurity. Oman is an oasis of peace and economic stability in a turbulent region. This made possible the achievement of important welfare targets, including food security both as Millennium Development Goal (MDG) 1C and World Food Summit (WFS) targets (FAO, 2015a). However, the world and the region are becoming increasingly more insecure with important economic risks (e.g., price volatility) and natural risks (climate change effects). Although food self-sufficiency is an unfeasible and uneconomic policy objective, sustainably increasing the domestic production of some selected products – i.e., the ones that may be convenient from a domestic resource cost[11] viewpoint – may help strengthen national security. Doing so requires a whole set of interventions, including enhancing the institutional and regulatory framework, improving the environment for doing business, providing financial services tailored to farmers' needs, strengthening the knowledge base for agriculture and rural development, implementing an effective innovation system for a competitive and sustainable agriculture and increasing social support to agriculture and rural development.

Better diet for better health. While Omanis' diets have improved over the last decades (Romano, 2016), the population is experiencing new phenomena that are cause for concern, such as overweight and obesity. According to the World Health Organization (WHO, 2015), in 2014, 30.9 percent of the total population over the age of 18 was obese and 62.4 percent overweight. Of particular concern is the fact that females and youth show even higher percentages. Even though overweight and obesity do not depend exclusively on high caloric diets, thus calling for broader changes in peoples' lifestyles (e.g., more physical activity), there is no doubt that better balanced diets are key, and that better nutritional information and education are essential in order to address this very serious issue. Of course, in order to achieve well-balanced diets, agriculture must play a major role, through the production and increased availability of fresh fruit and vegetables.

2.6. Concluding Remarks

Oman's social and economic achievements over the last 45 years have been impressive. What used to be an isolated and less developed country, lacking basic facilities and infrastructure, is today one of the most developed and stable countries in the Arab world, characterized by high income per capita, open trade and a moderate, independent foreign policy that has thus far guaranteed peaceful modernization in a turbulent region.

At the same time, looking at the structural characteristics of the Sultanate economy, it can be concluded that recent economic growth has fallen short of achieving its primary goal of reducing Oman's dual dependence on hydrocarbon revenue and foreign labour, making Oman the most vulnerable economy among the GCC countries.

The analysis of the current situation emphasizes significant strengths and opportunities for further development, but only if some major challenges are addressed.

[11] The domestic resource cost is an indicator measuring the country's (static) efficiency in producing a given commodity, taking into account the shadow price of the domestic resource (e.g., water, land, labour) used to produce that good.

Among the former are the country's political and economic stability, its sound infrastructure base, an optimal geographical position within the global trade flows, the existence of a virtually unlimited regional market (GCC) and the country's relatively good endowment of natural resources.

The major challenges are partly related to factors that are beyond the control of Omani authorities (e.g., adverse impacts of climate change, increasing global and regional insecurity) and partly related to the country model of development, which is still heavily dependent on oil and gas (e.g., limited oil/gas reserves and increasing regional disparities within the country).

Therefore, economic diversification is imperative for Oman and represents an extraordinary window of opportunity to mark the progress of the country. If this will be done, the country will be able to further develop over the next 25 years. From this perspective, an important role could be played by a few non-oil sectors, including the agriculture and rural sector.

3. Agriculture and Rural Sector

This chapter provides an assessment of Oman's agriculture and rural sector, summarizing the main conclusions of the situation analysis carried out in preparing the SARDS 2040.[12] This assessment emphasizes the opportunities and challenges agriculture and rural development face and represents the basis upon which the SARDS 2040 was designed.

3.1. Agriculture in the Economy

3.1.1. Agriculture as a Whole

The economic importance of the agriculture and rural sector shrunk dramatically with economic growth. Since the development of oil and the explosive growth of a modern economy, the contribution of agriculture to Oman's economy dwindled from nearly half of the GDP (46 percent in the 1960s) to less than 1 percent today (WB, 2015; NCSI, 2015b). Agriculture, the main source of employment in the 1960s, today provides around 5 percent of the total employment of Omanis.[13] Despite the stated objectives of developing the sector primarily to promote food security and provide work opportunities for Omanis in rural areas, the targets set in the country's Vision 2020 – agriculture's contribution to the GDP is expected to raise to 3.1 percent by 2020 with an annual growth of not less than 4.5 percent – seem quite ambitious. This calls for a more realistic and effective strategy of intervention aimed at making the sector more competitive.

The agricultural trade balance is structurally in deficit. Agricultural products represent 2.4 percent of total exports (NCSI, 2015b) and are extremely concentrated, with the first three commodity groups – meat, vegetables and cereal and milk preparation - accounting for 60.5 percent of total agricultural export value (GTIS, 2016). Agricultural imports account for 12.4 percent (NCSI, 2015b) of total imports, with a marked growth over the last years in line with the surge in domestic demand for food and beverages (CBO, 2015) by an increasing and more affluent population. Imports are also quite concentrated, with the first four import items – dairy products, cereals, meat and fats and oils – accounting for 69.3 percent of total agricultural imports (GTIS, 2016). The agricultural trade balance is structurally in deficit.[14] This calls for improvements in the agriculture and rural sector's performance, aimed at increasing the self-sufficiency rate for those subsectors that show good prospects in terms of comparative advantage and domestic resource cost.

Agriculture has modernized and its productivity has increased. Although the contribution of agriculture to the GDP is dwarfed by the oil and services sectors, agriculture has experienced an increase in arable area, higher livestock numbers and

[12] For a more detailed analysis, the reader can refer to the background papers to the SARDS 2040 no. 1 to 5 (Annex 4).

[13] The most recent estimate refers to the population census of 2010, when the share of agricultural employees was 5.2 percent of the total workforce (MNE, 2016).

[14] Oman is self-sufficient only in dates. The most updated statistics (MAF, 2016) show that in 2014 the self-sufficiency rate for other major groups of agricultural products range between one-third and two-thirds, namely: 67.7 percent for vegetables; 31.9 percent for fruits; 50.7 percent for red meat; 42.5 percent for poultry; 51.2 percent for milk; and 48.4 percent for eggs.

important productivity growth. Crop production and food production indexes increased five times since the 1960s, livestock production more than four times and cereal yields more than five times over the same period (Kotagama, 2014). Thus, Oman's agriculture today is a small but dynamic part of the economy: the GDP of agriculture in 2014 amounted to OMR 224.1 million and grew at an average rate of 3.2 percent per year between 2011 and 2014 in nominal terms (MAF, 2016). Nevertheless, some structural constraints still need to be removed to make the sector more efficient and profitable.

There is a growing 'duality' in Omani farming. Omani agriculture is characterized by structural dualism: 89 percent of farmers (farm size less than 5 *feddans*) own 25 percent of land, while 0.2 percent of farmers (farm size more than 50 *feddans*) own 21 percent of land (MAF, 2014). Farming may be split into two distinct categories: (i) an expanding, highly commercialized and market-oriented, high-tech agriculture; and (ii) a tendency of many holdings towards lower-tech, non-market, family-oriented production. It is unlikely that the latter is 'subsistence' in the conventional sense, but rather low-level market gardening to supply extended families. One of the issues to be addressed is how to deal with these different agricultural systems.

Relatively few farmers are engaged full-time on their farms. For most farm owners, agriculture is only a subsidiary source of income. According to the Agricultural Census (MAF, 2014), only 16 percent of farm owners describe their main occupation as farming and many of these owners are old or retired. In fact, there has been an increase in the pluriactivity of farmers, as the farmers who are employed in the government sector increased from 22 percent in 2004 to about 53 percent in 2013. These changes may be related to the labour market – in particular, the government-determined, relatively higher remuneration in the public sector – and the drudgery of agricultural labour compared with non-agricultural labour. This situation may lead to less professionalism in farming management as a result of the lack of attentive agricultural supervision and entrepreneurship.

The majority of agricultural workers are unskilled expatriate labourers and the labour-to-land ratio is often inadequate. Expatriate labour use increased from 58 percent to 62 percent of total agricultural labour use between 2004 and 2013 (MAF, 2014). This has important consequences in terms of farm management, considering that the vast majority of labourers are unskilled workers. The law imposes a fixed labour-to-land ratio of 0.2 labour units per *feddan* that is rarely optimal, given the different requirements of the various agricultural systems. In fact, almost all farms already employ more expatriates than allowed by law (0.4 labour units per *feddan*), but farmers claim that even this is inadequate with most production systems requiring a much higher labour force. The situation will become more critical if Oman pursues a policy of agricultural intensification and commercialization, as this will require even more labourers. All these distortions of the labour market need to be addressed.

Young generations, especially better-educated people, show little interest in entering the farming profession. Young Omanis show unwillingness to work in agriculture because of misconceptions of prestige, hard working conditions, a long working day and less pay compared with governmental and other jobs (Kotagama, 2014). According to the last Agricultural Census (MAF, 2014), 21 percent of the farmers were more than 65 years old and only 9 percent were less than 35 years old. Only less than 6 percent of farmers had a university or an intermediate/technical college degree. As farming becomes more intensive and commercial, there is a need for more

skilled management. The challenge is how to attract young and well-trained Omanis into agriculture as a rewarding profession.[15]

The local context for agriculture-oriented research and development (R&D) has recently improved, but there is still room for enhancing the process of technological innovation. Important policy and institutional changes took place over the last decade, such as the 2006 consolidation of numerous isolated governmental entities under two Directorates – the Directorate General of Agriculture and Livestock Research (DGALR) and the Directorate General of Fisheries Research (DGFR); the 2011 establishment of The Research Council (TRC); and the 2012 enactment of the Science Technology and Innovation Policy. Agricultural R&D spending rose by roughly one-third during 2007-2012 (IFPRI, 2014). The ratio between investment in agricultural research and agricultural GDP (6.5 percent in 2012) is among the highest in the world.[16] The number of agricultural researchers employed at DGALR, DGFR and Sultan Qaboos University (SQU)-College of Agricultural and Marine Sciences increased steadily from 2009 to 2012, although most of the new recruits only had a B.Sc.-degree level (IFPRI, 2014). Despite the consolidation process, the scale of these research centres is well below the critical mass required by modern R&D activities. Therefore, identifying appropriate technological innovations to address the issues of Omani agriculture will rest on some domestic frontier research in specific fields (e.g., crop genetic improvement, crop pest and disease control) as well as on the adaptation to the Omani context of the most advanced modern technologies developed abroad.

The agricultural extension service is far from being adequate, both in terms of number of staff and skills. In any effective agricultural research and extension system, the number and skills of extension agents needed to ensure that research is mainstreamed within the farming community must be adequate. In Oman, the ratio of extension staff to land holders (farmers) is 1:1,800 and there is only one extension agent for every five agricultural research staff (Amraish, 2014). Also the composition of the extension staff in terms of position and skills does not seem optimal: around 40 percent of staff are directors and heads of departments; most of the staff (54 percent of total) are 'general' extension experts, while marketing and socio-economics experts (e.g., gender issues, home economics, etc.) are lacking (Amraish, 2014). Furthermore, the modalities of extension activities follow out-dated, top-down models instead of being demand-driven. In general, the services do not reach women or foreign workers who often manage farms. Reforming the organization and operation modalities of extension services is key for effective technological transfer and innovation adoption.

Operators within the food value chains are not organized. Farmers are fragmented and most of them manage small holdings with a low level of technology. There are very few producer organizations in the country, although some have been formed recently and a very effective association is located in the Al Batinah region.[17] Under the current

[15] This will also contribute to the Government's strategy to look at entrepreneurship and self-employment, especially among youth, as key components in tackling unemployment, providing opportunities for higher education and diversifying the economy.

[16] Though such high ratios are not uncommon in countries with small populations and relatively high per capita income such as Oman.

[17] The Agricultural Association for Al Batinah Region Farmers is the only effectively operating farmer organization among the associations registered at the Ministry of Social Development. It was established in 2005, but recognized only in 2009 (under the RD 126/2009). Yet, only a few farmers are member of this association and its operations are limited to the Al Batinah region. Al Dhahirah Association is now active and three more associations are requesting their legalization so far.

regulatory framework (R.D.14/2000), associations can only be established as non-profit organizations with limited humanitarian functions. This means there is no room for the creation of cooperative enterprises, inter-professional organizations, firms with the necessary scale for production and marketing of products (associations, consortia) or even semi-private technical assistance bodies for the promotion and advocacy of a subsector. Yet the Government has prepared a regulatory framework for cooperatives that is in the final stages of approval. This process needs to be sped up and there is a need to learn from successful experiences abroad on integrated business models and successful cooperatives and producer organizations.

The role of women and their organizations in the agriculture and rural sector is generally weak. Only 10 percent of farms and less than 3 percent of land are held by females (MAF, 2014). The share of female-held farmland in 2013 shrunk dramatically since the previous Agricultural Census (MAF, 2004) when it was 16 percent of total farmland. There are generally no women-only farmer organizations. The MAF's Department of Rural Women (DRW) of Al-Raffd Fund and the Section of Rural Women (SRW) under the MAF's Regional Department implement development programmes for women in rural areas. Yet, their operation capacity is weak. Action is required to support the DRW and SRW to advance in this area, particularly in enhancing knowledge about the actual situation of rural women in the various contexts and on the modalities to strengthen rural women's awareness and empower them as agents of change in rural areas.

3.1.2. Crop Sector

Crops still predominate in farming systems, but there is a trend towards farm diversification and crop-livestock integration. According to the last Agricultural Census (MAF, 2014), crop production dominates Oman's farming systems and is practiced on 52 percent of the total number of holdings (39 percent in terms of area), while another 37 percent of total holdings (61 percent in terms of area) have mixed farming systems that include crops; however, there is a trend towards more diversified farming (Table 3.1). The proportion of farms with a combination of crops, livestock and poultry increased from 7 percent to 11 percent of farmed land between 2004 and 2013. In principle, this trend may be considered a positive development not only in terms of farm production and market risk management but also in terms of resource conservation (e.g., use of on-farm crop residues, manure, etc.). However, an increase in on-farm animal husbandry may also indicate extra pressure on water resources as farmers grow more irrigated feed and have less recourse to rangeland.

Table 3.1. Farm enterprise combinations (*feddan*)

Enterprises	Year				Change 2004-2013	
	2004		2013			
	Area	%	Area	%	Area	%
Crops only	125,219	38.6%	137,513	38.7%	12,294	9.8%
Livestock only	4,868	1.5%	2,645	0.7%	-2,223	-45.7%
Poultry only	8,573	2.6%	20	0.0%	-8,549	-99.8%
Crops and livestock	161,953	49.9%	165,207	46.5%	3,254	2.0%
Crops and poultry	2,083	0.6%	10,969	3.1%	8,886	426.6%
Livestock and poultry	198	0.1%	93	0.0%	-104	-53.0%
Crops, livestock and poultry	21,496	6.6%	38,559	10.9%	17,063	79.4%
Total	324,389	100.0%	355,010	100.0%	30,621	9.4%

Source: MAF (2014)

Fruit trees still dominate the area under crop production, but there has been a trend towards market-oriented horticulture and fodder production. Fruit trees dominate the area under crop production (47.9 percent of total crop area on average between 2012 and 2014), with date palms accounting for almost 80 percent of the total fruit area. Other crops are fodder crops (27.9 percent), field crops (14.6 percent) and vegetables (9.5 percent) (MAF, 2015). Ten years ago, dates and other fruits were by far the major crops, accounting for almost 60 percent of the cultivated area (Table 3.2). Perennial forage grasses were second in importance, accounting for about 25 percent of the cultivated area. The last decade witnessed a significant shift away from tree crops (15,000 *feddan* reduction, only 45 percent of the cultivated area in 2013). In parallel, the area devoted to perennial forage increased by 11,000 *feddan* (a 28 percent increase), and the area cultivated in vegetables more than doubled. The most updated statistics (MAF, 2016) show that crop production grew on average by 2.2 percent per year between 2011 and 2014, with vegetables showing the best performance (Table 3.3). These data reflect the growing market for, and increased profitability of, horticulture and the strong demand for animal feed as extensive pastoral systems convert to intensive animal husbandry and more integrated crop-livestock operations. The increase in forage cultivation is quite concerning for its high water requirements.

Table 3.2. Crop combinations (*feddan*)

Crops	Year				Change 2004-2013	
	2004		2013			
	Area	%	Area	%	Area	%
Vegetables	12,267	8,1%	27,574	16,9%	15,307	124.8%
Field crops	13,317	8.8%	13,402	8.2%	84	0.6%
Perennial forage	37,976	25.1%	48,750	29.9%	10,774	28.4%
Dates and other fruits	87,884	58.0%	73,319	45.0%	-14,565	-16.6%
Total	151,444	100.0%	163,045	100.0%	11,601	7.7%

Source: MAF (2014)

Table 3.3. Crop production (000 tonnes)

Crops	2011	2012	2013	2014	Avg. growth rate
Vegetables	203	193	313	335	13.3%
Field crops	56	46	28	22	-20.8%
Perennial forage	765	658	745	754	-0.4%
Dates and other fruits	362	361	397	404	2.8%
Total	1,386	1,258	1,483	1,515	2.2%

Source: MAF (2016)

Despite the expansion of horticulture, the evidence on trends in commercialization of Omani agriculture is ambiguous. Production for export appears to have increased over the last decade, with almost 14,000 *feddans* devoted to export crops in 2013 (up from 9,000 *feddans* in 2004). At the same time, the Agricultural Census records a decline of 15,000 *feddans* in the area devoted to production for the local market and an increase of 35,000 *feddans* in production solely for family consumption (Table 3.4). Expansion in horticulture is constrained mainly by the availability and suitability of water and land (see Section 3.2.1), as well as the availability or willingness of youth to work in

agriculture. Most of the date palms and fruits trees are of low quality cultivars and are constrained by the seasonality of production, resulting in substantial price variations. Low enforcement of regulatory frameworks and controls on traded vegetables, and poor management (slow tree substitution rate, inefficient irrigation and water management) are among the top weaknesses of this subsector.

Table 3.4. Level of commercialization of farming (*feddan*)

Type of utilization of farm product	Year				Change 2004-2013	
	2004		2013			
	Area	%	Area	%	Area	%
Family consumption	199,424	61.5%	234,523	66.1%	35,099	17.6%
Marketing within Oman	116,215	35.8%	100,797	28.4%	-15,418	-13.7%
Export	8,679	2.7%	13,714	3.9%	5,035	58.0%
Industry	46	0.0%	152	0.0%	106	230.4%
Unknown	25	0.0%	5,824	1.6%	5,800	23576.4%
Total	324,389	100%	355,009	100%	30,620	9.4%

Source: MAF (2014)

Despite significant opportunities to expand the horticulture sector, it is marked by high post-harvest losses and low value addition practices. The demand for fruits and vegetables is generally increasing in both the domestic and international market.[18] This bodes well for the future of the Omani horticulture sector. However, high post-harvest losses and reduced market quality are serious constraints.[19] In fact, the Omani horticulture sector is characterized by low marketable yields and less than optimal product quality in both domestic and export markets. The sector's agroprocessing industry is not extensively developed, particularly for large volume operations that could benefit from economies of scale. The sector's competitiveness requires constant supplies of high-quality products provided over extended periods of time, utilizing proper post-harvest care, cooling after harvest and proper cold chain temperature maintenance. The development of a significant agroprocessing sector and concomitant market outlets could expand the portfolio of product offerings and expand non-production-related employment opportunities with an overall economic impact from the agriculture sector.

Food safety and biosecurity measures are still not satisfactory. A major constraint to the market competitiveness of many Omani horticultural crops is the high incidence and severity of insects and diseases, resulting in low yields, variable product quality and high fruit tree mortality. It is thus necessary to prevent further losses in yield and the mortality of hundreds of thousands of date palm, citrus, mango, papaya and other fruit trees from lethal in-country pests (e.g., red palm weevil, citrus greening, mango sudden decline, lime witches broom). In addition, in order to reach international markets, Omani fruit and vegetable products must adhere to strict phytosanitary measures to avoid product contamination with live insects, specific virus, fungal and bacterial diseases and pesticide residues at non-permissible or above tolerance levels.

[18] Oman still mostly depends on imported horticultural food products to satisfy consumer demand – the average self-sufficiency rate for crop products in 2014 was 33.2 percent, with vegetables showing a rate of 67.6 percent, fruits 68.4 percent and field crops a meagre 2.9 percent – while export volume of fruits and vegetables is minimal.

[19] Average product post-harvest losses exceed 25 percent for many fruits and vegetables, and seem to be increasing since the early 2000s when it was estimated at 19 percent (Opara, 2005).

3.1.3. Livestock Sector

Despite having an important stock of animals, Oman's domestic supply in many animal-sourced foods is not enough to meet demand. In 2014. Oman produced 99,500 tonnes of milk and 42,100 tonnes of red meat (Table 3.5) thanks to livestock numbers (Table 3.6) amounting to over 1.1 million units (MAF, 2015a).[20] Most rural livestock producers in Oman are small and medium-sized farmers who own small dual-purpose herds and flocks[21] that modestly contribute to domestic production. The domestic supply of red meat and dairy products is below national demand. Oman currently produces 51 percent of its raw milk needs and 60 percent and of its red meat needs. Most of the livestock is from unimproved local breeds (87 percent in the case of meat livestock).

Table 3.5. Livestock production (000 tonnes)

Livestock products	2011	2012	2013	2014	Avg. growth rate
Red meat	24	25	41	43	15.7%
Poultry meat	41	42	42	66	12.6%
Fresh milk	71	72	89	100	8.9%
Table eggs	12	13	13	14	3.9%
Total	148	152	185	223	10.8%

Source: MAF (2016)

Table 3.6. Number of livestock in Oman (heads)

Type of livestock	Year				Change 2004-2013	
	2004		2013			
	Heads	%	Heads	%	Heads	%
Cattle	301,558	13.0%	359,507	11.1%	57,949	19.2%
Camels	117,299	5.0%	242,833	7.5%	125,534	107.0%
Goats	1,557,148	66.9%	2,085,206	64.4%	528,058	33.9%
Sheep	351,066	15.1%	548,231	16.9%	197,165	56.2%
Total	2,327,071	100.0%	3,235,777	100.0%	908,706	39.0%

Source: MAF (2014)

The poultry industry is perhaps the only livestock sector where Oman can be successful, but value chain re-organization and efficiency gains are needed. The competitive pressure on the Omani poultry industry from the leading grain-growing countries (e.g., Brazil) is high, with Omani poultry products more expensive than imported ones. Nevertheless, the poultry industry is a sector where Omani agriculture can be successful. Approaching self-sufficiency by 2020 (currently standing at 43 percent for broiler meat and 48 percent for table eggs) and obtaining a recognizable presence on international markets – primarily the GCC, but also East Africa – are ambitious, yet achievable targets. In order to do so, the poultry industry in Oman will

[20] Livestock unit conversion was done at 450 kg live weight and a conversion factor of 1.2 for camels and 1/6 for sheep and goats. In absolute numbers, in 2014, cattle amounted to 367,000 heads, camels 248,000, goats 2,127,000, and sheep 559,000 (MAF, 2015a).

[21] According to the last Agricultural Census (MAF, 2014), the average livestock holding size was 11.8 cattle, 13.5 camels, 16.4 sheep and 32.2 goats. These averages are below or close to the lower limit for considering a holding a small commercial livestock farm that, according to the MAF Decree 12/2005, stands at 20 cattle, 10 camels and 100 sheep or goats, respectively.

have to work towards its sustainability in the economic, environmental and social dimensions.

The camel industry requires specific attention due to its importance for rangeland sustainability and Omani animal husbandry tradition. Since 2000, camel inventories in the Dhofar governorate have spiked by 72 percent, reaching 146,000 heads (Table 3.7). The Government has made several attempts to reduce camel stocks, without success. In the Jebel area, which hosts about 60 percent of the camels, urban sprawl, encroaching infrastructure and a virtually absent pasture management framework have resulted in patchy rangeland, overall pasture deterioration and desert expansion, putting the entire traditional livelihood at risk. In the absence of lucrative markets, disinterest in animal productivity has resulted in irresponsible pasture use with no planning or rehabilitation activities and rudimentary animal husbandry practices. These in turn have led to low milk productivity (12 litres/day vs. a potential 20 litres/day) and a high percentage of unproductive animals in the herd structure (up to 75 percent).

Table 3.7. Number of livestock in Dhofar (heads)

Type of livestock	Year				Change 2004-2013	
	2004		2013			
	Heads	%	Heads	%	Heads	%
Cattle	173,892	7.5%	207,891	6.4%	33,999	19.6%
Camels	53,527	2.3%	145,875	4.5%	92,348	172.5%
Goats	170,123	7.3%	278,499	8.6%	108,376	63.7%
Sheep	7,605	0.3%	14,403	0.4%	6,798	89.4%
Total	405,147	17.4%	646,668	20.0%	241,521	59.6%

Source: MAF (2014)

There are many constraints in developing the livestock industry, such as the lack of good quality feed and market infrastructure. At present, the country produces 886,500 tonnes of dry matter feed resources (cumulative from range vegetation, feed residue, bran, etc.), which is equivalent to 39 percent of the amount required (MAF, 2015b). The deficit is imported. There is a lack of accurate data on slaughtered animals, though it is estimated that about 95 percent of slaughtering is done outside slaughterhouses, compromising public health. Market infrastructure, especially cold chains, is of poor quality. Therefore, losses of animal source foods are high (26 percent for dairy and 16 percent for meat).

The participation of most livestock producers in formal markets is poor. The commercialization rates for raw milk and offal (skins and hides) are virtually zero as the aggregation function (e.g., milk collection, feedlots, skin collection centres) among producers and buyers (agribusinesses interested in processing) is missing. The Government is about to start two large-scale milk collection operations in Dhofar and Muscat, foreseeing milk collection from traditional animal breeders. These initiatives may provide an excellent opportunity for organized milk collection from small to medium-sized producers, which can have a catalytic effect on animal productivity and collective rangeland management. These initiatives are necessary but may not be sufficient for private investors to run a successful dairy factory, as the current quality of raw milk is very poor.

Biosecurity and food safety measures are still far from being satisfactory. In Oman most of the livestock-supporting infrastructure is below standard. There is no acknowledged chief veterinary office (CVO) or centrally located chief animal production

officer (CAPO), and there are often uncoordinated activities, e.g., vaccination campaigns carried out by veterinarians belonging to different institutions (MAF and the Ministry of Regional Municipality and Water Resources [MRMWR)]). Furthermore, there are no early warning and early response mechanisms for emergencies such as the threat of epidemic diseases. Most livestock slaughtered in the country do not receive pre-slaughter veterinary inspections or post-slaughter public health inspections, mainly because most of the slaughtered animals are slaughtered outside the official abattoirs. In the case of vertically integrated poultry operations, veterinary inspections are not an issue, although the issue of abattoirs serving micro-holdings and small and medium enterprises (SMEs) calls for urgent attention.

Honey is one of the most lucrative agriculture subsectors, and there is scope for product diversification and value addition. Oman is reputed to have some of the highest quality honey in the world. Besides the importance of honey production for professional beekeepers, honey production already represents a significant source of income for many small farmers. Moreover, huge growth opportunities exist in diversifying the product mix through the production of beeswax, royal jelly and other value-added honeybee products that can become a significant source of income for commercial beekeepers as well as smallholder farmers. However, recent stress-related factors – mite infection, pesticide residues and inadequate food and water – have widely reduced bee health and vigour and thus pollination effectiveness. Colony Collapse Disorder (CCD) is also a serious threat. A major constraint to the market competitiveness of Omani honey is the relatively low yield and lack of modern apiculture technologies.

3.2. Agriculture and the Environment

3.2.1. Water Management in Agriculture

The quantity and quality of Oman's groundwater resources have been seriously impaired by over-abstraction for agriculture. Roughly 94 percent of groundwater abstractions are used in the agriculture sector (Ward, 2016). Abstractions for agriculture each year are well in excess of the renewable resource: all but 2 of the 11 main agricultural areas in the country are in overdraft. The rate of overdraft ranges from 26 percent in Salalah to over 100 percent in Shinas-Liwa (117 percent), Samail (223 percent) and al Masrat (182 percent). Reducing abstractions in these areas to sustainable levels will require a 20 to 70 percent reduction in pumping, with an average reduction of over 40 percent.

Oman has invested considerably in recharge dams but there is still scope for further infrastructure development. A total of 43 groundwater recharge and flood protection dams were constructed at the terminal reaches of the *wadi* flow where the topography and soils provide high infiltration rates (mainly concentrated along the Al Batinah coast). These dams have generally been designed to store *wadi* flows for a few days, to allow silt to settle before allowing for the controlled release of water downstream to recharge the alluvium. These dams have also served as flood protection, largely for settlements. Numerous small storage dams were also constructed, largely in the higher plateaus, contributing to agriculture and livestock in the mountains. Despite the construction of these dams, surface flows are still lost both to the sea and to the desert, particularly during high rainfall periods. However, the technical and economic justification must be carefully assessed for further construction of recharge dams.

The share of non-conventional water resources is increasing but virtually none of it is used in agriculture. Non-conventional water sources currently account for 14 percent of Oman's water resources. Oman has decided to allocate low cost groundwater to agriculture and to produce desalinated water at three times the cost for municipal and industrial supply. Treated wastewater is currently used for municipal landscaping and, in Salalah, to combat seawater intrusion.

***Aflaj* remain an important irrigated agricultural system, accounting for almost one-third of the irrigated area.** The MRMWR database documented the existence of 4,112 *aflaj* in 1997. In recent years, changes in water abstraction patterns have led to the drying up of over one-quarter of the *aflaj,* severely affecting village economies, with an estimated annual loss per household of OMR 3,300 and a net annual loss to the economy of more than OMR 59 million. According to the 2013 Agricultural Census, the area irrigated by *aflaj* in 2013 accounted for 30 percent of the irrigated area – and 31 percent of total agricultural water use - suggesting that little or no further abandonment of *aflaj* had occurred in recent years. Water efficiency is, however, quite low, partly because flows cannot be controlled.

Water pumping from wells is virtually out of control. The tubewell and associated use of diesel and electric water pumps have enabled a large agricultural area to be irrigated (up to 175,000 *feddans* today). Farmers were quick to see the advantages of the new technology over both the *aflaj* and the traditional well technology.[22] The downside was that wells proliferated without any clear basis for establishing the safe yield of the aquifer, assigning water rights or regulating abstractions. Without a working groundwater governance and regulation framework, each farmer is able to pump from the shared aquifer without any regard to others and with no incentive to manage the resource sustainably. As a result, a variant of the tragedy of the commons emerged, with a 'race to the bottom'.

Modern irrigation technology has been introduced to make water use more efficient, but there is no evidence that this has reduced water use. The Government has long promoted subsidy programmes to encourage the adoption of modern irrigation technology. The objective was to improve water efficiency and reduce water use at farm level. However, although modern technology has certainly made water use more efficient, there are no indications that it has reduced water use.

3.2.2. Land Management in Agriculture

Oman has considerable land suitable for agriculture, but there are significant constraints to its use. Land suitability and soil capability surveys found that 7 percent of the land area (5.2 million *feddans*) is suitable for agriculture. There is plenty of land that could be developed for agriculture, but water is a constraint. At the same time, Oman's agricultural soils are poor in natural fertility, lack natural organic matter and deteriorate under continuous cultivation. These soils need careful management to keep fertility and produce good yields.

The net increase in land developed for agriculture over the last decade masks contrasting changes, and not all of this land is actually cultivated. Some major farming areas, particularly Al Batinah, lost a substantial portion of their farmland over the

[22] Motor pumps and tubewells tapping deeper into the aquifer provided an apparently unlimited year-round reliable source of high-quality water right on the farm, without the need to cooperate with neighbours.

last decade, primarily due to salinization. On the other hand, several regions, particularly Dhofar, saw considerable development of new farmland. At the same time, there is pressure around cities, particularly Muscat, to convert farms into real estate for construction. Overall, within the area developed for agriculture, only a proportion is actually cultivated land: due to water constraints and the need for fallow rotation, less than half of the farmland developed is actually cultivated each year.

The increase in livestock numbers has put rangelands under pressure. Historically, rangeland management was collaborative and sustainable, adapted to the environment. Increasing demand for livestock products and government promotion programmes have driven livestock numbers beyond the carrying capacities of the rangelands grazed. Programmes of subsidized feed and the development of water points have contributed to increasing animal numbers, disturbing the historic balance between animals and plants. Furthermore, the diminishing role of traditional institutions and the abolition of their role in regulating and controlling the utilization of local resources[23] (water, range and forests) have had a negative impact on rangelands. As a result, rangelands are degrading and desertification is on the rise, with deterioration in vegetation composition and biomass productivity. These problems are being experienced across all of Oman's rangelands but are most acute in Dhofar where reports suggest that the productive rangeland area has decreased by almost two-thirds (62 percent) in the last 25 years.

3.2.3. Impact of Agriculture on the Environment

Domestic and industrial effluents are affecting water quality. Disposal of untreated effluent and solid waste are reportedly threatening water quality. The problem is worse in densely populated areas, especially in and around Muscat, where microbial elements enter the water table because of inadequate sewerage systems and disposal of sewage water through septic tanks. Threats of pollution by chemical elements in industrial effluents have also been reported. In the more remote areas where oil is being extracted, it is reported that hydrocarbons and chemicals are contaminating groundwater when associated water is re-injected into the deep aquifer. Leakages of agrochemicals (pesticides, insecticides, herbicides, etc.) into groundwater have only seldom been reported and do not appear to be a serious threat to water quality.

Threats to the environment from agriculture are mostly related to the salinization of water and soils. The most serious threat to water quality is salinization as a result of water overdraft from aquifers and the resulting seawater intrusion. The alluvial aquifer area having fresh groundwater has reduced from 30,000 *feddans* in 1995 to 19,000 *feddans* in 2010. The Oman Salinity Strategy (MAF, 2012) indicates that by 2030 the cultivated area of fresh water may be reduced to only 4,700 *feddans* and the cultivated area with high salinity water (more than 5,000 ppm) is projected to increase from 17,000 *feddans* in 2010 to about 29,000 *feddans* by 2030. In the absence of any mitigation measures, the continued deterioration of groundwater quality will reduce the profitability of farms through yield reductions on an increasingly restricted range of crops. Most of the farms affected by salinity are the more traditional farms east of the coast highway. Typically, these are small, averaging about 3.5 *feddans*. On this basis, about

[23] The RD n. 8/2013 confirmed that rangeland is 'state property' and that the MAF is responsible for its allocation, regulation, management and improvement. This decree changed the historic systems of rangeland management by local communities and centralized decision-making in the hands of Government entities.

4,900 farmers are currently affected by high salinity and this number will rise to 8,300 by 2030 (MAF, 2012).

The country's rich agrobiodiversity is under threat. Oman is rich in biodiversity (MECA, 2014) and has a considerable endowment of landraces and animal breeds adapted to the environment. For instance, Oman's plant agrobiodiversity comprises 109 crop species, 43 crop landraces, 708 crop wild relatives and 448 medicinal plants (Al-Lawati et al., 2016). At the same time, Omani biodiversity is under threat. The most important threats come from urban sprawl, settlement projects for nomadic communities, expansion of commercial agriculture, overgrazing, pollution, unregulated tourism and introduction of species alien to the Omani environment. Specific threats from agriculture include widespread mono-cropping in agricultural areas and overgrazing, which are reducing the quantity and variety of wild native flora and fauna. Salinization of land and water is also leading to changes in vegetation.

3.2.4. Climate Change and Agriculture

Climate change is already affecting Oman and will do so even more in the future. The threat of climate change has been growing in recent years in Oman along with the increasing frequency of tropical cyclones (Zaman, 2014). The country experienced one event a decade between 1890 and1959, but eight events in both the 1970s and 1990s and super-cyclone events in more recent years.[24] Because of climate change, it is likely that Oman will experience decreased and less predictable rainfall (an average reduction of about 40 percent in annual rainfall), particularly in northern regions, as well as higher temperatures (estimated at 0.2°C warmer each decade) (Al Charaabi and Al-Yahyai, 2013). There is likely to be an increase in aridity, with lower rainfall and higher temperatures, increasing evapotranspiration and producing hotter summers and shorter winters. Possibly the most serious risk is the increasing frequency of extreme events: droughts, cyclones and violent storms.

Climate change will likely have significant negative impacts on agriculture. Possible consequences for agriculture include (Ward, 2016): (i) threats to animal and plant health from higher temperatures, new disease vectors and intensification of existing vectors; (ii) threats to the quantity of water resources from changing rainfall patterns; (iii) threats to water quality from increased saline intrusion resulting from a rise in sea level; (iv) threats to agricultural production from an increasing incidence of drought, more variable rainfall patterns, rising temperatures and the increased risk of aridity and change in seasonal climate; and (v) threats to ecosystems and biodiversity from rising temperatures and changes in rainfall patterns.

3.3. Rural Economy

There is a high concentration of people in urban centres and significant rural-urban migration. Despite being the 70th largest country in the world, Oman is one of the least densely populated countries with just nine people per square kilometre, thus

[24] In 2007, the country suffered an unprecedented natural disaster from Cyclone Guno, which brought over 900 mm of rain in a very short space of time and caused 50 mortalities and OMR 1.5 billion in damages. Torrential rainfall, more than eight times the annual average, led to flooding and the overflowing of dams. A second cyclone in June 2010 dropped 450 mm of rain over northeastern Oman, causing 24 mortalities and substantial damage to irrigation and other infrastructure throughout the coastal areas.

ranking 220th in the world for population density. In 2015, the share of urban dwellers on total population was 77.6 percent. Population projections show that this percentage will continue to increase, reaching 84.8 percent by 2040. The country's recent history has been characterized by strong internal migration flows from the countryside to urban centres. This phenomenon, resulting from the difference in living standards and economic opportunities between rural and urban areas, will pose serious problems of unbalanced regional development, with increasing pressure on urban areas (increasing demand for services and congestion) as well as on rural areas (weakening of the social and economic resource base).

There is a significant difference in living standards between rural and urban areas. There is a substantial variation in the availability of services in rural and urban areas, with the former showing consistently worse indicators than the latter in terms of infrastructure and social services. In some cases, the difference is not striking, as in the case of access to sanitation facilities or access to drinking water sources. In other cases, the difference can be significant, such as access to paved roads, schools, stores and health centres (SCP, 2013). These structural differences are mirrored in the way citizens evaluate their access to infrastructure and social services. The level of satisfaction of individuals living in urban areas exceeds the level of satisfaction of individuals living in villages in all aspects of welfare except social safety nets, health and personal safety. The dimensions showing the more significant negative differences between the two areas are leisure and recreation opportunities[25] (52.2 for urban population vs. 46.8 for rural population on a scale of 0 to 100, with 0 being completely dissatisfied and 100 completely satisfied) and economic opportunities[26] (41.2 vs. 37.6).

There is a significant difference in economic opportunities between rural and urban areas. The results of the Household Expenditure and Income Survey 2009-2010 (SCP, 2013) show that household income in urban areas was 41.6 percent higher than that in rural areas (OMR 1,150/month vs. OMR 812/month).[27] Income composition is largely the same in the two areas, with salaries being the most important source. However, the share of remittances in rural households is double that of urban households, showing the former's higher dependence on external sources. In urban areas, the income of Omani households headed by a person holding a certificate from an intermediate college was double that of a household headed by a less educated person (below primary school), while in rural areas the difference was only one and a half. This can be interpreted as a higher skill premium in urban areas for those having invested in human capital and a possible determinant of migration to urban centres by the best-educated and skilled people.

[25] Significant indicators for this dimension are the availability of entertainment facilities (43.3 vs. 36); the cost of entertainment facilities (42.3 vs. 37.3); and the ease of access to activities (48 vs. 39.2).

[26] This dimension, which is an indicator of how easy it is to do business in each region, includes ease of getting a loan (39.6 vs. 36.4); ease of access to markets for selling products (44.1 vs. 41); ease of getting production means (47.9 vs. 42.7); ease of getting agricultural land (35 vs. 32.2); conditions of work environment (51.7 vs. 46.8); salary (44.2 vs. 40.3); and level of prices (30.8 vs. 27.2).

[27] Inequality in the two regions is not much different: in both cases the distribution of household consumption is quite egalitarian, though slightly more egalitarian in rural areas (Gini index = 0.309) compared with urban areas (Gini index = 0.332).

3.4. Concluding Remarks

The assessment carried out in this chapter emphasizes that the Omani agriculture and rural sector faces both challenges and opportunities.

The most important global challenge to Omani agriculture is the adverse impacts of climate change, which compound an already unsustainable use of major natural resources (water depletion, soil salinization, rangeland overgrazing).

There are also some weaknesses specific to the agriculture and rural sector such as inefficient and unsustainable agricultural practices,[28] an overdependence on unskilled immigrant labour, poor post-harvest care and weak value addition and marketing that lead to high post-harvest losses, low value of domestic production and a disconnect between domestic production and downstream phases along the agrofood value chain.

There are, however, some important opportunities that characterize the Omani agriculture and rural sector, such as the relatively good endowment of natural resources compared with other countries in the region, diverse environments, agrobiodiversity and rich cultural/historical heritage (*aflaj,* man-made landscapes, historical centres) giving rise to a rapidly developing rural tourism and ecotourism industry, both from domestic and foreign tourists.

Also important are the opportunities offered to agriculture and rural development by some features of the broader context, such as potentially unlimited domestic and regional (GCC) markets; the changing structure of consumer demand geared more towards high-value agricultural products (primarily horticultural products); an optimal geographical position within the global trade flows offering the opportunity to develop a vibrant logistics industry for agrofood products; the complementarity of the Omani growing season vis-à-vis the richest destination markets (such as the European Union, Japan, etc.); and a very positive image of the country abroad, providing opportunities for branding and product differentiation.

All call for a coordinated set of interventions that should build on opportunities while addressing the challenges in a comprehensive way.

[28] This is partly due to a system of generalized subsidies not conducive to sustainable and efficient agricultural practices and partly to the sector's heavy dependence on unskilled labour.

4. Institutions and Policies

4.1. Agricultural Institutional and Regulatory Context

4.1.1. Main Stakeholders and Institutional Organization

The MAF is the main stakeholder of the SARDS 2040. Its mandate comprises the definition of financial and technical instruments to induce change in farming systems, agriculture research, control of plant and animal pests and diseases, regulation of the use and application of chemical products in agriculture, regulation and enforcement of pastureland preservation measures and analysis and approval of private business proposals in the agriculture and rural sector.

In addition to the MAF, there are other ministries with key regulatory, investment and coordination responsibilities for the development of agriculture and rural areas. Their main functions are summarized in Table 4.1.

4.1.2. Agricultural Regulations[29]

Omani water use regulations in agriculture are sensible and, if enforced, could bring the country back to a sustainable water balance. On the other hand, access to land for agriculture is constrained by the small size of agricultural holdings that can be traded in the market, and by restrictions on access to uncultivated land owned by the State (RD 5/1980, 5/81, and 24/95). If the process of establishing new rural enterprises is to be accelerated and private investment stimulated, the issuing of land, water and agricultural permits needs to become a joint effort among all involved institutions.

The restriction on the use of foreign labour (RD 35/2003) also poses a risk for the competitiveness of labour intensive activities. While poultry enterprises can largely be automated and provide jobs that attract national citizens, for example, many horticultural activities do not provide attractive jobs and their competitiveness largely depends on labour availability.

The RD No. 66/2014 (Consumer Protection Law) in art. 9 stipulates that in a "situation that results in an abnormal increase in prices, the chairman [of the Public Authority for the Consumer Protection (PACP)] … shall take temporary measures to curtail the increase in prices." This law has generated concerns among national investors that prices may be set below break-even or import parity prices by the PACP, deterring investment in the production of the commodities in the list.

Another constraint to the development of private enterprises in agriculture and rural development and a thriving civil society is the current regulation on establishing civil society organizations. An 'association', as established in the RD 14/2000, is a non-profit organization with functions limited to social purposes. This means that the country does not have the legal space for the creation of cooperative enterprises, inter-professional organizations or privately financed entities for the promotion and advocacy of agriculture and rural development.

[29] More details on regulations relevant for agriculture are reported in the background paper no. 6 (Alacevich and Diaz Pereira, 2016).

Table 4.1. Main functions of the public institutions relevant for the SARDS 2040

Ministry	Functions
Ministry of Finance (MOF)	It decides on budget allocation to the ministries on a five-year and annual basis and analyses and approves project revisions (objectives and budget) of the ministries within each five-year plan. It also studies and makes decisions on the attribution and size of subsidies.
Royal Court Affairs (RCA)	Mostly dedicated to the management of the Royal court (palace, cavalry, etc.), it oversees a number of key activities of the SARDS 2040, as it runs research centres and laboratories on livestock and oversees the management unit of the *One Million Palm Dates Project*.
Ministry of Regional Municipalities and Water Resources (MRMWR)	Its relevant functions for the SARDS 2040 include: (i) investment in local infrastructure (such as central *souqs*, slaughterhouses and wastewater treatment plants); (ii) development and enforcement of regulation on building construction, water use, licensing and inspection of wells drilling, construction projects, leases (of houses, shops, building or farms), underground water extraction, *aflaj* and springs maintenance and transport of foodstuffs; (iii) registration of commercial activities in the regions; (iv) protection of public health and safety of food products; and (v) preservation of the heritage of traditional Omani markets.
Ministry of Environment and Climate Affairs (MECA)	It develops, implements and monitors policies on the environment, namely wildlife protection, marine resources protection and climate change monitoring and adaptation.
Ministry of Commerce and Industry (MOCI)	It registers the companies operating in Oman (and classifies them as micro, small, medium or large) and is responsible for the safety of imported processed foodstuff. It also prepares statistics and conducts studies that inform decisions on the promotion of increased production efficiency in the commercial, industrial and mineral sectors.
Ministry of Housing (MOHO)	It allocates land plots and decides on their uses, grants the right of land usufruct and assesses land ownership applications for lands not yet registered.
Ministry of Manpower (MOM)	It regulates and enforces the labour law and regulations, maintains a database of the local manpower, conducts studies on the private sector's requirements for foreign employment and issues work permits. It contributes to strengthening labour capacities by developing vocational training curricula, providing vocational training and issuing respective certifications.
Ministry of Social Development (MSD)	It is responsible for the regulation and oversight of civil society organizations.
Ministry of Tourism (MOT)	It identifies local and international markets and promotes Omani products and destinations. It provides information online on *aflaj,* traditional villages, *souqs* and alternative lodging facilities (camping sites).
Ministry of Heritage and Culture (MHC)	It is responsible for the recuperation of a number of national monuments, which can benefit from further associated commercial activities (lodging, handicrafts production, shops).
Public Authority for Consumer Protection (PACP)	An offshoot of the Ministry of Industry and Commerce, it performs inspections on commercial establishments and shops to ensure that the goods offered are genuine and conform to the approved standards and regulating import/export procedures. It is also responsible for domestic price stability and consumer awareness raising.
Public Authority for Investment Promotion & Export (Ithraa/PAIPED)	It conducts activities to attract sustainable FDI and promote the export of Omani non-oil goods and services.
Public Authority for Stores and Food Reserves (PASFR)	It ensures a continuous supply of basic food commodities for emergencies such as abnormal climatic storms and hurricanes. It also aims to maintain the stability of basic food commodities prices, in cases of international food crises (storage and targeted sale at subsidized prices).
National Centre for Statistics and Information (NCSI)	An autonomous statistical agency,[30] it is responsible for the production of all official statistics and information according to the highest standards and international best practices.
Omani Chamber of Commerce and Industry (OCCI)	It conducts economic research and studies, engages in public relations to facilitate business, promotes and participates in exhibitions and marketing events, assists member with legal affairs and advocates for policy changes.
Agriculture and Fisheries Development Fund	It conducts studies, surveys and assessments on the sector and provides data and information necessary for planning and development. It funds agriculture, livestock,

[30] Established by the RD No. 31/2012.

(AFDF)	fisheries research and projects aimed at fostering the adoption of improved production and marketing techniques. It also supports the development and qualification of human resources, particularly of farmers, livestock breeders and fishers.
The Research Council (TRC)	It builds research capacity to assist the country's research institutions in achieving a high degree of research excellence, and engages in dialogue and advocacy activities to provide an enabling environment for research and innovation in the country (not specific to agriculture).
Sultan Qaboos University (SQU)	It comprises a College of Agriculture and Marine Sciences with departments on animal and veterinary sciences, crop sciences, food science and nutrition, natural resource economics and soils and water and agricultural engineering. It conducts research on sustainable production, value addition for food products, sustainable management of land, water and natural ecosystems and food security through trade and agribusiness.

Source: adapted from the Official Oman e-Government Services Portal and the Ministries' websites.

In an urban society and globalized economy, biosafety and food safety measures are key factors for a sector's competitiveness. With regards to biosafety, responsibilities are shared between the MAF and the MRMWR. The former is responsible for all imports of live animal, beehives, and plants, for their transport within the country as well as for plant protection. Investment has been made in clinics and quarantine facilities (plants and livestock) in the last five years, but more is required. The MRMWR is responsible for enforcing the GCC standards in livestock production. Although comprehensive, these standards have not always (e.g. poultry) been updated to comply with the *Codex Alimentarius*.

Food safety faces a similar situation as that of biosafety. Imported food control is under the aegis of the Ministry of Commerce and Industry (MOCI), while products manufactured in the country are under the responsibility of the MRMWR. In both cases, the GCC standards are the norm for food safety and again not all have been updated to be in line with the *Codex Alimentarius*. Additionally, there are limited enforcement capacities: even if the laboratory capacity exists, there is no traceability system for agricultural products. The MAF is responsible for the safety of agricultural food products, in particular for the correct use of agrochemicals. Enforcement and inspection capacity are a problem.

The country has made several attempts to alleviate the pressure on its natural pastures due to overgrazing. According to the pastures and animal wealth law (RD 8/2003), the MAF defines and regulates the exploitation of natural pastures, which are state property. In particular, the MAF defines the cultivation of pastures, cutting or burning of trees and plants, construction of installations, exploitation of pasture products, introduction of new species of plants and animals' grazing and breeding. However, these measures have not been effective, as the number of animals in the country has significantly increased since the law was enacted (Kotagama, 2014).

Other regulations relevant to agriculture and rural development are the tourism law (RD 33/2002) and the law on protection of geographical indications (RD No. 40/2000). The former sets an exclusive right for Omani nationals to own a tourist license (with the exception of large integrated tourism complexes) and the responsibility to issue licenses on a case-by-case basis to the Ministry of Tourism (MOT). The latter provides for the recognition, registration, use and protection of geographical indications, but no provisions are made for the registration process or for the definition of the characteristics of a particular product from a certain region. To be comparable to similar frameworks providing consumers with a guarantee of differentiation, a mechanism to establish criteria for the characteristics that define a product as typical from a region (e.g., fruit variety and traditional agricultural practices) needs to be put in place, certification bodies set up and traceability schemes developed.

4.1.3. Incentives

Currently the agriculture sector benefits from the following incentives: (i) installation of modern irrigation systems; (ii) installation of new greenhouses; and (iii) equipment and inputs related to extension programmes (e.g., inputs for integrated pest management, equipment for poultry and livestock farms, beekeeping equipment). In most cases, 75 percent of the value of the equipment is subsidized. Incentives are given, subject to funds allocated by the Ministry of Finance (MOF), and by order of request by the farmers, resulting in a waiting list for the provision of subsidized equipment.

As incentives to agriculture are provided through dispersed projects under the responsibility of different departments, and not as an integrated programme for sector development, evaluation of results and lessons learned from these policies is very difficult. However, the MAF seems to agree that, although some changes have occurred in the modernization of agriculture, particularly in the use of greenhouses and irrigation practices, it is possible that: (i) current policies do not encourage change towards more sustainable and efficient agricultural practices;[31] and (ii) the uncertainty in the level and time frame of the incentives acts as a deterrent to investment for those on the waiting list, rather than an incentive.

4.1.4. Agriculture-related Strategies

This section summarizes a few agriculture-related strategies under the direct responsibility of the MAF. There are two subsector strategies (date palm and livestock) and three cross-cutting ones, such as salinity, rangelands and agriculture and livestock research.

Date Palm Development Strategy 2020 (2001-2020) – Leading institution: MAF

The main goal of the *Date Palm Development Strategy 2020* is to maximize the economic, water, social and environmental returns of date palm production at individual and national levels in the Sultanate of Oman. This is pursued through strengthening entrepreneurship and optimizing production of each date palm product, taking advantage of existing modern techniques. The objectives of the strategy are to: (i) produce high-quality date palms that meet consumer expectation for both table and processed dates; (ii) market dates both locally and abroad throughout the year; (iii) market manufactured added value palm products other than dates; (iv) raise palm productivity and reduce production costs (especially inputs); (v) enhance palm pest and disease prevention and protection, especially reducing wastage/losses of palm products before and after harvest; (vi) organize the palm subsector to meet the country's needs and optimize water use; (vii) strengthen the conservation of local date palm varieties and improve some of them; and (viii) optimize agricultural ecosystems for maximizing yields per unit of water used for date palm production. Achieving these objectives will be done through two axes: the first is the axis of ‘investment extension’ and the second is the axis of ‘applied research’. The first axis focuses on giving guidance on investment areas such as production, processing and marketing; applied research focuses on finding scientific and economic solutions to unlock the potential of processing, production and marketing. All of the above are relevant for the SARDS 2040.

[31] The distribution of equipment and inputs is not conditioned to the adoption of good agricultural practices.

Strategy for Sustainable Development of Livestock in the Sultanate of Oman (2012-2027) – Leading institution: MAF

Oman has developed several strategies, policies and decrees over the years aimed at developing livestock and rangeland resources. The latest was prepared in 2011 for the period 2012-2027, aimed at aligning the strategy for the livestock sector to the Vision 2020 and to the Five-Year Plans (FYPs). The strategy for sustainable livestock development identifies several objectives that are relevant to the SARDS 2040, such as organizing the livestock sector; ensuring sustainable management of deteriorating rangelands; reducing further wastage of scarce water resources; improving local livestock breeds and management; making use of agriculture by-products for animal feed; and supporting outsourced fodder production. The livestock strategy also aims to support research programmes modernizing livestock production through the production and dissemination of research results consistently with the *Agriculture and Livestock Five-Year Research Strategy* (see below).

Oman Salinity Strategy (2011-2015) – Leading institution: MAF

The formulation of the *Oman Salinity Strategy* comprised a comprehensive assessment of the current status of the agricultural systems in Al Batinah and Salalah governorates, including the extent of the salinity problem, distribution of water resources, productivity of different agricultural systems and impact of salinity on farmers' income, policy and legislation. Furthermore, the strategy addresses socio-economic aspects and capacity-building needs at all levels. The strategy makes a good analysis, considering financial and economic aspects, and identifies alternative scenarios for sustainable water resources and production systems to bring about a more efficient and sustainable use of natural resources (MAF, 2012). Overall, tactical measures were grouped into four classes: (i) regulation; (ii) economic and financial incentives; (iii) public goods (e.g., dams); and (iv) capacity development. Regulation adjustment and enforcement and economic and financial incentives are expected to play a major role in driving change, namely options for rezoning (biosaline agriculture was deemed not viable in the long term), licensed water allocations through telephonic/digital management and incentives to reduce the areas under water inefficient crops (e.g., forage) and substitute them with higher-value and less water-intensive crops.

Rangelands Management Strategy (2001-2010) – Leading institution: MAF

Although this strategy was programmed to end in 2010, many of its proposals are still valid for the SARDS 2040. The strategy has two main fields of intervention: rangeland management and livestock development. Specific interventions include: improving the rangeland and livestock legal framework; registering all animals; reducing the number of animals while increasing economic returns; including farmers in sustainable systems of pasture management; raising livestock farmers' awareness on herd management; reshaping the livestock herd structure; decreasing the number of camels; finding low cost alternatives for input provision; introducing modern techniques and systems in raising and sheltering animals; encouraging the private sector to establish competitive marketing facilities; surveying pasture resources; undertaking pasture resources development; collecting fog water; controlling rangeland carrying capacity; improving livestock genetics and identifying best alternative cattle breeds; and improving feed processing and animal nutrition. All are relevant to enhancing livestock sector competitiveness in a sustainable way (see section 6.2).

Agriculture and Livestock Five-Year Research Strategy (2011-2015) – Leading institution: MAF

The *Agriculture and Livestock Five-Year Research Strategy*, formulated for the period 2011-2015, aimed to: (i) increase productivity of major crops (date palm, lime, wheat, etc.); (ii) increase productivity of the main vegetables and fodder crops; (iii) increase the productivity of livestock through breeding and genetic improvement; (iv) ensure the sustainability of biodiversity and genetic resources; (v) improve water use efficiency of crops; (vi) increase the use of non-conventional irrigation water resources like saline water and tertiary treated water; (vii) increase the use of wastewater; (viii) control pests and diseases of major field, vegetable and horticulture crops; (ix) control livestock pests and diseases; and (x) undertake studies on the social and economic feasibility of the research projects. A new agriculture and livestock research strategy for the country would need to change some of the areas of focus to be aligned with the SARDS 2040. For example, crop species and varieties for development should be chosen based on an initial overview of those with the greatest potential to achieve relatively high values per drop of water. Or research on the development of non-conventional water sources should be preceded by studies on their technical, economic and social feasibility and in cooperation with other Gulf countries.

4.2. Other Policy Frameworks

4.2.1. Broader Policy Frameworks

In 1995 Oman was the first among the GCC countries to launch a long-term national development strategy, the so-called Vision 2020. Its overarching goals include ensuring economic and financial stability, boosting private sector participation, diversifying the economy away from oil and other unsustainable resources and investing heavily in the Omani workforce, among others.

Major projects that have either been carried out or are currently being carried out under Vision 2020 include the development of new industrial estates at Buraimi, Nizwa, Salalah, Sohar and Sur; a series of important investments in the country's power and water networks; the establishment of the Public Authority for Small and Medium Enterprises Development (PASMED); a number of investments in the tourism sector; and a handful of large-scale projects aimed at improving the quality of Oman's national workforce and ensuring that Omanis are able to compete effectively for jobs in the international market.

Yet, "Vision 2020 has fallen short of achieving its primary goal of reducing Oman's dual dependence on hydrocarbon revenue and foreign labour. Vision 2020 has also failed to develop a strong private sector that is independent of oil and government support. Oil production and extraction continue to be the primary economic activity and almost the exclusive source of wealth. As a result, the economy improved, but did not transform" (SQU Consulting Team, 2015: VII).

Oman's Government is currently drawing up a new long-term economic strategy, provisionally known as Vision 2040. The development of Vision 2040 is led by the Secretariat General of the Supreme Council for Planning (SCP) and an independent

committee made up of ministers and other senior policy-makers.[32] This new Vision, taking into account the assessment of Vision 2020 by the Secretariat General of the SCP, is expected to benefit from local, regional and international social and economic developments.

Key objectives of the new plan will likely include boosting non-oil economic growth, reducing government expenditure, developing technical and entrepreneurial capabilities mostly through expanding the existing SME and Omanization programmes, enhancing family and community well-being, building world-class infrastructure and urban systems, improving governance effectiveness, ensuring equitable regional development and preserving environmental sustainability.

4.2.2. Other Sector or Cross-sector Policy Frameworks

This section summarizes the main policy frameworks, other than those that are sector-specific, relevant to the SARDS 2040. They can be clustered into four groups, namely: food and nutrition; natural resources and environment; other sectors; and cross-cutting strategies.

Food and Nutrition

Food Security Strategy (2010-2020) – Leading institution: Public Authority for Stores and Food Reserves (PASFR)

This strategy focuses mostly on consumption and the country's capacity to respond to demand. As it is not sustainable or efficient to produce all of the main food commodities in the country, the strategy promotes mechanisms to ensure national reserves of at least three months of supply for the main food items.

It also advocates for improving the agriculture sector, such as modernizing irrigation systems, using alternative water sources and promoting better crop management and the use of salt-tolerant crops. It highlights the importance of conserving rangelands for their biodiversity, strategic forage supply and contribution to the food security of nomadic herdsmen and some rural households. However, these are not seen as the source of significant fodder/forage for commercial red meat or milk production.

The strategy proposes keeping the same levels of domestic consumption of Omani fruits and vegetables, investing in particular in improving harvest and post-harvest practices and food safety (pesticide application) and developing niche products. It also advocates value addition for both high-quality and lower-quality dates.

With regards to eggs, it proposes securing the market share through quality differentiation, as producers cannot compete on price with imports. Some reservations are also shown for milk where it concludes that fresh milk is the only dairy subsector that can compete with imports,[33] as the production of longer life dairy products in Oman is not viable.

[32] The Main Committee of the Oman Vision 2040 was formed in 2013, while the Vision 2040 is expected to be launched during an international conference to be held during the second half of 2018.

[33] If the Kingdom of Saudi Arabia reduces the subsidies, as it might, given its current budget constraints.

The role of investments in agricultural production abroad is seen as contributing little to enhancing food security, indicating that sourcing food from a wide range should be preferred and that any investment in food production abroad should be considered in the context of a commercial investment.

Oman Nutrition Strategy (2014-2050) – Leading institution: Ministry of Health (MOH)

The strategy focuses on reducing overweight and obesity, improving women's health and nutrition before, during and after pregnancy, reducing micronutrient deficiencies and promoting physical fitness through active living. The synergy with the SARDS 2040 can be found in its stated objective of increasing the national consumption of safe and nutritious food, both imported and locally produced. This can be pursued through food safety surveillance mechanisms, working directly with farmers, and awareness raising campaigns on food safety and diets rich in fruits, vegetables and key animal products.

Natural resources and environment

Water Master Plan (2000-2020) – Leading institution: MRMWR

The plan considers the significant potential to increase the economic benefits derived from natural resources with a reform within the agriculture and rural sector. In particular, the main opportunities come from: reducing surface and underground losses to the sea or the desert; increasing water availability by treating and re-using wastewater; making limited and strategic use of non-renewable potable and brackish water reserves; improving the *aflaj* irrigation systems; and establishing sector water allocations and management of water demand on farm properties irrigated by wells.

The *Water Master Plan* calls for an integrated water sector planning, proposing the establishment of a water sector committee to provide policy direction and promote devolvement of responsibility for water matters to the regions where and as appropriate.

The plan maintains current allocation of water to *aflaj,* but seeks reduced water use and consumption on properties irrigated by wells through a phased demand management programme with the early introduction of a quota system for individual water users. Water use reductions through quotas would act as a catalyst for reform, encouraging the modernization of the agriculture sector.

National Action Programme to Combat Desertification in the Sultanate of Oman (2005-2020) – Leading institutions: Ministry of Environment and Climate Affairs (MECA) and MRMWR

It proposes interventions that include improved husbandry systems, afforestation, improved water crop management, salinization control, adjusted legal frameworks, improved agricultural technologies and increased public participation of farmers, pastoralists and *aflaj* stakeholders. It sets the land use/animal husbandry balanced systems of the *Jebalis* (mountain dwellers, typically from Dhofar region) as examples of improved living conditions and income of farmers and herders, and regional development and opportunities for alternative livelihoods. It also advocates for an insurance mechanism against the risk and effects of recurrent drought, such as early warning systems and drought preparedness for alternative crops and livelihoods.

Specific interventions that would contribute directly to achieving SARDS 2040 results include: land use planning at the local level; determining profitability and competitiveness

of agricultural crops and varieties; promoting ecotourism through local community management in Dhofar; promoting irrigation water use efficiency; establishing forest management plans in pilot areas in the Dhofar governorate and the southern region and Sharqiyah; promoting sustainable agricultural practices; sustainably improving rangeland management in the southern region, and soil conservation measures in saline and degraded soils of Al Batinah region; reforming the legislative framework for the management of natural resources (land, water, vegetation cover); making a wells inventory; preparing and implementing a water and soil conservation programme; and promoting small-scale milk processing units in the *Jebel* areas.

Climate Change Adaptation Plan and Disaster Risk Management Plan – Leading institution: MECA

The climate change adaptation strategy is still under formulation. Climate change adaptation is one of the proposed activities of the SARDS 2040 (see Section 6.4) that contributes to addressing complex issues that go beyond the mandate of the MAF and require a multi-sector approach, such as prevention against extreme weather events, or land and water resources planning. Disaster risk management is mostly under the mandate of the MECA and addresses cross-cutting issues such as basin plans for urban and rural development, protective infrastructure, warning and disaster management, etc.

Other sectors

Strategy for Tourism – Leading institution: MOT

The tourism strategy, not yet finalized, should identify priorities for development in the different regions, the type of tourism to promote in each of the regions and the mechanism to put in place for the development of tourism activities. The development of rural tourism and ecotourism can shape opportunities for rural development in selected areas.

Cross-cutting

Social Policy Strategy – Leading institution: Ministry of Social Development (MSD)

The General Secretariat of the SCP prepared a report on “Social Policies related to the economic expansion” that was integrated into the 9th Five-Year Plan (FYP) (2016-2020) and gives clear orientations for the Vision 2040. The overall objective is to contribute to citizens’ well-being through a set of policies, programmes and projects. Key objectives are to strengthen social and political stability by responding to social expectations, especially in youth employment, reinforcing decentralization in national policies. The balance between social policies and economic policies is key, especially when it comes to strengthening the role of youth, women and low-income people or people living in developing areas. In pursuing this, the Government is focusing especially on aspects related to citizen livelihoods, creating job opportunities, strengthening capacities through education and training and fostering and disseminating science, culture and knowledge. Implementation is based on new institutional arrangements, such as the Social Fund for Development and the National Fund for Trainings, and on making reforms that, for example, strengthen the role of the general commission for SMEs.

The Research Council Strategy – Leading institution: The Research Council (TRC)

The TRC strategy is set around nine priorities or major programmes relevant to agriculture: date palm production; efficient use of water; plant genetic resources; animal genetic resources; integrated management of agricultural crops; development of biological resistance; food quality and safety; water use on non-traditional agricultural production; and epidemiological animal diseases.

These programmes are all relevant to the agriculture sector, although the specific activities in each might need to be geared towards answering directly to the sector development objectives as identified in the SARDS 2040 (e.g., for genetic resources, invest in the development of locally adapted varieties and breeds that are water efficient, can fetch a high market price and are suitable for processing).

Another relevant and primary objective of the TRC strategy for the success of the SARDS 2040 is its focus on the continuous development of human resources in the country's research agricultural institutions.

4.3. Concluding Remarks

The institutional setup for agriculture in Oman is characterized by highly fragmented mandates relevant for the SARDS 2040; the MAF is responsible for only part of it. Furthermore, there are some institutional bottlenecks and constraints relevant for the SARDS 2040, namely:

- a legal framework that constrains access to land, labour and investment;
- unenforced water regulations resulting in environmental degradation and decreasing agricultural potential;
- the lack of comprehensive and fully enforced biosafety and food safety regulations, which may constitute a lost opportunity for gaining consumer confidence (domestic and abroad) for Omani products;
- legal impediments to establishing groups within civil society that can act as subsector advocates or groups crucial for market development, such as producer organizations, cooperatives, inter-professional organizations (bringing together different actors along the same commodity chain), enterprises with the necessary scale for production and marketing (associations, consortia) or even semi-private technical assistance bodies;
- an underperforming financial system and the lack of inclusive financial services (savings, credit, insurance, etc.) that prevent agriculture and rural development-related market opportunities for new investments from being seized;
- burdensome project analysis and approval processes that delay and act as a disincentive to private investment;
- the lack of a reliable, comprehensive and well-coordinated data system and access to information to facilitate decision-making at all levels; and
- an extension system that is insufficient in promoting innovation, networking and information exchange among actors for a more competitive and sustainable agriculture.

Initiating an inter-institutional dialogue, identifying and implementing coordination mechanisms to improve the effectiveness of the tasks with shared mandates and reforming the country's regulatory framework are of utmost importance for stimulating

higher market efficiency and the competitiveness of economic and social actors, and for reducing natural resource depletion.

5. SARDS 2040 Structure

5.1. Background

The design of the SARDS 2040 took place within the context of many policy frameworks relevant to agriculture and rural development at different levels – agricultural subsectors, sectors other than agriculture, cross-cutting sectors (e.g., water, nutrition) and the whole economy (e.g., broader development strategies such as the Vision 2040) (Chapter 4). The development of the SARDS 2040 took into consideration all of them, absorbing the relevant content whenever appropriate and ensuring consistency between the SARDS 2040 and these other frameworks, whenever their time frames overlapped with that of the SARDS 2040.

From a procedural viewpoint, the SARDS 2040 design aims at:

a) being as comprehensive as possible in terms of content, addressing all relevant issues of Omani agriculture and rural economy; and

b) reflecting a strategic articulation, ensuring:

- consistency with Oman's overall development objectives as defined in broader policy frameworks, such as the Vision 2040;
- coordination with existing policy frameworks (not only in the agriculture and food areas, but also in others such as water, the environment, etc.);
- the possibility of effectively monitoring and evaluating the interventions (proposing a results framework); and
- a preliminary ranking of interventions reflecting the relative weight of SARDS 2040 components (i.e., programmatic areas of interventions, programmes), leaving for future reflection the streamlining of specific interventions.

Within the policy development process, a strategy corresponds to the highest level in the policy-making articulation, reflecting a vision from which a clear structure of objectives and areas of interventions are identified. Therefore, the content of the SARDS 2040 necessarily reflects a hierarchical articulation, moving from the vision towards the more operational programmatic level (Figure 5.1).

The various hierarchical levels involved in the SARDS 2040 design, as well as the relevant results expected at each level – to be monitored with the RF (Chapter 7) – can be summarized as follows:

a) The Vision describes how the agriculture and rural sector can contribute to the country's overall development objectives; at this level, SARDS 2040 impact is measured;
b) The pillars represent broad areas of intervention that pursue similar objectives (e.g., economic, environmental, etc.); no results are measured at this level;[34]
c) The programmatic areas of intervention identify groups of programmes pursuing similar objectives (e.g., enhancing the competitiveness of the crop sector); at this level, SARDS 2040 outcomes are measured; and

[34] This reflects the fact that within the SARDS 2040, the pillars play a midwifery role in broadly organizing interventions that produce outcomes and IOs expected at a lower level of disaggregation.

d) The programmes describe organic sets of interventions (e.g., one or more projects aimed at a common result) grouped within a common framework to ensure their coordination and effectiveness; at this level, SARDS 2040 IOs are measured.[35]

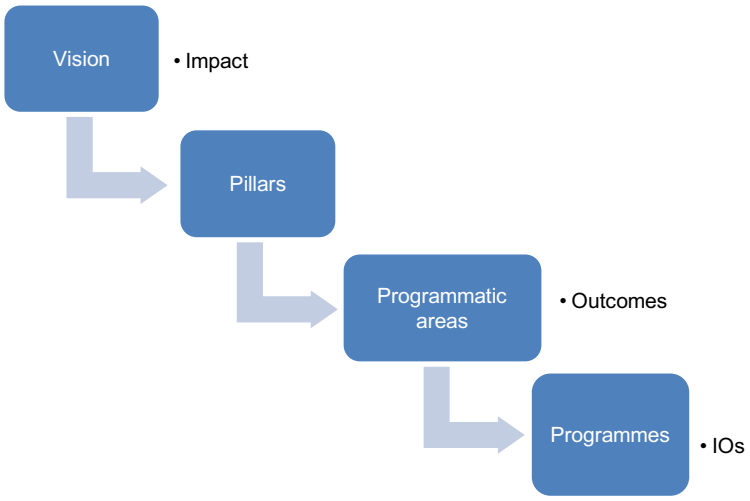

Figure 5.1. The hierarchical articulation of the SARDS 2040: from vision to programmes

Being a strategic document, the SARDS 2040 provides the broad architecture for operational plans such as the SARDS 2040 IP (Chapter 8).

The next sections will analyse the rationale and content of each of the hierarchical levels; however, before proceeding, the principles adopted in designing the SARDS 2040 and the rationale for organizing it as is are briefly discussed.

5.2. Principles

In developing the SARDS 2040, the following principles were adopted:

- *Participation*: ensuring the involvement of all key stakeholders during the different stages of SARDS 2040 formulation to guarantee that all claims, views and expectations would be duly taken into account in formulating the Strategy;
- *Consensus-building*: ensuring consistency between the SARDS 2040 and existing relevant sectoral policies and broader development strategy, through the critical assessment of these policy frameworks, as well as fostering consensus through participation of key stakeholders;
- *Ownership*: ensuring the ownership of the SARDS 2040 by all relevant stakeholders through their involvement at different stages, and implementing consensus-building mechanisms throughout SARDS 2040 formulation;

[35] Below this level are operational interventions (e.g., projects, investments); at this level, outputs are measured. This level is beyond the scope of the SARDS 2040 and left to more operational planning stages.

- *Feasibility*: acknowledging the existence of cultural, political and institutional constraints and identifying the existing/potential room to manoeuvre, crucial for the design and success of the proposed SARDS 2040 interventions;
- *Prioritization*: ranking the proposed interventions according to their level of importance/feasibility; this prioritization is based on the relevance of each intervention to the agreed-upon policy objectives and of each intervention for the key participating stakeholders;
- *Innovation-led*: taking into consideration the best available technologies and practices in formulating the proposed interventions for addressing the serious environmental and institutional issues characterizing the operational environment of Omani agriculture;
- *Results-oriented*: planning from the outset the monitoring and evaluation (M&E) of SARDS 2040 interventions through the adoption of an RF, including specific indicators at different levels, for assessing the achievements of interventions and driving them towards intended results;
- *Flexibility*: sequencing SARDS 2040 interventions according to priorities and allowing for gradualism in their implementation, ensuring learning by doing and the possibility of fine-tuning for more effective implementation of subsequent SARDS 2040 interventions; and
- *Risks consideration*: for effective implementation, taking into account, through appropriate contingency mechanisms, that the operational conditions, and consequently the design of interventions, may change over time.[36]

The above principles represent a coordinated and consistent set of operating rules for all stages of SARDS 2040 formulation and implementation,[37] though they are relatively more important at some stages than others. For instance, participation, consensus-building and ownership operate at all stages of the process, but play a crucial role in the process of designing the overall SARDS 2040 Vision, identifying the policy objectives and articulating its structure (e.g., pillars, outcomes and IOs). Feasibility, prioritization and innovation-led principles are more important in identifying specific programmes of interventions (i.e., at IO level), while results-orientation, flexibility and consideration of risks are more important in the implementation phase and therefore more essential in developing the SARDS 2040 IP.

Given the above, it can be concluded that the most important characteristic of the SARDS 2040 formulation process was the application of an inclusive and consensus-based approach, whereby all relevant stakeholders were informed and actively involved in identifying, and engaging in dialogue on, the strategic development priorities through their representatives. Participants in the process (Annex 3) included: farmers and their associations; traders (domestic and international); consumer associations;

[36] This is ensured mostly at operational level, through planning and implementation of five-year cycles of investments: at the end of each cycle, lessons learned over the concluding period will be used to design the next planning cycle (Chapter 8).

[37] The process of SARDS 2040 formulation is embedded in a policy cycle comprising three components that together, and applied in sequence, allow for the Strategy's results-based management: (i) planning (identifying the vision, setting the policy objectives, choosing the measures and instruments for implementation, identifying the role of stakeholders); (ii) implementation and its monitoring (providing regular feedback on progress being made towards achieving planned objectives during implementation); and (iii) evaluation (making an assessment to identify the extent to which planned results have been achieved and to determine the relevance and impact of the implemented policy).

agroprocessors; relevant civil society representatives; and local and central authorities and institutions, including academia and research institutions. As such, given stakeholders' evident mutual scope, the participatory workshop sessions provided opportunities to benefit from synergies and complementarities, while avoiding overlaps.

5.3. Rationale

The situation analysis (Chapters 2 to 5) emphasizes that Omani agriculture and rural development face a complex set of strengths, weaknesses, opportunities and threats (Table 5.1).[38]

In terms of strengths, Oman has a relative abundance of untapped natural resources, diverse natural environments and rich agrobiodiversity, all of which can offer investment opportunities in agricultural production and productivity. At the same time, its important cultural and historical heritage is a potential source of investment in the rural tourism and ecotourism industry, both for domestic and foreign tourists. There are also sector-growth opportunities offered by: (i) the virtually unlimited regional market for high-value agricultural products (primarily horticultural products); (ii) the optimal geographical position within the global trade flows, particularly interesting for the development of a vibrant logistics industry; (iii) the complementarity of the Omani growing season vis-à-vis the richest destination markets (such as the European Union, Japan, etc.); and (iv) a very positive image of the country abroad that offers opportunities for branding and product differentiation.

In terms of weaknesses and threats, the depletion of the water resource base and the impact of climate change are of course major threats to the sector's development, particularly in this region of the world. In Oman, the current structure of incentives is leading to inefficient and unsustainable agricultural practices resulting in water depletion, soil salinization and overgrazing of rangelands. At the same time, an overdependence on unskilled, immigrant labour coupled with poor post-harvest care and weak value-addition and marketing are resulting in high post-harvest losses, the low value of domestic production and a disconnect between domestic production and the downstream phases of the agrofood value chain. Finally, yet importantly, the agriculture and rural sector is confronted with the lack of coordination among different stakeholders, the existence of some uncoordinated – and sometimes even conflicting – policies and the need to strengthen management capacities in design, implementation and M&E at ministry level.

[38] As known, the strengths, weaknesses, opportunities and threats (SWOT) analysis aims to identify the key internal and external factors seen as important to achieving an objective. SWOT analysis groups key pieces of information into two main categories: (i) internal factors – the strengths and weaknesses internal to the subject of analysis (in our specific case, Oman as a whole and, specifically, its agriculture and rural sector); and (ii) external factors – the opportunities and threats presented by the environment external to the subject of analysis.

Table 5.1. SWOT analysis of the agriculture and rural sector in Oman

Strengths	**Weaknesses**
Overall • Political stability • Political will to diversify the economy • Sound infrastructure base **Sector-specific** • Political will to develop a strategy for agriculture and rural development • Relatively good endowment of natural resources • Rich agrobiodiversity • Highly diverse environments • Cultural/historical heritage (*aflaj*, man-made landscapes, historical centres) • Increasing rural tourism demand from domestic consumers • Changing food consumption patterns towards high-quality products • Huge market potential for domestic agrofood products • Existence of modern appropriate technologies for addressing the Omani agriculture issues	**Overall** • Weak management (design, implementation, M&E) capacities at MAF • Fragmented competencies and lack of coordination among ministries/municipalities/authorities • Uncoordinated/conflicting policies • Increasing regional disparities • Social groups facing social and economic barriers (e.g., youth, women, expatriate labourers) **Sector-specific** • Structural dualism (small vs. large farms) • Little share of professional farmers • Generalized subsidies leading to unsustainable and inefficient practices • Ineffective innovation system (research, extension) • Overdependence on unskilled immigrant labour • Obsolete and inappropriate farming technologies and practices • Natural resources depletion (water, rangelands, salinization) • Domestic production delinked from processing and domestic consumption • Huge post-harvest losses • Poor value addition of primary agricultural products • Weak biosecurity and food safety standards • Farming not appealing to young people • Limited involvement of women in agriculture and rural development • Limited organization of professional groups (cooperatives, unions, associations) in the value chains • Limited role of civil society organizations • Underestimation of the contribution of agriculture and rural development to the well-being of Omanis • Low social support to agriculture
Opportunities	**Threats**
• Virtually unlimited regional (GCC) markets • Optimal geographical position within the global trade flows (logistics) • Complementarity of the growing season vis-à-vis richest markets (European Union, Japan, etc.) • Increasing rural tourism and ecotourism demand from foreign consumers • Positive image of the country abroad	• Limited oil/gas reserves • Overdependence on oil/gas • Climate change • Increasing global and regional insecurity • Instability/volatility in international commodity (including food) markets

In short, in order for the agriculture and rural sector to play a more proactive role in the development of the Omani economy and society, a strategy must look into building on the sector's strengths and opportunities, while addressing its weaknesses and threats. This is exactly what the SARDS 2040 proposes to do.

In view of the potential for agriculture and rural development to contribute to solving some of the country's most important challenges over the next 25 years by enhancing sustainability, increasing economic returns, promoting job creation and reducing regional

imbalances, the SARDS 2040 proposes to unlock the sector's potential by pursuing three major thrusts:

- **Go commercial**: enhancing economic efficiency, profitability and competitiveness of agriculture and rural activities;
- **Go sustainable**: improving environmental sustainability and resilience to natural disasters (including climate change shocks); and
- **Go territorial**: reducing regional unbalances between rural and urban areas and promoting social inclusion by empowering local communities and providing livelihood opportunities in rural areas.

These thrusts represent the three main dimensions of sustainable development:[39] economic, environmental and social. A fourth dimension, which is key for achieving the Strategy's objectives, is the enabling environment. Policy, institutional and regulatory interventions allow the fulfilment of the other three dimensions.

5.4. Vision

The four dimensions mentioned above will lead to the realization of the SARDS 2040 vision of:

"A sustainable and profitable agriculture and rural sector contributing to the achievement of food security and Oman's overall development objectives."

This Vision qualifies the type of agriculture and rural development Oman is striving for, and its contribution to the country's development objectives and ultimately the well-being of the Omani people. The key words are a 'sustainable' and 'profitable' agriculture and rural sector as a means to achieve some development outcomes, namely the ones set in the Oman Vision 2040 strategy (Chapter 9) and food security.[40] The SARDS 2040 expected impact is directly linked to the above Vision.

5.5. Pillars

SARDS 2040 is organized around four pillars, representing broad areas of intervention that pursue broadly homogeneous objectives, namely (Figure 5.2):

A) enhancing economic competitiveness;
B) improving environmental sustainability;
C) promoting rural development; and
D) creating an enabling institutional environment for agriculture and rural development interventions.

[39] Sustainable development encompasses the following three dimensions (WCED, 1987): (i) efficiency, which is an economic concept hinting at an efficient use of resources to produce a given output; (ii) ecosystem functioning, which is an ecological concept focusing on the capacity of the environment and natural resources to keep doing their own functions; and (iii) equity, which is an ethical concept focusing on the distributional consequences within the society of policy alternatives. These three dimensions are also at the core of the Oman Vision 2040 strategy.

[40] SARDS 2040 is aligned with the Food Security Strategy and Master Plan 2010-2020 (GRM International, 2010), which makes clear that, considering the heavy water constraint in the country, the top objective is to sustainably improve the efficiency in domestic production (see Outcomes 3 and Sections 6.1 to 6.3 below).

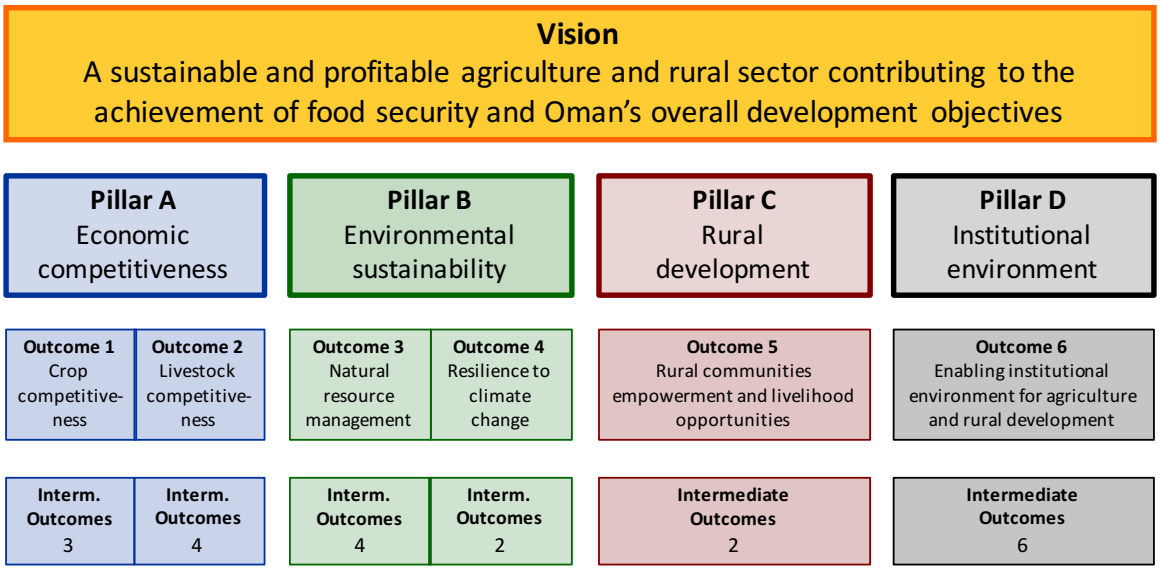

Figure 5.2. The SARDS 2040 structure: pillars, outcomes and intermediate outcomes

The four pillars bring together different perspectives in an innovative way in order to achieve the country's Vision. While the pillar on economic competitiveness is a standard component in any sectoral strategy (including previous agricultural policy frameworks in Oman), the pillar on rural development is rather new in Oman's policy context. It aims to foster the local economy by building on synergies between agriculture and other economic activities such as industry and tourism, thus contributing to reducing the regional development divide between rural and urban areas.

The pillar on environmental sustainability has been included in other strategies. What makes it new in the SARDS 2040 is the urgency of addressing environmental sustainability issues in the current Omani context, characterized by increasing natural resource scarcity and high vulnerability to climate change. This is imperative and must be pursued with the highest determination.

Last but not least, the pillar on the enabling institutional environment represents the overall institutional framework that facilitates the success of the other three pillars: without addressing institutional issues, it will be difficult to maximize the impact of all the other interventions.

5.6. Outcomes and Intermediate Outcomes

Each pillar is organized along one or more programmatic areas of intervention, identifying programmes that pursue similar objectives, namely (Figure 5.2):

A) Pillar A – “Enhancing the competitiveness of agriculture” pursues two outcomes, one per each of the main agricultural subsectors:
   - Outcome 1 – “Crop sector competitiveness increased”, and
   - Outcome 2 – “Livestock sector competitiveness increased”;

B) Pillar B – “Improving environmental sustainability” of agriculture and rural activities pursues two outcomes, one on the relationship between agrofood activities and the environment and the other on the resilience to natural disasters, including climate change:
   - Outcome 3 – “Sustainable management of natural resources in agriculture enhanced”, and
   - Outcome 4 – “Resilience of agriculture and rural livelihoods to climate change and natural disasters improved”;

C) Pillar C – “Promoting rural development” pursues one key outcome:
   - Outcome 5 – “Rural communities empowered and rural livelihood opportunities improved”;

D) Pillar D – “Creating an enabling institutional environment for SARDS 2040 interventions” also pursues one key outcome:
   - Outcome 6 – “Enabling institutional environment for agriculture and rural development strengthened”.

Each of the above programmatic areas of intervention is broken down into organic sets of interventions aimed at a common result. These correspond to programmes, each of which pursues an intermediate outcome (IO) as per Table 5.2. As a result, there are 21 IOs for the whole SARDS 2040.

Table 5.2. SARDS 2040 Outcomes and Intermediate Outcomes (IOs)

No.	Outcomes and Intermediate Outcomes
Outcome 1	**Crop sector competitiveness increased**
IO 1.1	Technical and organizational innovations promoted, high-value varieties developed, crop yield and nutritional quality improved
IO 1.2	Post-harvest losses reduced, product market quality improved, product value added developed and market opportunities enhanced
IO 1.3	Stringent food safety and biosecurity measures for crop products enforced
Outcome 2	**Livestock sector competitiveness increased**
IO 2.1	A more productive, market-oriented and sustainable red meat and dairy industry developed
IO 2.2	National poultry industry competitiveness and sustainability enhanced
IO 2.3	Apiculture practices and technologies, organization of producers, value addition and marketing enhanced
IO 2.4	Stringent food safety and biosecurity measures for animals and animal products enforced
Outcome 3	**Sustainable management of natural resources in agriculture enhanced**
IO 3.1	Income per unit of water used in agriculture maximized
IO 3.2	Capture, re-use and storage capacity of water for agriculture increased
IO 3.3	Soil management improved
IO 3.4	Agrobiodiversity conserved
Outcome 4	**Resilience of agriculture and rural livelihoods to climate change and natural disasters improved**
IO 4.1	Climate change adaptation and natural disaster risk management integrated into agricultural and rural development policy, investment and programmes
IO 4.2	Climate change mitigation and agricultural footprint improved
Outcome 5	**Rural communities empowered and rural livelihood opportunities improved**
IO 5.1	Rural economic activities diversified and livelihood opportunities improved
IO 5.2	Local cultural heritage and traditional social values preserved and valued
Outcome 6	**Enabling institutional environment for agriculture and rural development strengthened**
IO 6.1	Institutional and regulatory framework enhanced and enforced
IO 6.2	Economic environment enhanced
IO 6.3	Provision of inclusive financial services improved
IO 6.4	Knowledge base for agriculture and rural development strengthened
IO 6.5	An effective innovation system for a competitive and sustainable agriculture implemented
IO 6.6	Social support to agriculture and rural development enhanced

While Chapter 6 discusses the justification, objectives, articulation and implementation modalities of each IO, it is worth emphasizing a few aspects of the organization of SARDS 2040 interventions into programmes, which sheds some light on the rationale for the above structure.

First of all, the SARDS 2040 adopts a programmatic approach, which is something new in the current Omani policy-making procedures. The standard way of policy interventions in the Sultanate of Oman is through projects, mostly organized within the framework of the FYPs. However, the FYP process has a few shortcomings that impact the effectiveness of proposed interventions, such as fragmentation of interventions and lack of institutional cohesion. Indeed, more often than not, planning is done within each ministry, directorate general and often department, resulting in project proposals that are quite different in size and scope, poorly coordinated and rarely integrated in order to build on each other's synergies.

The SARDS 2040 and its IP adopt a programmatic results-based approach, in which each programme has a broader scope and is more integrated, compared with the standard project-based approach of current Omani planning procedures. It also strives to be 'people-centred'. Interventions with shared goals are clustered within a common framework (the programme) to ensure a higher level of coordination and effectiveness.

At the same time, the IOs generated by the various programmes represent a necessary intermediate step in the results chain (see Chapter 7), linking the results of more operational interventions (project and investment outputs) to higher-level results

(outcomes and impact). As such, they clarify how interventions contribute to achieving overall SARDS 2040 objectives.

By and large, the level at which the programmes are located within the hierarchical structure of the SARDS 2040 corresponds to that of the IOs. However, this correspondence is not rigid. The SARDS 2040 leaves some flexibility for policy-makers in identifying the boundaries and programme content for streamlining interventions at the operational level (e.g., in the IP).

Indeed, policy-makers may decide that the breadth of a specific programme is a subset of all possible actions that can contribute to a certain IO. This could occur, for instance, in subsectors that deserve particular attention, such as dates in the crop sector or dairy products in the livestock sector.

On the other hand, a programme could also be devised to achieve more than one IO. This could be the case of some cross-cutting initiatives, such as water management, or of certain interventions attempting to comprehensively address the problems of a given region, such as conserving the Dhofar mountain rangelands (see Box 1 in Chapter 6), promoting sustainable agriculture in Al Batinah (see Box 2 in Chapter 6) or the Jebel Akhdar rural development programme[41] (see Box 3 in Chapter 6).

From an analysis of the various IOs listed above, SARDS 2040 programmes can be classified into four typologies:

a) ***sector/subsector*** **programmes**, adopting a value chain approach, such as programmes contributing to Outcome 1 (Crop competitiveness) and Outcome 2 (Livestock competitiveness);

b) ***thematic*** **programmes**, adopting a more cross-cutting, issue-oriented approach, as can be seen through programmes contributing to Outcome 3 (Natural resource management) and Outcome 4 (Resilience to climate change and natural disasters);

c) ***regional*** **programmes**, adopting a territory-based approach that requires an even more comprehensive method of addressing all issues within a given area, such as programmes contributing to Outcome 5 (Rural development) or specific regional programmes such as the conservation of the Dhofar mountain rangelands and the promotion of sustainable agriculture in Al Batinah; and

d) ***institutional environment*** **programmes**, which aim at reforming the existing institutional and regulatory setting (including policies and laws) as well as improving the investment climate and dialogue between the stakeholders, such as programmes contributing to Outcome 6 (Enabling institutional environment). The breadth of this typology affects the whole country.

A programme contributes not only to its specific IO, but also more or less directly to other IOs.[42]

[41] Actually, this is not the specific feature of Jebel Akhdar: any rural development programme requires a territory-based approach instead of the usual sector-wise approach (see Section 6.5).

[42] For instance, pursuing a more efficient use of water in irrigation contributes not only to environmental sustainability, but may also contribute to a more profitable crop production.

6. SARDS 2040 Interventions and Expected Results

6.1. Outcome 1 – Crop Sector Competitiveness Increased

The overall objective of Outcome 1 is to sustainably increase crop sector competitiveness.[43] Due to binding resource constraints (primarily water), this outcome will mostly be achieved by increasing resource use efficiency and adding value to domestic crop production through technical and organizational innovations. Expanding the area of crop production is generally not feasible; however, it will be allowed in certain cases when farms comply with the above-mentioned efficiency and sustainability objectives.

A focus on high-value crops, efficiency (primarily in water use), reduction of post-harvest losses (primarily through cold chain technology), wide adoption of good agricultural practices and related certifications, support to farmers and other operators in the value chains to form collective action organizations, value addition through packaging and processing, product differentiation (including geographical indications, organic certification, branding) and higher standards in biosecurity and food safety will drive this competitiveness.

Priority will be given to establishing post-harvest infrastructure in key production areas (e.g., in Al Batinah) and supporting farmers to meet the required quality standards and to access this infrastructure. Assisting farmers and other operators within the value chains in organizing themselves is an essential step for increasing efficiency and should be prioritized. These interventions should later be expanded to the rest of the country.

Interventions under Outcome 1 should also be coordinated with efforts to achieve Outcome 3 (Sustainable management of natural resources) and Outcome 4 (Resilience of agriculture and rural livelihoods). Outcome 1 needs to target farmer groups engaged in improved water resources management (e.g., in a given aquifer of Al Batinah or in the modernization of *aflaj* irrigation systems).

Outcome 1 is pursued through three IOs, namely:

- IO 1.1 – Technical and organizational innovations promoted, high-value varieties developed, crop yield and nutritional quality increased;
- IO 1.2 – Post-harvest losses reduced, product market quality improved, product value added developed and market opportunities enhanced; and
- IO 1.3 – Stringent food safety and biosecurity measures for crop products enforced.

IO 1.1 – Technical and organizational innovations promoted, high-value varieties developed, crop yield and nutritional quality increased

Justification

The horticulture subsector of Omani agriculture can provide substantially higher economic impact and market growth potential compared with other types of agricultural activities. Producers typically get significantly higher rates of return from horticultural crops compared with forage crops, grains and other crops. The characteristic of 'high

[43] For a detailed analysis on horticulture and forage crops see the background paper no. 5 (Picha, 2016).

value per unit area of horticultural crop production' is particularly important to those smallholder producers where land for cultivation is limited.

The yield potential of any crop is a function of its genetic purity, the disease-free sanitary status and the production practices used during growth. In fact, a major constraint to the market competitiveness of Omani horticultural crops is the use of older cultivars from non-certified planting stock and non-certified seeds. High quality germplasm adapted to the production area and cultivars that have a high yield potential along with adequate pest resistance are essential for the sustainability and profitability of the crop sector.

Another important limitation to the competitiveness and sustainability of the Omani horticulture subsector is the non-application of efficient and modern farming technologies, resulting in low crop yields and inconsistent quality. Proper crop production methods, utilizing good agricultural practices and optimizing on-farm water use efficiency, are necessary for competiveness against imported products, for export market penetration and for the sustainability of the crop sector.

Objectives

The objectives of IO 1.1 include: (i) introducing new and improved high quality crop cultivars free from insects and disease pests, and in demand in the domestic and international marketplace; (ii) adopting proper manual and mechanical crop production practices that incorporate integrated pest management practices and appropriate harvesting techniques to obtain high crop yields and product market quality; and (iii) maximizing crop productivity through the optimization of plant population density per hectare, on-farm water use efficiency and operation management.

Implementation modalities

Research and outreach are the most important activities required to achieve this IO. The MAF will paly a key role. However, implementation requires collaboration with the private sector, the Royal Court Affairs (RCA), and other appropriate governmental institutions and ministries.

Research efforts should prioritize: (i) crops and production practices that will result in high-quality, safe food; and (ii) the most limiting factors for the growth of a specific crop (e.g., specific biotic pest, abiotic disorder, individual production constraint, etc.).

These activities should combine experiments/testing in regional research centres and on-farm trials in all of the major production regions. Experimental, on-field testing, as well as pilot and commercial model farms, will be established and/or improved. Training and continuing education of MAF staff in new production technologies and best management practices for optimum productivity of new and improved cultivars is an integral part of knowledge dissemination to the private sector and the advancement of the Omani horticulture sector.

New technologies such as mechanical pollination of date palms, use of bunch covers for date fruit pest control, active monitoring of plant health, new soil-less cultures and technology such as protected structures to grow crops should be incorporated into future crop production methods.

Optimization of crop water use efficiency should include a nationwide effort to adopt and monitor water application and quality. Crop water use requirements for economic and sustainable production for each of the main horticultural and forage crops should be delineated.

IO 1.2 – Post-harvest losses reduced, product market quality improved, product value-added developed and market opportunities enhanced

Justification

High post-harvest losses, resulting in low marketable yields and poor market quality in both domestic and export markets are serious constraints facing the Omani horticulture sector. Moreover, the current horticulture agroprocessing industry is not extensively developed, particularly in the case of economy of scale, large volume operations.

Consequently, despite significant opportunities for increasing the domestic market share and expanding the export market volume of Omani fresh and high-value horticultural products, domestic production is generally not able to seize market opportunities, with the production of fruit and vegetables virtually delinked from final demand. This is one of the most serious problems constraining the development of the Omani horticulture sector.

For the development of a strong and competitive Omani horticulture sector, more attention to post-harvest care, agroprocessing, value addition and marketing is essential. This includes appropriate investments in infrastructure and technologies as well as capacity building for proper product handling, grading, sorting, packing, cooling, processing, product differentiation, branding and marketing. The development of a significant fruit and vegetables agroprocessing sector and concomitant market outlets will expand the portfolio of product supply, as well as related employment opportunities and the agrofood sector's economic impact.

Objectives

The objectives of IO 1.2 include: (i) significantly reducing perishable product post-harvest deterioration and improving market quality through proper cooling, sorting, packing and temperature management; (ii) increasing the volume and value of agroprocessed fruit and vegetable products (e.g., preserves, juice, dried, frozen, puree, etc.) for domestic and export markets; (iii) facilitating private sector compliance with global good agricultural practices (GAPs), hazard analysis and critical control points (HACCP), International Organization for Standardization (ISO) and other international practices and processing certifications, food safety compliances and product traceability regulations; and (iv) increasing the market share of the domestic horticulture industry either through import substitution or export expansion.

Implementation modalities

Pursuing the objectives contributing to this IO requires a coordinated set of activities, including research, extension, investment and education. These activities require the collaboration between the MAF, private sector, RCA and other appropriate governmental institutions and ministries.

Diverse post-harvest, agroprocessing and marketing applied research should be established using the MAF research centre facilities and on-farm infrastructure such as storage and packinghouse facilities. Capacity building, training and technical assistance are needed for MAF personnel and commercial growers on the best post-harvest management practices, agroprocessing technology and value-added product development.

New post-harvest handling (regional collection centres) and product care technologies, controlled temperature and humidity storage, modified atmosphere packaging and transport technologies should be significantly expanded in order to provide more volumes of high-value horticultural crops. Modern and efficient agroprocessing technology training should be prioritized in order to enable the private sector to expand market opportunities for diverse agroprocessed horticultural crops.

Compliance with international GAPs and processing certifications, food safety compliances and product traceability regulations should be facilitated by specialized training courses provided by MAF personnel and in collaboration with private enterprises as well as producers and their organizations.

A market information system should be established to provide growers and buyers with daily price and market intelligence information on wholesale and retail markets throughout the country.

The MAF should develop grade standards describing the quality of different classes of individual fruit and vegetable products. A national grade standard product classification scheme will facilitate a more orderly marketing of fresh produce.[44]

Marketing programmes should be developed to support producers, cooperatives and SMEs in product branding, labelling, product traceability and identity. Global and local networking of farmer organizations should be strengthened. New market development initiatives should be encouraged such as e-marketing initiatives. Implementation of consumer education campaigns to increase domestic consumption of Omani-grown fruit and vegetable products should be implemented.

Overall, any effort should be made to reduce the transaction costs to bring the products to the market. These range from the lack of logistics facilities to some institutional regulations (such as the need to apply to the Public Authority for Consumer Protection [PACP] in case of price increases) that do not allow private enterprises to maximize a return on investment.

In light of the above discussion, this IO crucially depends on the implementation of many actions included under Outcome 6.

[44] The grade standards should be based on internationally accepted norms, such as *Codex Alimentarius*, or European Union or US Department of Agriculture standards.

IO 1.3 – Stringent food safety and biosecurity measures for crop products enforced

Justification

Proper sanitary and phytosanitary regulations, diagnostic capability, monitoring and enforcement procedures are fundamental for the protection of plant health and food product safety. Preventing the introduction and/or dissemination of foreign pests and maintaining the health and vigour of horticultural and forage crops are essential for the competitiveness and sustainability of the crop sector.

A major constraint to the market competitiveness of many Omani horticultural crops is the high incidence and severity of insects and disease, resulting in low yields, variable product quality and high fruit tree mortality. In fact, the protection of hundreds of thousands of date palm, citrus, mango, papaya and other fruit trees from lethal in-country pests (e.g., red palm weevil, citrus greening, mango sudden decline, lime witches broom) is a must. In addition, admitting Omani fruit and vegetable products into international markets requires adherence to strict phytosanitary measures to avoid product contamination with live insects, specific virus, fungal and bacterial diseases and pesticide residues at non-permissible or above tolerance levels.

Objectives

The objectives of IO 1.3 include: (i) establishing appropriate phytosanitary regulations to avoid the introduction and dissemination of foreign pests in order to maintain crop plant health and vigour; (ii) further enhancing public-private sector plant health diagnostic capacity, monitoring and enforcement of phytosanitary regulations required to maintain domestic plant health and comply with international market product admissibility requirements; and (iii) ensuring producer and agroprocessor adherence to good agricultural practices, proper post-harvest care procedures and proper handling practices to maintain a safe food supply and avoid food-borne illness outbreaks.

Implementation modalities

The phytosanitary activities include adopting measures to increase the country's capacity to prevent plant health contamination. This involves increasing border inspection and control of foreign planting stocks and edible food product introduced into Oman. It will also involve establishing national disease surveillance and control units and facilities. National biosecurity, phytosanitary certification and food safety legislation will be enhanced and the enforcement capacity strengthened. In addition, the use of restricted pesticides will require a license. It is recommended that the establishment of phytosanitary and diagnostic laboratories be located in the municipalities.

It is assumed that the MAF will monitor and enforce a strict phytosanitary certification system pertaining to the dissemination and sale of planting materials. Adequate resources will need to be allocated to permit the MAF personnel to respond to plant disease outbreaks. In fact, the capacity of the MAF and other appropriate governmental agencies to respond to diseases should be increased. The regulation and testing for purity and authenticity of agrochemicals and pesticides sold in Oman should be strengthened.

6.2. Outcome 2 – Livestock Sector Competitiveness Increased

The overall objective of Outcome 2 is to sustainably enhance the competitiveness of the livestock industry and ensure higher biosecurity and food safety standards. This will be pursued through adding value to existing livestock production and increasing its potential without compromising the environment. Reducing the impact on the environment, ensuring a sustainable use of natural resources and adopting renewable energy sources must be streamlined in all interventions under this Outcome.

Key interventions are: (i) organizing producers through cooperatives or other forms of economic association throughout the value chains, primarily in the milk (cattle and non-cattle) collection systems that supply existing plants; (ii) providing post-harvest infrastructure (e.g., cold chains) for improving milk collection networks and dairy plants, or infrastructure associated with slaughterhouses; (iii) introducing high value-added technologies (e.g. special cuts, use of sub-products, specialized technical assistance to farmers on breeding and feeding); and (iv) improving biosecurity and food safety procedures (e.g., HACCP) throughout the country.

Geographical priority on animal production, animal health, feed production and processing should be applied where there is potential for the sector's development and where the need to improve environmental sustainability is the highest. As such, priority should be given to the Dhofar mountains because of the specific sustainability issues related to rangeland management, with a special focus on product differentiation (e.g., camel and local goat products). Poultry production follows a similar approach, but not the same geographical focus, as it will need to identify a geographical area where biosecurity and the environment are not at risk.

Interventions under Outcome 2 should be coordinated with efforts for the achievement of Outcome 3 (Sustainable management of natural resources) and Outcome 4 (Resilience of agriculture and rural livelihoods), with specific reference to measures that aim to reduce the ecological footprint of livestock-intensive operations.

Outcome 2 is pursued through four IOs, namely:

- IO 2.1 – A more productive, market-oriented and sustainable red meat and dairy industry developed;
- IO 2.2 – National poultry industry competitiveness and sustainability enhanced;
- IO 2.3 – Apiculture practices and technologies, organization of producers, value addition and marketing enhanced; and
- IO 2.4 – Stringent food safety and biosecurity measures for animals and animal products enforced.

IO 2.1 – A more productive, market-oriented and sustainable red meat and dairy industry developed

Justification

Considering the forecasted increase in population (see Section 2.1), the production of meat and dairy products will need to increase significantly to keep up with the current rates of consumption of domestic animal products. This cannot be achieved if producers – especially smallholders – do not improve the productivity of their animals and increase their participation in formal market channels (Sidahmed, 2016). At the same time, these

productivity increments cannot be achieved in a business-as-usual scenario characterized by scarce water supplies and rapidly deteriorating rangelands. Environmentally safe, market-oriented animal production systems need to be introduced.

Animal production in Oman is seriously constrained by a number of factors that must be addressed before any development can occur. In fact, producers are increasingly confronted with the lack of feed resources, inadequate extension services, irregular access to veterinary services and, most importantly, the lack of incentives to improve their herds and flocks, which translate into less than optimal management practices and low participation in the market. Moreover, the subsector is confronted with absentee livestock owners and unskilled foreign workers carrying out many tasks, leading to a situation where there is a lack of proper practices and prompt decision-making, all of which must be taken into account when designing any development intervention.

Modernizing the sector requires mainstreaming animal identification (pedigree recording, tagging and a central database) and accurate traceability along the supply chains. Moreover, commercialization rates for raw milk and offal (skins and hides) are virtually nil, as the aggregation function (e.g., milk collection, feedlots, skin collection centres) among producers and buyers (agribusinesses interested in processing) is missing. The Government is about to start two large-scale milk collection operations in Dhofar and Muscat foreseeing milk collection from traditional animal breeders. These initiatives may provide an excellent opportunity for organized milk collection from small and medium producers that can have a catalytic effect on animal productivity and collective rangeland management (Dhofar-specific). However, these operations may be necessary but not sufficient for the private investor to run a successful dairy factory, as the quality of raw milk is currently very poor.

To summarize, increasing the competitiveness of the livestock sector is a complex problem of feed resources, governance and infrastructure, but most importantly knowledge and information.

Objectives

The overall objective of this IO is to increase and stimulate market-driven production of quality animal source foods for local consumption and export. The specific objectives are to: (i) maximize the commercialization and valorisation of animal products by local milk and red meat producers in an environmentally sustainable way; and (ii) return animal husbandry to sustainable levels to save the country's rangelands (in Dhofar, see Box 1 and Punda, 2016b). This can be achieved by: (i) strengthening the feed base by introducing locally-grown ingredients and providing adequate services to producers; (ii) facilitating the establishment of formal market channels and the linkages between the latter and small- and medium-scale producers; (iii) promoting private investments and the formation of producer groups; and (iv) rehabilitating rangelands and introducing sustainable land use practices (in Dhofar).

Box 1 – Dhofar Mountain Rangeland Regeneration and Management Programme

Justification: Since 2000, camel inventories in the Dhofar governorate have spiked by 72 percent, reaching 146,000 heads. The Government made several attempts to reduce camel stocks, without success. In the *jebel* (mountain) area, which hosts about 60 percent of the camels, chaotic construction and a virtually absent pasture management framework have resulted in patchy rangeland, overall pasture deterioration and desert expansion, putting the entire traditional livelihood at risk. In the absence of lucrative markets, disinterest in animal productivity has resulted in irresponsible pasture use with no planning or rehabilitation activities and rudimentary animal husbandry practices. These in turn have led to low milk productivity (12 litres/day vs. potential 20 litres/day) and a predominance of unproductive animals in herd structures (up to 75 percent). Low productivity, pronounced seasonality and poor hygiene are serious obstacles for the dairy business.

The close link between livestock productivity and the rational and efficient use of pastures requires focusing on the interaction between natural resources management and livestock production. This in turn requires an effort to mainstream climate change adaptation into livestock and pasture management while providing valid market opportunities for animal owners. This is key to switch from increasing the number of animal heads to focusing on animals' productivity.

The proposed pilot programme offers a holistic approach to reducing the stocking rates in the *jebel* area in Salalah district, combined with applied research and territorial development elements. Community-driven pasture management and powerful market opportunities for herders coupled with good production standards are the only sustainable way to effectively reduce the stocking rates and rehabilitate and manage the rangelands effectively. A camel dairy value chain development was selected as part of this programme, featuring climate change adaptation considerations (maintaining camel productivity in a harsh environment) and looking into existing international commercial opportunities for non-cattle dairy. Clearly, cattle and small ruminants will also benefit from better pastures and organized collection and processing infrastructure.

Objectives: Achieve sustainability in pasture management through community-driven organized grazing, efficient knowledge and service provision to herders and attractive market opportunities for camel milk, meat and skins to be managed by the private sector.

Interventions: The programme echoes various elements of the SARDS 2040 and specifically builds on: (i) enhancing feeding system productivity and sustainability; (ii) fostering research on camel biology, productivity and processing technology; (iii) improving camel reproduction and production performance, applying results from research; and (iv) developing innovative camel dairy products.

Primarily, a master plan for land use in the *jebel* area with a specific rural settlement area will need to be adopted. In parallel, an information campaign has to be conducted to mobilize camel owners' willingness to pilot the proposed model of organized, community-managed grazing and upgraded live animal production using applied research and strong linkages to markets. Also, a massive upgrade in animal performance (animal health, productivity, quality of raw milk) will need to be carried out alongside implementation of the pasture management plans. Finally, champion herders will run the Salalah Camel Experimental Farm to demonstrate the state-of-the-art production, processing and commercialization model.

Implementation of the proposed programme calls for close collaboration with the private sector, the RCA Research Centre in Muscat (on camel research programme), SQU, MECA (on fog catchment), MRMWR (on water use efficiency in camel hydrating) and other relevant institutions. Modern technologies, such as land use change and biomass assessment using remote sensing tools and GPS for animal grazing tracking, and the use of hydroponics for forage production, should be incorporated into future animal production models. A baseline assessment of the current pasture area and condition has to be carried out.

Expanding milk collection infrastructure and providing a modern Halal-certified slaughterhouse with a skins collection facility and a de-boning (premium cuts, vacuum packaging) shop, paired with a meat processing plant (for sausage production), are key to ensuring commercial viability of the private business, and stable market channel for herders. Impeccable cold chain management (storage, handling and transport) are essential for increasing the competitiveness of Omani animal products in general. Finally, eco- and agrotourism and a massive promotional campaign of Omani camel products will secure high demand for these unique products.

The private sector, working in partnership with the Government, is part of the solution. The private capital, skills and technologies can have a big impact through increased innovation and efficiency gains. However, in the fragmented production structure, bringing small- and medium-scale producers to the level of 'approved' suppliers is challenging. The proposed programme should contribute to strengthening local institutions and training producer groups (e.g., cooperatives, rangeland users' groups), offering high-quality raw material.

Box 1 – Dhofar Mountain Rangeland Regeneration and Management Programme (contd.)

The Government needs to focus its resources on rangeland assessment, pasture rehabilitation, camel breeding-related research, knowledge management and dissemination and demonstration of the excellency of camel products to attract investors. The emphasis should be directed towards land, water and animal productivity per unit of production (in terms of yield or value per unit). For instance, technologies like fog catchment for light pasture irrigation, feed crops seeding and reforestation are paramount.

Implementation modalities

Pursuing the objectives of IO 2.1 requires an important increase in animal productivity and quality (both for red meat and raw milk),[45] while reducing losses along the supply chain, encouraging value chain linkages and organizing producers' supply (horizontal linkages). Enhancing the MAF's capacity to enforce regulations relevant to the livestock sector, monitor the situation on the ground and be prepared for actions responsive to emergencies is crucial.

Increased productivity spurs concern as growing pressure on natural resources and climate change are key challenges across the whole agriculture and rural sector in Oman. Sustainability should therefore be the driving force behind any development intervention to reach maximum productivity. Environmentally friendly animal products will also create opportunities for quality product diversification and greater market opportunities as public concerns on health and climate change rise.

The best opportunity for addressing food security is to prevent animal source food losses and waste and improve commercialization, an area where large gains are possible through improved infrastructure and investment in processing capacities. Functional roads, large modern logistics infrastructure (e.g., collecting centres, cold chain facilities, transport infrastructure, ports, etc.), unique genetic resources and the existence of natural pastures offer important opportunities to reach the country's livestock potential.

The public sector already provides core infrastructure. However, the *software* required to accompany the *hardware* is still not in place, such as capacity building, extension, research and the organization of producers' supply. More importantly, efforts are still required to enhance the quality of animal products (primarily through compliance with safety standards) and to favour the aggregation of livestock producers, private investments and the development of public-private partnerships (PPPs), all of which can be a good conduit for the necessary improvements required for this sector.

Overall the implementation of this programme calls for a well-defined and streamlined interaction and collaboration between the various public and private stakeholders concerned with the livestock sector (municipalities, MAF, RCA, livestock producers and communities, private sector and customs and border control authorities).

Improving herders' knowledge and skills through capacity development and learning/sharing interventions can lead to tremendous gains. Capacity development and extension interventions, including on-farm demonstrations by 'trainer-to-trainer' farmers, model farms piloting new technologies and the establishment of a national livestock capacity building and training centre, will be key to improving the technical and entrepreneurial capacities of producers. Through these initiatives, producers should be encouraged to share and learn from good practices, both in the country and abroad.

[45] Priority should be given to enhancing camel and goat milk production and marketability to maximize milk production using limited available resources, primarily water.

Smart incentives directly linked to achieving programme objectives will be essential for encouraging better performance (e.g., better raw milk quality) and sustainability (e.g., use of photovoltaic energy in cold chain management or water use for animal hydration). Increased access to markets and finance, access to better and timely information and farmers' ability to manage business risks will also drive productivity.

IO 2.2 – National poultry industry competitiveness and sustainability enhanced

Justification

The Omani poultry industry is much less competitive than that of the leading grain-growing countries. Nevertheless, the poultry industry is definitely a sector where Omani agriculture can be successful. Improved technical and managerial knowledge can significantly lower production costs and, if paired with a policy favouring competition, make domestic poultry products more competitive. Lower retail prices and diversified domestic supply will boost consumption, providing the national industry with a solid ground for further development. To achieve these results, the poultry industry in Oman will have to become economically, environmentally and socially sustainable.

It will be difficult to reach the proposed targets with the current production structure and relevant policies. Currently, each micro-holding and SME operates its own slaughter-house and struggles to market its products under a given brand. In order to obtain a place on the market, producers lower prices, but since the cost of production is high, they sacrifice quality. Moreover, the policy of 'price determination per bird' (instead of per kg, as is the case in modern retail) fosters producers' underperformance.

The current feed price compensation schemes have incurred high costs to the Government without yielding substantial returns in terms of reducing national poultry production costs. Consequently, consumers have not witnessed a reduction in the price of broiler meat or eggs.

Poultry-specific advisory services are virtually non-existent. This, *inter alia,* resulted in poor performance indicators for producers in general (Punda, 2016a). Another factor negatively affecting performance indicators of micro-holdings and SMEs is manual labour (e.g., feed provision to birds is suboptimal).

There is a need to re-organize the entire value chain and upgrade the businesses lagging behind. Value chain optimization calls for better integration of micro-holdings and SMEs, more effective input supply management (feed, parent stock, bedding material), clear marketing strategies for producers in different categories (large enterprises, cooperatives/SMEs and micro-holdings) and, most importantly, enhanced knowledge among all value chain participants to boost their performance and ensure environmental sustainability. Strict compliance with the national biosecurity framework is fundamental as food safety and nutrition concerns will drive the market.

Objectives

The main objective of the proposed programme is to build the knowledge base within the sector, provide incentives for businesses to perform better[46] and establish linkages within the value chain, cooperatives or outgrower schemes. Specifically, it will: (i) provide technical and technological support to businesses (focusing on performance indicators, marketing, water and energy use efficiency); (ii) seek to better control input supplies (primarily feed); and (iii) organize micro-holdings and SMEs into cooperatives and support them. A dedicated window for indigenous chicken development bred by traditional poultry farmers is also foreseen.

Implementation modalities

The major pre-conditions for successful programme implementation include: (i) a strict biosecurity regime in place; (ii) amendment of the law on cooperatives allowing the latter to act as a legal entity; and (iii) establishment of a 'one-stop shop' to facilitate private agribusiness development.

While the private sector will establish parent stock production within the country, the Government should facilitate the establishment of a trading company for corn and soy contract farming outside of Oman. Simultaneously, the national feed standard will need to be enhanced.

A critical element of the programme is the establishment of the Independent Expert Poultry Council (Steering Committee) under the Royal Court. The Council will be an extended arm of the MAF and MRMWR and provide targeted technical assistance to the industry. The Council will elaborate the compendium of best practices and provide demand-driven advisory services to the industry. SMEs and micro-holdings forming a cooperative will be given priority access to these advisory services free of charge.

MAF teams, together with the Independent Poultry Expert Council (see below for a description of the Council's functions), will have to focus on creating a detailed database of active poultry operations and enforcing biosecurity and food safety legislation (focus on SMEs and micro-holdings). The latter includes technical audits and licensing of SMEs for outgrowing schemes.

Policy measures specific to poultry should provide incentives for better performance, environmental commitment and the achievement of economies of scale. With regards to broiler cooperatives in particular, it is crucial the Government expands its sourcing from these producers to support Omani entrepreneurship and generate more jobs in agriculture.

IO 2.3 – Apiculture practices and technologies, organization of producers, value-addition and marketing enhanced

Justification

Oman is reputed to have some of the highest quality honey in the world. Besides the importance of honey production for professional beekeepers, honey production already represents a significant source of income for many small farmers. Moreover, huge

[46] In addition to good performance indicators, businesses invest in process automation, application of water-saving technologies and practices and use of renewable energy sources.

growth opportunities exist in developing a stronger honey and related value-added products industry.

At the same time, the yield potential and quality of many fruit and vegetable crops, extremely important for economic return, depend on adequate flower pollination by honeybees. If honeybees are stressed, flower pollination and subsequent yields of many horticultural crops will be reduced. Recent stress-related factors – mite infection, pesticide residues and lack of adequate food and water – have reduced bee health and vigour. CCD is also a serious threat to honeybees and must be minimized for effective horticultural and forage crop pollination and sustainable honey production.

A major constraint to the market competitiveness of Omani honey is its relatively low yield and the lack of modern apiculture technologies. The introduction and dissemination of modern beekeeping skills and technologies, both to smallholder and commercial beekeepers, is essential for strengthening the flower pollination service sector and the commercial honey industry.

Objectives

The main objective of the programme is to increase honey production and quality. This can be pursued through a set of specific activities such as: (i) introducing and using new and improved beekeeping technologies to optimize flower pollination and increase honey production and its value-added products; (ii) reducing the incidence and severity of honeybee stress-related disorders and CCD; and (iii) creating an enabling environment for investment in honey production and honeybee-produced commercial products (regulation, research, training and technical assistance).

Implementation modalities

A diverse MAF-led research programme is required on the production, storage and development of honey and honeybee value-added products. Regional research centre evaluations and on-farm trials of advanced apiculture techniques will be instrumental in establishing a modern industry of honeybee products. Utilization of proper honey storage conditions and facilities to maximize honey market life and quality will be emphasized.

Training and technical assistance to commercial beekeepers and MAF personnel on best beekeeping practices and proper apiculture techniques will strengthen knowledge and human resource capacity and establish a critical amount of information to advance the sector. Proper integrated pest management (IPM) practices will be adopted for the control of mites and other pests associated with CCD.

The MAF will facilitate the commercial adoption of improved beekeeping practices and apiculture management. Incentives to invest in honey production and value-added honey products are required to stimulate the beekeeping sector. The development and marketing of new value-added honey, beeswax, royal jelly and other commercial products will be prioritized. Specialty honey products with high-value niche market opportunities need to be prioritized and promoted (e.g., specialty locations, frankincense-flavoured, etc.). Packaging and branding of honey products also need to be improved. Regulations on the transport of bees will require revision. Stricter regulations and testing for authenticity and purity of agrochemicals and pesticides are also required.

IO 2.4 – Stringent food safety and biosecurity measures for animals and animal products enforced

Justification

In Oman, most of the livestock-supporting infrastructure is below the expected biosecurity standards. There is no acknowledged CVO or CAPO. And there are often uncoordinated activities, e.g. vaccination campaigns carried out by veterinarians belonging to different institutions (MAF and MRMWR). Furthermore, there are no early warning and early response mechanisms for emergencies such as the threat of epidemic diseases. Most livestock slaughtered in the country do not receive pre-slaughter veterinary inspections or post-slaughter public health inspections, mainly because most the slaughtered animals are slaughtered outside the official abattoirs. This is not an issue for vertically integrated poultry operations, though the issue of abattoirs serving micro-holdings and SMEs calls for urgent attention.

The biosecurity law has recently been adopted; however, it seems there is no clear roadmap for its enforcement. There is a legal framework concerning health certificates for the import and export of live animals, hatching eggs and animal source foods; however, these requirements are not always effectively met, e.g., in regulating the passage of livestock from the harbours to the slaughterhouses or re-export destinations in GCC countries. Also, measures to declare food products of animal origin free from radiation or environmental pollutants and toxic substances, such as dioxin, are either lacking or not functional.

With the liberalization of trade in agriculture, Oman is in an excellent position to play a major role in providing GCC countries with red meat (beef, mutton, goat meat and camel meat), broilers and eggs, and to become the hub for livestock reaching the Arabian Peninsula from Africa, Australia and South America.[47] Grasping the opportunities of the new international trade order calls for adequate facilities and infrastructure to support and enable the execution of animal and public health measures and regulations for an effective permanent surveillance system.

Objectives

The overall objective is to enforce an effective national biosecurity and food safety framework in line with the *Codex Alimentarius* and World Organization for Animal Health (OIE) Guidelines (adapted to the Omani conditions) to ensure widely recognized healthy livestock and safe animal source food. The specific objectives are: (i) completing (if appropriate), consolidating and harmonizing livestock sector regulations and legislation; (ii) improving veterinary services and disease control on livestock and animal source food, ensuring balanced and strategic outreach throughout the Sultanate; and (iii) implementing quality assurance systems to enhance quality control and responsibility along the livestock value chains (e.g., GAPs, good manufacturing practice, good hygienic practices and HACCP).

[47] However, trade liberalization may also bring challenges as it has opened new routes for animal diseases and pests through the import of hatching eggs and animal products. Other risks come from political unrest in neighbouring countries, such as Yemen, and, more generally, the lack of controls in transboundary animal movements.

Implementation modalities

A contemporary risk-based approach for ensuring food safety requires application at those points along the food chain that have the greatest ability to reduce food-borne risks to consumers. This calls, first of all, for an effective regulatory and governance system aimed at strengthening the capacity for disease detection, prevention and control, within which are embedded the country's ability to comply with international biosafety, hygiene and public safety measures. This regulatory framework should be complemented by well-staffed, trained and equipped veterinary services, guaranteeing an adequate legislation enforcement capacity. For example, it is crucial to address the shortage and low performance of current quarantine facilities, clinics and veterinarians, and the non-existence of livestock traceability systems.

Livestock operations and agribusinesses also need to adopt a set of quality assurance systems specifically devoted to food safety. While some large companies have already adopted the HACCP requirements, this is not compulsory in the country, and overall the sector lacks proper traceability. HACCP, good hygiene practices and good manufacturing practices should become mandatory standards for all sector players, including cooperatives. This will simplify veterinary inspections and business monitoring. Moreover, the provision of the necessary conditions for establishing 'farm to fork' marketing infrastructure, including cold chain management,[48] is essential for aggregated, small and medium producers (e.g., cooperatives).

Traditional and emerging commercial livestock producers need training, through animal health awareness programmes, in identifying infections and in carrying samples to the laboratories, which are currently very limited in number or access. Adequate and effective animal extension services and media awareness programmes should be provided as a priority to high livestock concentration municipalities (Al Batinah and Dhofar).

There is also a need to harmonize and integrate efforts of various government institutions in developing and executing the national vaccination programmes, especially for transboundary animal and zoonotic diseases, and to provide sufficient training and equipment to professional staff.

Implementation of the programme calls for close collaboration between the MAF and the MRMWR on biosecurity, and between the MOCI and the MRMWR on enforcing food safety standards. Ideally, there should be one authority responsible for enforcing the biosecurity law capable of effectively monitoring, detecting and controlling zoonotic agents along the supply chain, including in feed.

The MAF should have the capacity to ensure on-farm veterinary surveillance, implying proper records management. The MOCI laboratories and technical staff have to be strengthened to be able to enforce compliance with food safety standards of all food products entering the Omani market. The MOCI should update a series of technical regulation standards on animal products, while the MRMWR should monitor to ensure the national food safety law is in line with the *Codex Alimentarius*.

There is a need to accredit a national competent authority to certify national companies against international norms. Private service providers should be encouraged to provide compliance capacity services to the companies requesting certification(s).

[48] Cold chain establishment and management is the backbone of the sector. Large commercial operations seem to operate proper cold chain facilities, however this is far from the case for micro-holdings and SMEs.

6.3. Outcome 3 – Sustainable Management of Natural Resources in Agriculture Enhanced

The overall objective of Outcome 3 is to make farming practices more sustainable with specific reference to the use of natural resources, primarily water, which is the binding constraint on Omani agriculture. This will be done through interventions that enhance the efficiency of water resources management (the target is to remain within the water budget) and increase water productivity in agriculture (maximizing the value per unit of water). This programmatic intervention area includes as IOs the conservation and improvement of soils and the conservation of Omani agrobiodiversity.

Water use and water management are the most important issues. Therefore, intervention priorities are set for aquifers and regions where: (i) agricultural production is largely concentrated and there is a clear trend of groundwater depletion and seawater intrusion; (ii) farmers are well organized and efforts to strengthen water users' groups, as well as dialogue platforms between different water users, would be easier; and (iii) opportunities for product value addition are greater. Hence, the Al Batinah region would fit within these criteria as the first possible intervention, along with some *aflaj* irrigation systems, where changes in production, irrigation techniques and farmer organization show potential to improve local livelihoods and contribute to better water management.

Increasing water productivity sustainably is addressed through the production improvements necessary for achieving Outcomes 1 and 2. The interventions under Outcome 3 should be coordinated with Outcome 5 (Rural development) as far as *aflaj* conservation is concerned (IO 5.2), and Outcome 6 (Enabling institutional environment) for the institutional reforms of water users' groups and land access (IO 6.1).

Outcome 3 is pursued through four IOs, namely:

- IO 3.1 – Income per unit of water used in agriculture maximized;
- IO 3.2 – Capture, re-use and storage capacity of water for agriculture increased;
- IO 3.3 – Soil management improved; and
- IO 3.4 – Agrobiodiversity conserved.

IO 3.1 – Income per unit of water used in agriculture maximized

Justification

Oman has a hot, arid climate where sustainable agriculture is only possible because of the existence of a small, annually renewed groundwater resource; in Oman, water – not land – is the binding constraint on agriculture. Today, this water resource and the farms that depend on it are under threat. Farmers are extracting much more water than is renewed each year, more than 50 percent in total (MRMWR, 2013). This alarming rate of groundwater overdraft is permitting saline intrusion and an increasing rate of salinization of freshwater aquifers and lands irrigated by the salinized water (Ward, 2016).

Much water use in agriculture is inefficient, giving lower 'income per drop' than it can and should. There are non-beneficial water losses to seepage and evaporation between the wellhead and plant roots. There are economic losses through crop choices and crop husbandry that do not return the maximum value at harvest: lower-value crops dominate cropping patterns and there are large economic losses in the post-harvest chain.

Agriculture is in effect wasting precious water and giving much lower economic returns to farmers and the national economy than it could potentially.

Caring for Oman's precious groundwater resource and planning for its best use are the most important challenges the country faces. Therefore, correcting the groundwater overdraft and increasing 'income per drop' are essential. The amount of available groundwater is finite (and under threat) and agricultural growth can only come from getting higher returns on each drop of water. In addition, if farmers are to be motivated to reduce their pumping, they will need to be able to maintain their incomes while using less and less water. 'More income per drop' is the only farming strategy open to Omani farmers who want to stay in business.

Across the world, recovering control over groundwater once it has been lost has proven difficult. Experience shows that retrofitting a groundwater governance system once the resource is fully developed and is being over-exploited is a long and arduous process that requires both sustained political commitment and the consent and collaboration of water users.

There are, however, several factors that may favour the establishment of a collaborative governance framework in Oman. There is a shared understanding of the problem and of its critical nature. There is knowledge of what needs to be done. There are indications that a collaborative institutional approach is possible. A pilot programme of SQU and the MAF has shown that smart metering can work and that farmers are prepared to collaborate in a programme of quotas and regulation, provided it is seen to be fair and allows them to continue farming.

Objectives

The objective is to protect precious freshwater resources by reducing withdrawals of groundwater to safe levels. This will require: (i) establishing a groundwater governance framework that will allow the progressive reduction of abstractions, beginning in the most vulnerable areas and in any new irrigation areas that may be developed; and (ii) achieving the highest possible income per unit of water consumed by maximizing water use efficiency and crop water productivity. This will be achieved by promoting high-value, water-efficient cropping, sustainable, productive and efficient on-farm water management and best practice crop husbandry and post-harvest practices along the entire value chain. The target will be to maintain or increase farmer incomes while they use less and less water.

Implementation modalities

The programme will aim to progressively reduce groundwater overdraft. Measures will begin with the creation of a working partnership between the MRMWR and the MAF to: (i) scope and monitor water resources in each agricultural area; and (ii) progressively implement, in collaboration with farmers, the regulatory framework for groundwater set out in the Ministerial Decree 264/2000. In new irrigation areas, water quotas will be allocated to farmers and agreements made with them on groundwater pumping being metered and regulated from the outset. In existing irrigation areas, collaborative regulation will be introduced step by step. Based on the successful results of the SQU/MAF research programme, implementation will begin on a pilot basis in the Al Suwayq zone of Al Batinah (see Box 2) with actions to develop a mutual interest partnership with farmers, accompanied by incentives for compliance.

Box 2 – Al Batinah Sustainable Efficient Agriculture Programme

Justification: The Al Batinah plain is Oman's highest potential agricultural area, with 53 percent of the cropped area of the country, and 36 percent of its agricultural water. It is also a major livestock rearing area, with 24 percent of all livestock numbers in the country. However, the future of this fertile powerhouse is under threat. As elsewhere in Oman, groundwater resources on which agriculture depends are limited and vulnerable. Currently there is a massive overdraft in the plain, with abstractions of 557 million m3 against a recharge of only 360 million m3. The result is an annual overdraft of 200 million m3, 54 percent of the renewable resource. The resulting seawater intrusion and groundwater salinization have led to declines in yields and progressive abandonment of land developed for irrigation. More than 30 percent of the farmed area in Al Batinah now depends on groundwater with high salinity, and almost 12,000 *feddans* have gone out of production, 12 percent of the total cultivated land in the plain.

At the same time, water use efficiency is low and crop water productivity is well below potential. If the current groundwater overdraft continues, two-thirds of Al Batinah farmlands will be lost in the coming decades. It is estimated that with better irrigation infrastructure and management, better crop choice and husbandry and greatly improved post-harvest practices, value added from agriculture in the plain could double. Recent field research by SQU in Al-Suwayq has demonstrated that farmers are prepared to collaborate with the Government on improved groundwater governance and to reduce pumping, provided they can maintain their incomes. There are some embryonic farmer associations or cooperatives that could form the basis of farmer organizations to work with the Government, and further areas that can be developed upstream for irrigated agriculture (14,400 f*eddans*). Some of the salinized farms near the coast may be retired from farming without compensation as the land has a high value for alternative uses and can be rezoned for non-agricultural uses.

Objectives: The overall objective is 'more income for less drop in the Al Batinah Plain - sustainably'. This can be achieved through two inter-linked approaches: (i) living within the water budget by implementing a collaborative groundwater governance approach that will enable Al Batinah to reduce the current heavy overdraft of groundwater and related salinization of the aquifers; and (ii) maintaining or increasing contributions to the GDP and farmer incomes by maximizing economic returns for each cubic meter of water used in agriculture in the plain (including through better management of saline soils and use of brackish water).

Interventions: The programme would have two components. First, a series of measures would be aimed at sustainable groundwater management in the plain. This would be accomplished progressively through a partnership between the MAF, MRMWR and farmers to introduce a collaborative programme of water rights, metering and enforcement to bring groundwater abstraction to within sustainable levels. Moreover, because farmers will need to maintain – or even increase – their incomes while using less water, a second set of measures would target much higher water use efficiency and crop water productivity. In new irrigation areas, water quotas will be allocated to farmers and agreements will be made with farmers that groundwater pumping will be metered and regulated from the outset. In existing irrigation areas, collaborative regulation will be introduced step by step. Based on the successful results of the SQU/MAF research programme, implementation will begin on a pilot basis in the Al Suwayq zone of Al Batinah with actions to develop a mutual interest partnership with farmers, accompanied by incentives for compliance.

Although reducing pumping is imperative, it would not be fair to ask farmers to lose their livelihoods as a result. The programme aims to maximize the economic and cash returns per unit of water used. A 'comparative advantage and domestic resource cost study' will identify the priorities able to ensure the development of value chains that return the highest income per drop. These measures would be accompanied by the promotion of modern on-farm irrigation equipment and methods to increase water use efficiency, including drip irrigation/fertigation, protected agriculture in greenhouses, mulching, etc. Research and dissemination would be refocused on water use efficiency and crop water productivity along the value chain, including maximizing value added post-harvest activities. Agro-economic research would also be conducted to benchmark current water use efficiency and crop water productivity as the basis for measuring the potential for improvement and for tracking results.

Farmers will be encouraged to form water management groups, and a collaborative programme of metering and enforcement will be introduced to bring groundwater abstraction to within sustainable levels. The programme may be associated with the allocation of new land to young, graduate professional farmers. Farms in the already salinized coastal zone may be rezoned for commercial, housing or tourist development, which will provide incentives to farmers in these areas to stop pumping and to halt the process of seawater intrusion and salinization.

Securing the future of Omani agriculture depends on farmers reducing pumping but it will not be fair to ask farmers to lose their livelihoods. Because farmers will need to maintain – or even increase – their incomes while using less water, the programme of collaborative regulation and reduced pumping needs to be accompanied by measures to increase incomes per drop of water used.

An economic study will be conducted at the outset to find what combinations of crop and varietal choice, husbandry systems and water management give the best returns to each drop of water (a 'comparative advantage and domestic resource cost study'). The resulting priorities will drive crop-specific technical, economic and market interventions, for example, on export horticulture, which would ensure the development of value chains that return the highest income per drop.

Implementation of the programme will require joint planning and management between the MRMWR and the MAF, and the determination of all concerned to ensure the sustainable growth of agriculture through reduced groundwater overdraft and increased value from each drop of water. Government and farmers will have to agree to apply quantitative water rights/quotas and to adopt and implement a collaborative regulatory framework. Ideally, farmers would form into local groups to be able to act as partners of the Government.

Guidance to farmers on water use efficiency and crop water productivity would need to be provided within an integrated package of research, extension and government support. To achieve the needed focus in research, four of the Sultanate's six agricultural research centres would need to work together with SQU and farmer groups to identify and research priority themes towards the objective of 'more income for less drop' and to make the results accessible. Partnerships with regional and developed country research centres should be sought.

The MAF should continue to promote modern on-farm irrigation equipment and methods, but public subsidies should be tied to farmers' agreement to reduce pumping and to implement measures to maximize water use efficiency and crop water productivity ('smart' incentives).

IO 3.2 – Capture, re-use and storage capacity of water to agriculture increased

Justification

Recent studies have found that almost all of Oman's conventional water resources have been developed. However, several areas have annual surpluses of recharge and, although there are severe constraints to developing these resources, it would be worthwhile to evaluate the potential use of these areas for sustainable agriculture. In addition, there are volumes of water, including flood flows and storm waters, lost to the sea and sinks. It may be possible to harness some of these resources through dams for recharge or storage.

There are also several possible sources of non-conventional water. Quantities of treated wastewater are expected to increase considerably in the coming years and could be used in irrigation and aquifer recharge, although there are likely to be strong economic and sustainability constraints. In the Dhofar mountains, collection of fog water could provide a limited but useful supplement to water supplies for humans and animals. Domestic water harvesting systems that have already been tested on Jebel Akhdar could be expanded. In the central area of Oman there are sizable brackish or saline

water resources. There may be potential to desalinate some of these resources for domestic use, or to use the water for salt-tolerant crops. Finally, Oman's oil industry produces very large volumes of oil-associated water. A current project using artificial wetland technology may indicate economic methods of recovering this water.

Objectives

The objective is to assess supplementary sources of supply for irrigated agriculture and to develop those that can be used economically and sustainably.

Implementation modalities

It should be stressed that new resources are unlikely to be extensive or easy to exploit economically. Consideration of the potential of possible new resources should never distract from agriculture's principal task in the coming years to protect the quality and quantity of existing water resources and to get the absolute maximum value out of every last drop.

The programme will assess the economic potential for further development of conventional water resources. The assessment will cover the re-evaluation of surface flows lost both to the sea and desert, and the study of the potential for further harnessing flows either to promote recharge or to impound water in storage dams. The programme will also assess the potential agricultural use of groundwater in areas where there is a surplus of recharge.

The programme will look at possible non-conventional sources that might be economically developed for agriculture. A study will assess the scope for using treated wastewater for irrigation – the risks, economic and social feasibility and technical applicability. The potential of water harvesting and fog collection to supplement resources for households and livestock will be examined. A study will examine the potential for abstraction, desalination and use of brackish groundwater, and there will be an evaluation of the pilot project for oil-associated water with a view to scaling up for forestry and anti-desertification if economically viable.

In order to evaluate and plan for new resource development for agriculture, a partnership between the MRMWR and the MAF is needed to monitor and assess the resource and evaluate the viability of its sustainable and economic exploitation for agriculture. The MRMWR and the MAF will work together on assessing the potential for further development, including studies and assessments in the programme, and will plan and implement viable infrastructure projects on the basis of the study findings.

IO 3.3 – Soil management improved

Justification

Oman's agricultural soils are poor in natural fertility and need careful management to produce good yields. In addition, the growing salinization of groundwater and of soils irrigated with saline water is causing steep declines in productivity, with yields and farm profits dropping almost in linear fashion. Over half the farms in Al Batinah have high to very high salinity, as well as alkalinity hazards that affect the efficiency of micro-irrigation.

Other causes of soil and water degradation include intensive livestock production and overuse of agricultural chemicals, as well as problems of soil compaction and erosion caused both by farming and tourism.

If nothing is done, the *Oman Salinity Strategy* (MAF, 2012) estimates that under a business-as-usual scenario, the average agricultural productivity across Al Batinah would decline by 38 percent by 2030, and that "most of the Al Batinah agricultural system would be lost to salinization induced by seawater intrusion within fifty years".

The causes of salinization need to be addressed through action to reduce groundwater overdraft. Where land is already salinized, it will be important to counteract the decline in productivity through management practices adapted to saline conditions.

Objectives

In the case of salinized lands, the objective is to stem the spread of salinity and to adapt production systems to more saline conditions. The overall objective is to promote sustainable, environmentally friendly production systems.

Implementation modalities

The programme will help farmers to assess soil quality, adapt crop selection to soil capability, and practice better fertility management including techniques for soil moisture conservation. The programme will identify best practices in salinity management and develop extension programmes. It will also encourage changes in production systems, including planting alternative crops and adopting 'biosaline agriculture' systems.

Clean production technologies will be promoted, notably in high-risk livestock industries, and programmes will be developed to reduce risks to land and water from both livestock and cropping systems.

Implementation will require extensive inter-agency collaboration. On land issues, the MAF's main partner will be the Ministry of Housing (MOHO). The SQU faculty has shown good capacity to partner on study and research projects to fill the knowledge gap.

IO 3.4 – Agrobiodiversity conserved

Justification

Oman is rich in biodiversity, with 6.5 percent of all plant species classified as endemic and 9.3 percent as near-endemic or regional endemic flora (MECA, 2014). There is also a considerable heritage of landraces adapted to the environment. Most recent estimates assess that Oman's agrobiodiversity comprises 109 crop species, 43 crop landraces, 708 crop wild relatives and 448 medicinal plants (Al Lawati et al., 2016).

The centres of plant endemism are the mountains of northern Oman, the central desert and the mountains of Dhofar. More specifically, a landrace richness analysis found the highest landraces concentration in the north of the country, along the coast and in the Al Hajar, Al Gharbi and Al Hajar Ash Sharqi mountains.[49] Areas with high diversity in crop wild relatives include Dhofar, Jebel Al Akhdar and Musandam.

[49] This result is thought to be heavily biased by past surveying in this region. A more systematic approach to landrace surveying in Oman is urgently required.

At the same time, Omani biodiversity is under threat: according to the most recent survey, some 9.1 percent of the flora is considered threatened, 80 percent of which is in the south. The most important threats come from urban sprawl, settlement projects for nomadic communities, commercial agriculture expansion, overgrazing, pollution, unregulated tourism and alien species introduced into the Omani environment. Specific threats from agriculture include widespread mono-cropping in agricultural areas, and overgrazing, which is reducing the quantity and variety of wild native flora and fauna. Salinization of land and water is leading to changes in vegetation, with the substitution of salt-tolerant for salt-sensitive species. There is widespread growth of unpalatable alien plants, including the invasion of exotics.

The country's rich biodiversity is not only a source of biological and heritage interest but also an asset for economic development and tourism. Oman has recognized the need to conserve endemic genetic resources and to protect its biodiversity. Action is needed to reduce negative impacts of agriculture on the biosphere and to conserve Oman's unique biodiversity. Programmes have been designed, including for the collection of unique genetic material.

Objectives

The objective is to support the conservation of agricultural genetic resources and biodiversity, to align agriculture with national biodiversity conservation strategies and to tackle biodiversity issues specific to agricultural production.

Implementation modalities

The programme will comprise actions to conserve genetic resources, the implementation of biodiversity programmes and the mainstreaming of genetic resource conservation and biodiversity into agricultural programmes.

The genetic resource programme will include an inventory and information system on genetics, breeds and varieties and species, the setting up of a gene bank and a registration programme for indigenous varieties and breeds.

Specific conservation measures in areas with agro- and ecotourism potential will be implemented. A key role will be played by *in situ* conservation in farming that will be actively promoted, seeking framers collaboration, both individually and through associations.

Interventions will include education and awareness campaigns on biodiversity.

Implementation will require extensive interagency collaboration under the leadership of the MECA. The role of universities and research institutes will also be important.

6.4. Outcome 4 – Resilience of Agriculture and Rural Livelihoods Improved

The overall objective of Outcome 4 is to improve the resilience of agricultural and rural livelihoods to climate change and natural disasters. The required interventions are related to planning for disaster risk reduction and management (DRRM), improvement of institutional frameworks for coordination and collaboration towards DRRM and implementation of adaptation, mitigation and risk management measures to better cope with climate change and natural disasters.

Most of these activities fall under the mandate of the MECA, the MRMWR or other institutions other than the MAF. In this domain, the key role of the MAF is twofold:

(i) promote policy dialogue and inter-institutional coordination, in order to ensure that the role of agriculture and rural development is mainstreamed into national strategies and action plans for risk reduction and management; and (ii) contribute to field and research operations in order to ensure that climate change, disaster risk management and resilience-enhancement are mainstreamed into its research and extension activities.

A specific focus should be given to the dissemination of technologies and techniques for agricultural production, processing and marketing (i.e., throughout all SARDS 2040 interventions). The adoption of climate change mitigation measures in the agriculture and rural sector is an important component of this outcome. It should focus on improving efficient energy use and on adopting renewable energy resources. Resilience to shocks will be increased not only through adaptation to climate change, but also through institutional changes such as improved access to credit, insurance for farmers, household income diversification and the development of social safety nets in rural areas.

The actions above should be streamlined as resilience building and efficiency enhancing interventions under Outcomes 1 and 2. Most interventions under Outcome 3 (e.g., IO 3.1 on water efficiency and IO 3.4 on conservation of agrobiodiversity) have synergies with Outcome 4 and therefore need to be coordinated. Special emphasis should be devoted to considering natural risks in streamlining interventions under Outcome 6, specifically IO 6.3 on inclusive financial services (credit and insurance).

Outcome 4 is pursued through two IOs, namely:

- IO 4.1 – Climate change adaptation and natural disaster risk management integrated into agricultural and rural development policy, investment and programmes; and
- IO 4.2 – Climate change mitigation and agricultural footprint improved.

IO 4.1 – Climate change adaptation and natural disaster risk management integrated into agricultural and rural development policy, investment and programmes

Justification

Although all climate change projections carry uncertainty, it is likely that Oman will experience decreased and less predictable rainfall, particularly in the northern regions, as well as higher temperatures. There is likely to be a consequent increase in aridity, with lower rainfall and higher temperatures increasing evapotranspiration and producing hotter summers and shorter winters. Possibly the most serious risk comes from increasingly frequent extreme weather events: droughts, cyclones and violent storms. Already the incidence of cyclones appears to be increasing.

Possible consequences for agriculture include: (i) threats to animal and plant health from higher temperatures, new disease vectors and intensification of existing vectors; (ii) threats to the quantity of water resources from changing rainfall patterns; (iii) threats to water quality from increased saline intrusion resulting from a rise in sea level; (iv) threats to agricultural production from an increasing incidence of drought, more variable rainfall patterns, rising temperatures and increased risk of aridity and change in seasonal climate; and (v) threats to ecosystems and biodiversity from rising temperatures and changes in rainfall patterns.

Oman must prepare to deal with the relatively high level of risks the country is facing. A national adaptation strategy, currently under preparation and including major chapters on water resources and agriculture, is expected to be adopted in 2017.

Objectives

The objective is to prepare the agriculture and rural sector for a changing climate and to be able to adapt to it. This includes preparing for DRRM, proofing infrastructure against cyclone and flood risk and planning infrastructure and land use to take into account climate-related risks.

Implementation modalities

The principal areas of action will be in institutional organization. Institutional collaboration will be essential, particularly between the MECA, the MAF and the MRMWR. Furthermore, agriculture and rural development should be streamlined into strategies and planning for climate change adaptation, anti-desertification and DRRM. At the same time, agricultural planning and projects will systematically factor in climate risks.

The 2005 National Action Programme on Desertification will be updated, with a realistic investment and implementation plan. In addition to the formulation of the national strategy and preparation of the DRRM plan, institutional frameworks for coordination and collaboration on climate-related issues will be set up; knowledge and capacity for tackling climate change developed; infrastructure design guidelines for coastal region and flood plains susceptible to cyclone and flood risk prepared; and basin planning (infrastructure, land use) taken into account climate-related risks.

Awareness raising will be key, and information systems will increase knowledge, capacity and awareness on climate change.

IO 4.2 – Climate change mitigation and agricultural carbon footprint improved

Justification

The Oman Vision 2040 is planning for an economy different from today's hydrocarbon-based economy. In this perspective, agriculture, rural development and, broadly speaking, the whole food system, play a significant role in reducing their contribution to the overall carbon footprint. This is crucial considering that over the coming years the country wants to invest in energy-intensive food production activities (e.g., poultry and dairy). In this case, it is best to introduce from the very beginning renewable energy technologies.

The 'farm to fork' food chain can dramatically contribute to reducing the country's carbon footprint through three major avenues, namely: (i) increasing the efficiency in food production, processing and transportation, and shifting to cleaner energy resources (solar and wind); (ii) promoting less-impacting technologies and practices (e.g., conservation agriculture and minimum tillage to restore soil carbon, reducing the use of agrochemicals, increasing the carbon sink function through reforestation, etc.); and iii) changing food consumption patterns, modifying the individual diet and buying food with a lower footprint (e.g., organic).

Among all potential renewable resources the most feasible options for Omani agriculture are solar and wind energy. These two sources can be exploited as off-grid power

generation sources at individual farm or processing unit level virtually all over the country.

Objectives

The overall objective of this programme is to enhance the adoption of climate change mitigation interventions in the agriculture and rural sector through: (i) improving energy efficiency use; (ii) adopting renewable energy resources; and (iii) changing consumer food consumption behaviour.

Implementation modalities

The institutional and regulatory framework for renewable energy is still in its infancy in Oman, with the focus currently on identifying research needs, formulating pilot studies and studying the development of a renewable energy policy. Therefore, a preliminary step in developing the programme is setting up the appropriate regulatory and governance framework, integrating and aligning agricultural and rural development policy, programmes and investments related to the topic and closely collaborating and coordinating with the Public Authority for Electricity & Water (PAEW) and the Authority for Electricity Regulation on one side, and other relevant stakeholders, such as the MECA and the MRMWR, on the other.

A logical second step, which will permit the identification of sound interventions, is to launch a research programme to study existing renewable energy applications and fine tune them to local operating conditions in order to reduce losses and waste in agricultural production, rural development and at any stage along the food value chains. These studies' most promising results need to be piloted in order to test their feasibility for subsequent scaling up across the country.

This programme requires a multipronged, comprehensive strategy to ensure the needed cultural change. The sensitization of all players in the Omani economy – producers, processors, traders, consumers – must be enhanced through focused awareness raising campaigns. Capacity of all operators must be built through well-designed extension and technical assistance activities. At the same time, specific awareness campaigns, coupled with the introduction of sustainable development principles in the standard and vocational curricula, should be addressed to the most sensitive strata of the society – mothers and children.

The adoption of mitigation activities in agricultural production, rural development and food value chains should be favoured, streamlining these activities in all technical assistance projects and investment operations.

At the same time, the current structure of incentives must be reformed, providing the economic agents with the right incentives structure in order to behave consistently with the programme objectives and to overcome the natural inertia to continue as business as usual. Soft finance to enable investment into renewable energy adoption, tailored to operators at the various stages in the food chain, is also key.

All actions proposed under IO 4.2 may be eligible for programme support by the Global Environment Facility (GEF), which integrates learning by doing, supports institutional change and policy reforms and provides technical assistance to encourage innovation and test new approaches. The GEF has proven to be critical at promoting "readiness" for scaling up second-generation investments by focusing on building a solid foundation for other financing partners to invest. Therefore, it would be worth exploring the possibilities offered by GEF top-up financing.

This IO, as with many other environmental sustainability IOs (see Outcome 3), should be embedded in the set of criteria for any agricultural operation eligible for government support.

6.5. Outcome 5 – Rural Communities Empowered and Rural Livelihood Opportunities Improved

The overall objective of Outcome 5 is to promote the empowerment of rural communities – primarily youth and women – as well as the development and diversification of farm and non-farm economic activities in rural areas to increase income-generation and employment opportunities. This would contribute to a more balanced regional development by reducing the gap between rural and urban areas. Pursuing this objective requires the adoption of a territory-based approach[50] rather than the traditional sector-focused, production-oriented approach adopted so far.

Considering that Oman has no previous experience with territory-based approaches, the major thrust under this outcome will be to launch a pilot rural development programme in Jebel Akhdar. This area is considered the most appropriate because of its potential to generate immediate benefits (valorisation of local high-value agricultural produce and synergies that can be developed between on-farm and off-farm activities in the area, such as ecotourism business opportunities) and lessons for scaling up to other rural areas of the country.

Two conditions are key for the success of the programme, namely: (i) effective collaboration and coordination of all involved stakeholders (e.g., the MAF, MRMWR, MECA, MOT, MSD, MOHO, Ministry of Heritage and Culture [MHC], Ministry of Manpower [MOM], etc.) and endorsement from authorities at the highest level in order to ensure it; and (ii) engagement of the local community from the early stages to better identify territorial opportunities and needs, pinpoint target groups and actors (especially leaders to work with), develop participatory capacity development plans with local stakeholders following needs-based approaches and their capacity to get organized in order to professionalize farmers (women and men) and develop local partnerships (public and private) to design and execute interventions.

Considering the change of perspective implied by the territory-based approach typical of rural development programmes, pursuing Outcome 5 requires strong coordination with virtually all other programmes, specifically those related to Outcome 6 (Enabling institutional environment) and Outcome 3 (Sustainable management of natural resources), as well as some IOs under Outcomes 1 and 2, with reference to high-quality product differentiation, value addition and marketing.

Outcome 5 is pursued through two IOs, namely:

[50] Social and economic development are multidimensional processes. It is now widely recognized that a sector-based approach would not be sufficient to address the complexity and multidimensional and cross-sectoral nature of these processes (Barca et al., 2012; OECD, 2006). As a result, 'one-size-fits-all' policies are less effective than policies tailored to the specific needs and conditions of the geographical areas. To account for such heterogeneity, territorial (place-based) approaches have been proposed. These approaches acknowledge the strong influence of place-specific features on development processes and outcomes, such as formal and informal institutions, natural, productive, social and knowledge capital as well as culture, tradition and value, which together form what could labelled territorial capital.

- IO 5.1 – Rural economic activities diversified and livelihood opportunities improved; and
- IO 5.2 – Local cultural heritage and traditional social values preserved and valued.

IO 5.1– Rural economic activities increased and diversified

Justification

One of the major problems in today's Oman is represented by increasing disparities among different territorial entities, e.g. rural vs. urban, coast vs. interior, North vs. South. This has given rise to internal migration mainly due to differences in livelihood opportunities between urban and rural areas. The rural migrants are usually younger and better-educated/skilled individuals vis-à-vis the ones left behind. This dynamic translates into a low level of human capital in rural areas that risks creating a vicious circle, blocking any rural development and further increasing the regional disparities between rural and urban areas. Those issues are among the top development priorities emphasized by Vision 2040 over the next 25 years.

At the same time, rural areas have started to change. They are no longer the locus where only agricultural activities take place. Diversification of economic activities already comprises many activities linked to agriculture, such as local processing and value addition of agricultural products, agrotourism, craftsmanship, ecotourism, etc.

Rural development programmes can help to strengthen these diversification processes where they have already started, or stimulate them where they have not yet begun. Rural development may represent a way to address disparities and contribute to a more balanced development process between rural and urban areas and within rural areas at different levels of development.

Objectives

The objectives of this programme are: (i) to promote the development and diversification of economic activities in rural areas (both farm and non-farm); and (ii) to increase income-generation and employment opportunities, thus contributing to reducing the divide between rural and urban areas (i.e., contributing to a more balanced regional development).

Implementation modalities

The promotion of diversified economic opportunities (income and employment generation) for people living in rural areas is only one piece of the broader rural development strategy. The first step in any rural development strategy is to plan for interventions by first establishing the 'preconditions' for development, such as strengthening the institutional, infrastructural and service base.

Subsequently, the next step is to identify the specific rural area's assets – e.g., local landraces and animal breeds, traditional agrofood products, landscapes, artisanal products, etc. – to leverage upon for the development of economic activities in each intervention area. At this stage, it is essential to engage the local community to jointly identify opportunities and needs of the specific territory and identify target groups and actors (especially community leaders with whom the development programme will work). Programme implementation will require the training of local stakeholders in community-

driven development implementation modalities and the establishment of local PPPs to design and execute interventions.

Economic diversification in rural areas requires the development of synergies among the economic activities. This means the promotion of farming activities that are consistent with the objectives of the local development strategy (e.g., environmentally sustainable practices, organic farming, provision of environmental public goods); intelligent institutional support to favour innovations aimed at adding value to locally produced agricultural goods (e.g., the recognition of geographic identification of locally produced goods, ensuring effective implementation of the law on protection of intellectual property rights and promoting protected denominations of origin [PDOs] as well as protected geographic indications [PGIs]); promotion of short value chains for local produce (thus favouring the meeting between local supply and tourist demand); and promotion of synergies with other non-farm rural activities (such as agrotourism, ecotourism, craftsmanship, etc.) that can strengthen the economic fabric as well as the creation of a common image (territorial marketing) of the rural area at hand.

All these activities call for an improved human capital base: therefore, investments in capacity development (entrepreneurship, information, computer technology-related skills, etc.) are key for the activities' success. Moreover, in order to have effective rural development, specific attention should be given to the social inclusion of those more prone to migrate from rural areas (i.e., youth) and those not able to migrate because of specific deficits (e.g., education/skills, disabilities).

Rural development is a novel concept for Oman where the tradition has been to only consider the sector-wide, production-oriented section of the economic system. Rural development requires the adoption of a territory-based approach. Given its novelty, it is wise to gradually intervene, first piloting rural development programmes in one selected area of the country (see Box 3),[51] learn lessons and eventually scale up similar programmes throughout Oman.

For the programme's success, effective collaboration of all involved stakeholders (e.g., MAF, MHC, MOT, MOCI, MOHO, MRMWR, MECA, etc.) is essential. Considering the difficulty of such coordination, it is warmly recommended to look for patronage/sponsorship from authorities at the highest level (Sultan Qaboos or related high-level institutions such as the SCP).

In line with the community-driven development approach, it will be essential to involve civil society in the programme's design and implementation, including national, regional and local non-governmental organizations (NGOs). One avenue will be to encourage the involvement (and financing) of 'the sons and daughters of the village', mobilizing the internal Omani diaspora which retains strong ties to places of origin.

Finally, considering the novelty of the territory-based approach, involving foreign experts and institutions having solid experience in rural development design/implementation should be sought to facilitate the development of the local strategy of rural development.

[51] Should resources be available, this programme could also be piloted in an area with different characteristics from those of Jebel Akhdar, to explore the ability to replicate the approach and learn more from the implementation in different contexts.

Box 3 – Jebel Akhdar Rural Development Programme

Justification: Jebel Akhdar is the central section of the Al Hajar mountain range, extending about 300 km northwest to southeast and ranging some 100 km inland off the Oman coast, reaching an altitude of between 2,000 and 3,000 m above sea level. It is a well-identified area from an ecological, social and economic viewpoint. It also offers some of Oman's most spectacular landscapes.

The choice of Jebel Akhdar for a pilot rural development programme is due to: (i) the presence of highly diversified landscapes (mountain ridges, canyons, *wadis*, land terraces, historical villages); (ii) rich biodiversity (it is one of the most important sites for wild crop species and landraces and where specific breeds such as the Jebel Akhdar goats originate); (iii) a diversified and high-value agricultural production (e.g., pomegranate, apricot, peach, walnut, rose water, honey); and (iv) the existence of wild natural products (thyme, saffron, boot tree fruits [*Reptonia muscatencesea*]).

In addition, Jebel Akhdar has been included in the list of sites to be classified as a *Globally Important Agricultural Heritage Site* (GIAHS) (FAO, 2015b). The presence of a protected area since 2011 (RCA established the 'Jebel Akhdar Sanctuary for Natural Sceneries') and the proximity to *aflaj* irrigation systems in Nizwa (listed since 2006 as a UNESCO World Heritage Site) make the area relevant for its potential to contribute to maintaining the country's natural and cultural heritage. There is also a Royal farm that can serve as a model farm for developing high quality, high-value agricultural produce. Last but not least, there is the relatively compact social fabric and attachment to territory by both local inhabitants and the diaspora (the 'sons and daughters of the village').

The above-mentioned characteristics make Jebel Akhdar a natural candidate to pilot the proposed rural development approach that focuses on increasing and diversifying rural economic activities (both farm and non-farm), building on a trend that has already started in the area (e.g., the fast-developing ecotourism business opportunities).

Objectives: the general objective of the programme is to pilot the rural development approach in the Jebel Akhdar area during the period of 2016-2020 (first period of application of the SARDS 2040 IP), learn lessons and eventually scale up to other areas in the country. Specific objectives with reference to the Jebel Akhdar area are: (i) enhancing employment opportunities: (ii) favouring diversification of economic activities by building on existing assets (such as landscape and environment, typical agricultural products, cultural heritage); and (iii) promoting social inclusion.

Interventions: The entry point for the programme will be the valorisation of agricultural produce and the synergies that can be developed between on-farm and off-farm activities in the area. In order to do this, the whole set of interventions under Outcome 5 must be implemented in a coordinated and sequenced way. In the specific context of Jebel Akhdar, which is already well equipped in terms of infrastructure and institutions, the programme will focus mostly on economic diversification, cultural heritage and social value protection.

Two conditions are key for the success of the programme, namely: (i) ensuring effective collaboration of all involved stakeholders (e.g., the MAF, MHC, MOT, MOCI, MOHO, MRMWR, MECA, etc.), both vertically and horizontally; and (ii) engaging the local community from the early stages to identify territorial opportunities and needs, identify target groups and actors (especially leaders to leverage upon), and develop local partnerships to design and execute interventions.

Considering the novelty of the approach and the lack of expertise/skills, it is suggested to: (i) involve foreign experts and institutions with solid experience in rural development design/implementation to facilitate the development of the local rural development strategy; and (ii) build the capacities needed for both designing and implementing the interventions through specific training on community-driven development, including study visits and training internships to countries with previous good examples of rural development programmes.

Special attention must be given to support the interventions with the required innovations, mostly institutional ones, required to valorise local products such as: the implementation of geographic identification of locally produced goods (PDO, PGI, traditional specialty guaranteed, etc.); the adoption of an umbrella logo (Jebel Akhdar logo) for the branding of all locally produced goods and services and the institutional marketing of the area; and the development of short value chains to retain within the area larger shares of value added and to build trustful relationships between producers and consumers.

IO 5.2 – Local cultural heritage and traditional social values preserved and valued

Justification

Oman has one of the most diverse environments in the Middle East, with plenty of fabulous heritage. Oman's culture is rich in customs and traditions and the relationship between culture and tourism is well understood, as cultural heritage is central to Oman's national tourism strategy. Rural areas are an integral part of Oman's cultural tourism, with two out of four Omani UNESCO world heritage properties directly linked to agrarian landscapes.[52]

Cultural activities in rural areas can significantly contribute to providing more and better livelihood opportunities through tourism, craftsmanship, farming and agricultural-based industries, while traditional practices at local level are key to stimulating cultural tourism in the country. This two-way relationship is at the core of Oman's tourism strategy giving greater emphasis to cultural vibrancy through heritage, arts, events, festivals and fashion.

In particular, *aflaj* systems represent a precious economic, social and environmental heritage. They are key to the survival of Oman's rural society and to the maintenance of the landscape and the environment.

Objectives

The overall objective is to conserve the rural cultural assets and related institutions and enhance their economic value as far as possible. Promoting and adding value to local cultural heritage and traditional social values is an essential component of broader rural development programmes.

Specific attention should be devoted to *aflaj* systems through: (i) preserving the *aflaj* and their institutions as functioning socio-economic assets; (ii) ensuring that water flows to *aflaj* are protected against reductions in the water table or other changes in hydrology; and (iii) enhancing the economic role of *aflaj* through increased agricultural productivity and tourism and other ways of drawing value from these heritage assets.

Implementation modalities

The promotion and value addition to local cultural heritage and traditional social values is an essential component of any rural development strategy (GIAHS, 2016). As such, it requires a coordinated effort based on the valorisation of specific assets – historical centres, cultural heritage, landscapes, traditions, artisanal products – existing in rural areas and the development of synergies among the various economic activities, primarily tourism. Agrotourism, as part of the cultural tourism experience, is a natural entry point.

This translates into conserving and promoting local cultural heritage – *aflaj* irrigation systems, traditional villages, historical centres, cultural heritage – and social values, including traditional values, practices and cultural events, through a joint effort of all involved ministries (MAF, MOT, MHC, MRMWR, MSD) and agencies and the mobilization of civil society in support of heritage conservation interventions, including national, regional and local NGOs and communities. These activities must form an

[52] These are the frankincense route (2000) and *aflaj* irrigation systems (2006).

integral part of the broader rural development programmes aimed at developing synergies with other rural activities (such as farming, agrofood processing, craftsmanship, etc.) that can strengthen the economic fabric as well as the creation of a common image (territorial marketing) of the rural area at hand.

All of these activities call for higher skilled human capital. Therefore, investments in capacity development (entrepreneurship, information, computer technology-related skills, etc.) are key for these activities' success.

6.6. Outcome 6 – Enabling Institutional Environment for Agriculture and Rural Development Strengthened

The overall objective of Outcome 6 is to improve the institutional and economic environment for sustainable agriculture and rural development, thus enabling a more effective implementation of SARDS 2040 interventions. The interventions under Outcome 6 are needed to increase the likelihood of success of the entire Strategy, and aim to improve its ability to stimulate private investment.

In order to achieve the results expected under this outcome, the following priorities should be addressed: (i) institutional reform and enforcement of the regulatory framework, namely the effective enforcement of the water and anti-trust laws and the facilitation of entrepreneurial activities through regulatory reform of labour, land and association laws; (ii) reform of the current system of generalized subsidies in favour of a system of 'smart' incentives directly linked to the achievement of SARDS 2040 objectives; (iii) expansion of the provision and outreach of inclusive financial services (credit, insurance); (iv) reform of extension services and technical assistance to make them more effective and better oriented to beneficiaries' needs; (v) improvement of the quality of agriculture and rural development statistics, launch of specific studies for filling existing knowledge gaps and creation of information tools for decision-making (e.g., information systems); (vi) awareness raising to increase public support for the implementation of the various aspects of the SARDS 2040; and (vi) support for the development of policy dialogue platforms to discuss issues of mutual interest between the public sector, the private sector and NGOs.

Most of these interventions require strong coordination among all involved ministries. The MAF will initiate, convene and lead the inter-institutional policy dialogue, supported by the office of the Vision 2040, the RCA and other designated offices whose missions include the relevant laws or regulations. As the laws affect many sectors, the MAF should not be alone in mobilizing resources to facilitate the inter-institutional coordination and to ensure an open policy dialogue. Full participation, inclusiveness and openness in dialogue will mitigate the risk of failure.

Many interventions under this IO have limited financial implications besides the mobilization of technical expertise, as the bulk of them are related to policy dialogue and institutional coordination. However, the success of the outcome – and ultimately of the SARDS 2040 – depends on high political engagement and systematic, proactive effort by the MAF.

Outcome 6 is pursued through six IOs, namely:

- IO 6.1 – Institutional and regulatory framework enhanced and enforced;
- IO 6.2 – Economic environment enhanced;
- IO 6.3 – Provision of inclusive financial services improved;

- IO 6.4 – Knowledge base for agriculture and rural development strengthened;
- IO 6.5 – An effective innovation system for competitive and sustainable agriculture implemented; and
- IO 6.6 – Social support to agriculture and rural development enhanced.

IO 6.1 – Institutional and regulatory framework enhanced and enforced

Justification

The institutional setup for agriculture in Oman is characterized by a high fragmentation of mandates relevant to the SARDS 2040; the MAF is responsible for only part of it. The fragmentation adds to the complexity of the dynamics of institutional changes that the SARDS 2040 will require for successful implementation.[53]

In addition, the policies promoting investments and the provision of licenses to agricultural investments are often based on ad hoc agreements involving multiple institutions, rather than a clear straightforward process with widely known criteria.

Some particular bottlenecks include: (i) a legal framework, which conditions access to land, labour and investment; (ii) long project analysis and approval processes, which act as a disincentive to private investment; (iii) difficulties in establishing efficient and equitable collective action organizations both as civil society groups that could strengthen social capital and contribute to sector advocacy, and as professional groups (cooperatives, unions, associations) that could contribute to enhancing sector competitiveness in a sustainable way; (iv) poor coordination in enforcing and advocating biosafety and food safety regulations, which can constitute a lost opportunity for gaining consumer confidence (domestic and abroad) for Omani products; and (v) the continuous depletion of water resources, resulting in environmental degradation and decreasing agricultural potential.

In order to stimulate higher market efficiency, the competitiveness of economic actors and reduced natural resources depletion, it is of utmost importance to initiate and carry out inter-institutional dialogue to improve the effectiveness of the legal and policy framework and ensure its enforcement.

Objectives

The ultimate objective is to create a regulatory framework and institutional setting more conducive to the achievement of Outcomes 1 to 5 and specifically to sustainable agriculture and rural development in the country. As a result of the programme, it is expected that specific laws and regulations on land access, water use, labour, civil society organizations, biosafety and food safety will be revised, reformed and enforced.

[53] The MOHO deals with access to land for agriculture and restrictions to accessing uncultivated land owned by the State, both relevant to farming due the small average size of agricultural holdings. Civil society organizations are overseen by the MSD and are allowed for non-profit purposes only, not enabling them to be used as a mechanism for collective entrepreneurial activities, thus hindering economic opportunities from being seized. The mechanisms for enforcing water use regulations, which can play a critical role in reducing the depletion of the aquifers, are split between the MRMWR and the MAF. The restriction on the use of foreign labour, which poses a risk for the competitiveness of agriculture, particularly for labour intensive activities, is regulated and enforced by the MOM. Biosafety and food safety regulation and enforcement are scattered through the MRMWR, the MOCI and the MAF.

The dynamics generated by these interventions should enable stronger, faster and more sustainable growth of all economic actors operating in the agrofood sector.

Implementation modalities

Through the proactive and sustained initiative convened by the MAF, and in close coordination with the Office of Vision 2040 and the RCA, working groups should be created on the main legal frameworks that require reform and foresee the participation of the concerned ministries and institutions. These working groups need to engage in a participatory policy dialogue involving civil society and private sector stakeholders.

The dialogue needs to be backed by the proposed studies suggested in the SARDS 2040 and other previous strategies, such as a study on the best return for water (IO 3.1); labour requirements and land access reform; watershed management plans (IO 4.1); and any other topics deemed necessary (e.g., on the different types and roles of civil society organizations, their relevance to the country and the needs for legal reform).

A specific inter-institutional coordination body or mechanism may be established for ensuring effective implementation of the SARDS 2040. The programme will also explore the feasibility of a 'one-stop shop' as an entry point where multiple services are offered to the public.[54]

Moreover, a framework for different types of professional groups, such as inter-professional, farmer and water users' groups, will be established, not necessarily under the aegis of the same ministry.

The programme must also consider the *Principles for Responsible Investment in Agriculture and Food Systems*,[55] which would provide a consistent and responsible framework to regulate investments, both within the Sultanate and abroad, in the case of FDI by Omani companies.

IO 6.2 – Economic environment enhanced

Justification

In the case of the agrofood value chains, the environment within which economic actors operate, imposes high transaction costs, does not effectively stimulate economic actors' participation in the economy and often does not provide an appropriate structure of incentives to reward positive behaviours (sustainability, efficiency, technological, institutional and social innovations). In some cases, the system of public regulations risks being counterproductive as, for example, in the case of price controls managed by the PACP: with the genuine intent to protect citizens from market speculations and price volatility, it generates a set of sticky prices for agricultural commodities that crowds out innovations and does not reward improvements in product quality.

[54] The establishment of a single point of contact with the public would have benefits for the overall economy. As such, it is relevant to a number of IOs.

[55] The FAO Committee on World Food Security (CFS) endorsed the *Principles for Responsible Investment in Agriculture and Food Systems* on 15 October 2014. Overarching values for the implementation of the Principles comprise human dignity, non-discrimination, equity and justice, gender equality, holistic and sustainable approach, consultation and participation, the rule of law, transparency, accountability and continuous improvement. Responsible investment should respect and not infringe on the human rights of others and address adverse human rights impacts. It should safeguard against dispossession of legitimate tenure rights and environmental damage.

Oman's economy requires important stimuli for a stronger and more dynamic participation of private actors at all stages of agricultural and food production, processing and marketing. While the overall structure of the SARDS 2040 focuses on unlocking technical and institutional bottlenecks to stimulate more efficient production, processing and marketing, this programme originates around the need to stimulate, through proper economic incentives,[56] the sector's development.

Objectives

The main objective of the programme is to support the higher participation of private agents in the agrofood business, while ensuring a more rational and sustainable use of resources and protecting consumers from high price fluctuations and speculations. As a result of the programme, the number of operational and successful businesses along agrofood value chains is expected to increase despite the constraint of a sustainable use of natural resources (water, in particular).

Implementation modalities

The programme will provide stimuli to improve competition in the sector and within value chains, through a policy and legal reform of the economic environment as well as the incentives system. This will include, on the one hand, policy dialogue to stimulate wide agreement and enforcement of the anti-trust law,[57] and on the other, reform of the current system of generalized subsidies towards 'smart' incentives (i.e., linked to positive behaviour consistent with SARDS 2040 objectives) aimed at promoting sustainable, efficient and inclusive growth.

The programme will also include the establishment of agricultural investment promotion units in coordination with the PASMED. Through this initiative, PASMED could have its business incubator capacities improved to assist rural entrepreneurs in the development of bankable business proposals.

Within the framework of broader policy dialogue (see IO 6.1), the MAF will lead discussions promoting evidence-based (i.e., through ad hoc studies) specific policy dialogue to agree on a legal framework regulating the market and providing a more efficient incentives structure.

The main agents of change in the programme will be the MAF, which will progressively introduce smart incentives, as well as other selected ministries for endorsing and enforcing the antitrust law.

IO 6.3 – Provision of inclusive financial services improved

Justification

The system of credit and insurance for micro, small and medium farms and food enterprises requires adjustments to tackle financial exclusion and support the dynamic

[56] Although some changes have occurred in the modernization of agriculture – particularly in the use of greenhouses – and irrigation practices, it is possible that the current policies do not bring the necessary level of change related to more sustainable and efficient agricultural practices. The uncertainty in the levels and time frame of the incentives acts a deterrent to investment to those who are on the waiting list, rather than as an incentive.

[57] This will be important not only for enhancing competitiveness but also for protecting consumers from high prices better than the price control mechanism currently in place.

changes envisaged by the SARDS 2040 in the agriculture and rural sector. Existing SMEs, farmers and potential start-ups in the agriculture and rural sector have difficulty in accessing credit and therefore establishing and developing their business.

In fact, most credit institutions such the Oman Development Bank (ODB) require collateral in the form of physical assets that constrains access to credit for micro-holdings and SMEs. The limited number of ODB loans to agriculture and their small average size are a dismal record showing the modest impact of credit for investment in agriculture. The Al Raffd[58] fund and the PASMED, which incubates new enterprises and links them to credit, have not significantly ventured into agriculture and are only now starting to open offices outside of Muscat.

There is no agricultural insurance product in the country and the ODB is legally prevented from providing insurance. The lack of insurance schemes to protect farms against risks compounds the existing difficulties in accessing credit because of borrowers' lack of collateral, making lending operations in agriculture even riskier. Additionally, private, and to some degree public, financial institutions may not be keen to invest in creating products and training staff to operate in a small, rather complex and not very diversified (in terms of crop/livestock product mix) sector.

Hence, the financial institutions' participation risk and start-up costs (product development, analytical tools, advocacy, staff training, etc.) need to be lowered in order to provide financial products that can match the existing and potential demand from those actors currently excluded. At the same time, farmers also need to enhance their financial literacy and capacity to prepare their applications to financial institutions.

Objectives

The programme aims to strengthen the provision of inclusive financial services in order to increase the participation of SMEs and other economic actors in the financial sector, improving their access to credit and ultimately generating sector growth through SMEs. Moreover, it will also aim to increase the outreach of financial services by facilitating the establishment of an insurance scheme for agriculture.

Implementation modalities

The programme mostly focuses on advocating for a wider participation of existing financial institutions in the agriculture and rural sector and lowering the risks these institutions may incur. The MAF, in close coordination with the PASMED, could call for partnerships with public and private financial institutions for the joint development of new financial products.

The MAF and PASMED should also coordinate efforts to increase the capacity of rural entrepreneurs to design bankable projects. The MAF should have a facilitator role in linking entrepreneurs requesting licenses for business with the PASMED, as well as in advocating and co-financing for PASMED training in business development in the agriculture and rural sector.

A sequenced set of interventions would include: (i) carrying out studies, such as the production of benchmark business models for the assessment of proposals from key segments of key value chains and the development of financial products adapted to

[58] The Al Raffd Fund is a small and medium enterprises-dedicated fund related to PASMED (RD 6/2013).

Oman; (ii) establishing a data collection system on the overall agricultural risk environment and demand for insurance services, for a thorough assessment of the potential development of an agricultural insurance framework; (iii) promoting capacity development of financial institutions' staff, targeted to identifying market and credit opportunities and developing specific financial products for agriculture; (iv) promoting capacity development of government and financial institution officers for analysing project proposals and financing options, creating a more enabling environment for investments in agriculture; (v) piloting subsidized insurance schemes in partnership with the private sector (insurance companies) that stimulate their engagement, envisaging a gradual withdrawal of public financing; (vi) establishing agricultural investment promotion units in coordination with PASMED (see also IO 6.2); and (vii) promoting capacities of farmers and their organizations, related to inclusive financial services and schemes.

IO 6.4 – Knowledge base for agriculture and rural development strengthened

Justification

Overall, the production of national macroeconomic and financial statistics in Oman by the NCIS, an independent body, is considered quite satisfactory (IMF, 2015). On the other hand, the quality of agriculture and rural development statistics can still be improved in terms of accuracy and efficiency, data collection analysis and processing. Water resources represent an exception – with high quality information – but the collaboration between the MRMWR and the MAF is unsatisfactory.

Moreover, the impact of most policy interventions in the agriculture and rural sector is not assessed/evaluated. As a result, policy-making remains partially uninformed. A recent assessment of the MAF's capacities on this matter has highlighted the personnel's weak performance in developing and maintaining information as well as their capacity to link data to the planning process. In addition, there is a lack of an encompassing conceptual framework and related organizational coordination to systematize data, resulting in the inadequate dissemination of information among stakeholders.

The major risks associated with the above shortcomings are the generalized, inadequate appropriateness and timeliness of the decision-making process in agriculture and natural resources management by the MAF and all relevant stakeholders in the sector. Therefore, there is an urgent need to improve the quality of information, ease access to knowledge and enhance exchanges among data providers and between providers and data users.

In this context, the SARDS 2040 represents a window of opportunity to introduce a system that will ensure the production and dissemination of adequate information. The operationalization of the cross-cutting and wide ranging interventions proposed by the SARDS 2040 and its IP calls for the need to monitor and evaluate a whole new set of information. To ensure appropriate and evidence-based decision-making, it will be critical to create a solid knowledge and information base on the various aspects the SARDS 2040 will embrace, and to develop the capacity and governance for monitoring and evaluating SARDS 2040 interventions.

Objectives

The overall objective of this programme is to contribute to effective evidence-based decision- and policy-making in agriculture and rural development. The specific objectives are to: (i) contribute to harmonizing, complementing and improving the existing

information system and respective methodologies (statistics, databases and information repositories) on fields relevant to agriculture and rural development (with the RF indicators as one of the guiding tools); (ii) establish and ensure effective M&E functions of the SARDS 2040 and its IP within the MAF (and relevant institutions); and (iii) carry out a few policy impact assessment studies to inform policy design on selected topics/interventions that require a deeper analysis[59] in order to learn lessons for subsequent designs of policy interventions (e.g., upscaling of pilot interventions such as the water policy package in Al Batinah [see Box 2] and the rural development programme in Jebel Akhdar [see Box 3]).

Implementation modalities

As a first exercise, the MAF will need to review its information requirements vis-à-vis what is currently being produced. This exercise will identify: (i) where the existing statistics dataset will need to be complemented to meet SARDS 2040 information requirements (i.e., integration of the SARDS 2040 RF indicators into the regular statistics services);[60] and (ii) the studies required for obtaining information on the SARDS 2040 implementation progress, establishing baselines for interventions lacking baselines and assessing the impact of selected key interventions (e.g., water policy package in Al Batinah, rural development programme in Jebel Akhdar).

Additionally, the M&E activities of SARDS-related projects (the IP) will be improved while mechanisms will be developed to ensure regular M&E of results and the physical and financial implementation of SARDS IP projects. In order to do so, the MAF's capacity to generate information would be assembled under an agricultural (and fisheries) information centre[61] responsible for: (i) efficiently producing a comprehensive and coherent set of information, including statistics, project monitoring and sector/policy studies; and (ii) incorporating the different sources of information into policy advisory documents that can be used as a basis for policy dialogue and decision-making.

A pre-requisite for this initiative's success is creating awareness on information requirements, particularly on M&E, among senior management. The revision and approval of (new) mandates, including modifying/developing new terms of reference for staff and recruitment/relocation/placement of staff is also very important. Secondly, technical staff working on agricultural statistics, M&E and planning (at the central and governorate level) will require capacity development on different subjects such as results-based management, M&E, modern techniques for data collection and analysis, geographical information systems and sector analysis.

The MAF, in addition to generating its own set of information, will take a leading role in convening partner institutions (such as the NCSI, MOCI, MRMWR, MOH, etc.) to ensure that all relevant information is collected.

[59] Policy Impact Assessment studies are rigorous and independent studies aimed at identifying the extent to which planned results have been achieved and determining the relevance and impact of the interventions implemented. They require deep, tailored data and usually are based on surveys. Therefore, they are not carried out on a continuous base, but periodically (e.g., in the SARDS 2040 framework, after five years from start, i.e. 2020) and only for some selected important interventions.

[60] As we will see in Chapter 7, not all of the indicators' baselines and targets are currently available: filling this information gap will be one of the top priorities of the SARDS 2040.

[61] Hopefully this will represent the initial step in developing an integrated national information system on agriculture and natural resources management.

National agriculture and rural development statistics will be produced according to the standards promoted by the *Global Strategy to Improve Agricultural and Rural Statistics* (FAO, 2015). The M&E of the SARDS 2040 will follow, like the national statistics, principles of transparency, inclusiveness, accountability, simplicity and consistency with existing and already operational M&E systems.

All of the above should be reflected in the monitoring plan to be developed within the first 12 months of SARDS 2040 implementation (see Section 7.3). This is a necessary intermediate step not only for the M&E SARDS 2040 intervention but for improving the broader knowledge base in agriculture and rural development.

IO 6.5 – An effective innovation system for a competitive and sustainable agriculture implemented

Justification

By and large, over recent years Oman has improved its research capacities; however, extension services have not kept up the pace. The institutions responsible for agricultural research and extension in the country are the SQU, the MAF, the Agriculture and Fisheries Development Fund (AFDF) and the TRC.

Extension services are provided through the MAF governorate centres. Although all centres are technically equipped to ensure operations,[62] they are understaffed. In the context of a decreasing government budget, it is unlikely these centres will be strengthened with the additional staff needed to provide quality extension services.

Other, less 'classical' players exist in Oman, having the potential to bring about innovations. These include, among others, an SME incubator associated with the PASMED, micro-credit institutions, large agricultural development projects with technical staff and research facilities and the RCA.

In light of the above, the development of a more integrated agricultural innovation system (AIS), where synergies are sought among different players, is needed. This would, for example, enable research activities to be further mainstreamed into private farms (through demonstration farms), leveraging the efforts of the limited number of extension workers who can act as facilitators between local demonstration farms and the rest of the farmers. Also, large public endeavours such as the projects set up through the Oman Food Investment Holding Company (OFIC) or the *One Million Date Palm* project can also serve as models for technology adoption and GAPs and need to be brought into the picture. A process of bringing these actors together needs to be piloted and, if successful, upscaled.

Objectives

The programme aims to build an effective innovation[63] system required by a competitive and sustainable agriculture and rural sector. More specifically, the programme foresees: (i) restructuring the way extension is conducted; (ii) ensuring that rural business

[62] All centres include offices, a meeting room, a veterinary clinic, a 10-hectare piece of land for demonstration purposes, a number of 4-WD vehicles and audio-visual aids.

[63] By innovation it is understood something that is new in a specific context. As such, old technologies can be an innovation for a system that had never adopted them. Innovation can relate as much to technologies and practices as to new partnerships, forms of management or marketing.

capacities are strengthened in an efficient way; and (iii) ensuring that the most appropriate innovations and business models are in place consistently with SARDS 2040 objectives.

Implementation modalities

One of the pillars for change will be the creation of networks of non-absentee farmers/entrepreneurs with similar interests and farming systems. Such networks will be led by one or more innovative farmers and incorporate a mix of actors with complementing functions and different competitive advantages. The establishment of innovation networks would first be piloted in strategic locations and value chains (e.g., Al Batinah for horticulture and water, Dhofar for livestock).

Business incubators and research institutions with experience in the field of each network will start supporting the lead farmers in setting up demonstration farms. They will search for innovative market channels and support the development and/or adoption of practices (production, post-harvest, marketing, etc.) that are best suited to respond to the market and to farmer demands.

Research and incubation activities will be subsidized in order to provide an incentive for learning, adopting and sharing knowledge on innovations. Subsidized credit will also be made available for R&D. Ad hoc, subsidized, specialized private technical assistance should also be provided to develop and disseminate innovations.

Once the results from the research and incubation activities have been achieved by the lead farmers, they are to be shared (through field visits, information campaigns, etc.) with the remaining farmers in the network. Simultaneously, the farmers in the network should be assisted in their horizontal integration (through producer organizations) to increase the scale and stability of their production and gain access to new services (e.g., credit, insurance, private technical assistance). This, in turn, enables easier access to knowledge and larger and more sophisticated markets, increased bargaining power, and, if interested jointly, investment downstream in the value chain. In subsectors where innovative processing and marketing companies exist, opportunities for vertical integration with this network of farmers can also be sought if these bring new demands for sophisticated production and improved marketing opportunities.

As the network matures, more farmers can join. In the long term, the development of such networks should enable the establishment of a cadre of private service providers (technical, credit, etc.), which the new entrepreneurs should be willing and capable of hiring.

The successful development of an AIS will require parallel investment in building the capacities of researchers and technicians in the activities to be implemented; focusing university and research programmes on key agriculture and rural development issues identified in the SARDS 2040; spurring vocational training for farmers and local technicians; and supporting the development of financial products aimed at in IO 6.3.

The MAF, at central and mostly at decentralized level, will play a convening role in mobilizing farmers to form a network and in monitoring results, firstly at the demonstration farms and then within the network. At central level, the MAF will engage in disseminating results achieved in view of further adoption, policy dialogue and evidence-based policy formulation to stimulate the adoption of innovative practices and technologies.

Research institutions, SQU, the DGALR and the Royal Court will be instrumental in developing locally adapted technologies and in setting up on-farm activities that bring innovation into demonstration farms. In this regard, the AFDF can give priority to financing those research projects that address specific issues contained in the SARDS 2040 and that promote the consolidation of local innovation systems.

TRC will be instrumental in prioritizing and financing the development of technical capacities for research (both on-farm and on experimental fields). The PASMED, Al Raffd Fund and ODB are the natural business and financial services providers, even if they might require specific training or technicians with a background in agricultural finance in order to support agricultural value chains.

IO 6.6 – Social support to agriculture and rural development enhanced

Justification

Oman society has its roots in agriculture and livestock production: this sector has shaped the history and the socio-economic and institutional structure of the country. With the rapid modernization of the overall economy, smallholders mostly geared towards household and local consumption, may experience low levels of participation in the market. At the same time, traditional agricultural practices are rapidly becoming a significant part of the cultural heritage.

The socio-economic changes envisaged by the SARDS 2040 require a solid base of supporters at all levels, from the urban contexts – more sensitive to food safety and traceability of agricultural products – to the rural areas, with a higher concern for the value of each drop of scarce water, both for current and future generations, and for the conservation of landscapes and cultural heritage.

A new alliance can be created, leveraging the positive expected impacts of the SARDS 2040 that go well beyond the agriculture and rural sector, such as sustainable development, the preservation of natural resources, more balanced diets and nutrition, more attention to food safety and a more cohesive society – all contributing to the general well-being of Omani society. Transmitting the message that much more is at stake than simply investing in agriculture and rural development will be extremely important for bringing agriculture and rural development back to the centre of the policy debate and gaining support for the SARDS 2040.

Objectives

The programme will aim to increase public awareness on the overall content of the SARDS 2040, i.e., sustainable agriculture and rural development, with particular emphasis on the preservation of the social and natural resources base of Omani culture.

Implementation modalities

Key components of the programme include: (i) increased awareness of SARDS 2040 relevant issues; (ii) integration of environmental sustainability, agricultural and rural development and the related cultural heritage into general and specialized curricula; and (iii) establishment of a national framework for social responsibility in agrofood systems (agriculture and industry).

The first component will include campaigns aimed at increasing public awareness on the need to conserve water, and on environmental sustainability in general (Outcome 3).

Also, it will give emphasis to the promotion of food safety in order to generate consumer demand for high quality food and agricultural produce, thus complementing the role of the PACP (Outcomes 1 and 2). It will touch upon the cross-cutting promotion of better nutrition, including adequate nutritional intakes and diversification of food habits leading to greater demand for nutritious food – for both the Omani and expatriate population, the latter representing a large proportion of the national food demand. Moreover, it will promote the creation and dissemination of knowledge, strengthening of capacities of people working in agriculture and awareness on climate change adaptation and mitigation (Outcome 4). It will also raise awareness of the importance of rural development in realizing a more balanced development model and a more cohesive society, especially for youth and women (Outcome 5). All of the above-mentioned activities can be achieved through campaigns in schools, social events and the use of different media.

The second component foresees educational contents on environmental, agricultural and veterinary issues included in general and specialized curricula, both at vocational and higher education level.

Besides the importance of these two programmatic components, driven by the public sector, the programme will promote increased private sector participation. While the Government will initially favour policy dialogue among stakeholders, in the longer term, the programme will stimulate and operationalize a solid national framework for social responsibility in the agrofood system, embracing the production (agriculture), processing (industry) and marketing sectors (trade). Civil society organizations can also contribute to the development and monitoring of such a framework. This framework would ensure the implementation of strategies voluntarily adopted by companies to contribute to sustainable development.

In terms of public awareness, the MAF so far has played a marginal role with respect to other institutions that have specific mandates such as the MRMWR to preserve the heritage of traditional Omani markets and the MHC to recover and preserve sites and national monuments associated with the traditional culture of the country. Nevertheless, initial leadership from the MAF on topics related to agricultural development and food security is required in order to involve other key stakeholders such as the MOH or the Ministry of Higher Education for increasing public awareness on the role of agriculture and rural development.

7. SARDS 2040 Results Framework

7.1. Purpose of the Results Framework

A Results Framework (RF) is "an explicit articulation (graphic display, matrix or summary) of the different levels, or chains, of results expected from a particular intervention – project, program, or development strategy" (WB, 2012: 7). It captures the essential elements of the logical and expected cause-effect relationships among inputs, outputs, IOs and impact.

Defining cause-effect linkages for one or more interventions lays the groundwork for an RF. Thus, the development of a good RF requires clarity with respect to the theory of change – the reasons why a specific intervention will lead to the outputs; why those outputs are likely to lead to the IOs; and how those IOs are (at least hypothetically) linked with longer-term outcomes or impact. Outcomes and impacts are the main focus of an RF; project inputs and implementation processes are generally not emphasized, although outputs are often noted (Figure 7.1). This approach has also been adopted in developing the SARDS 2040 RF.

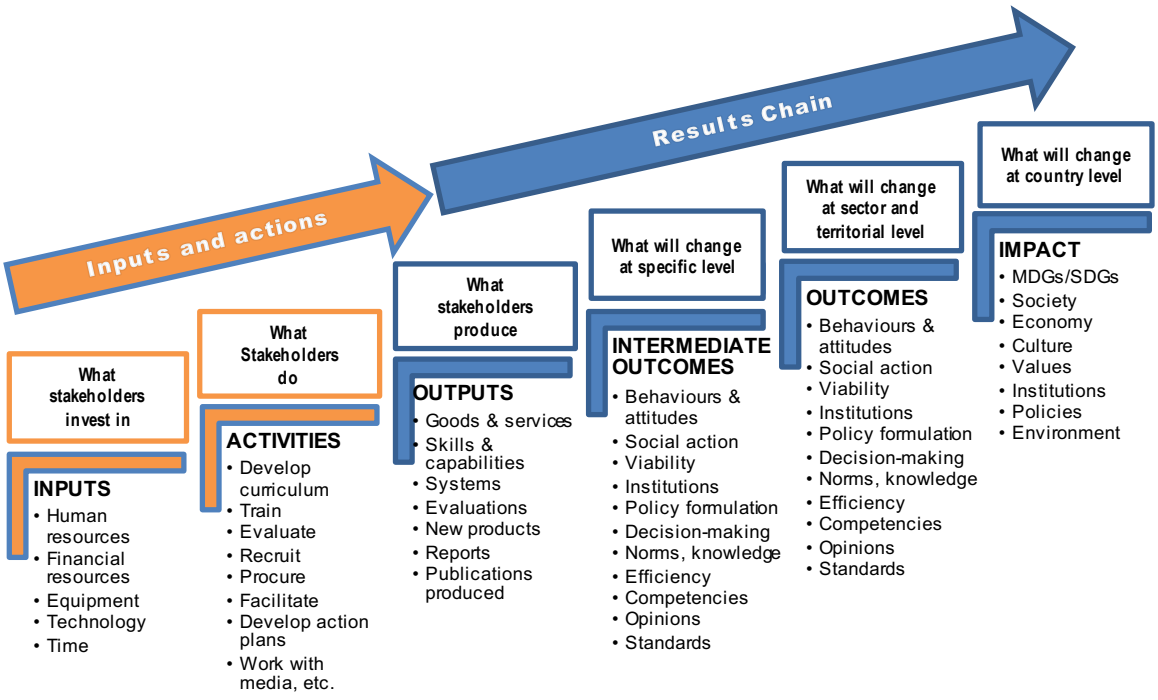

Figure 7.1. Nature of changes reflected in the results chain

This conceptual presentation of a results chain should be accompanied by a plan for monitoring progress towards achieving the ultimate objectives, which measures achievement of outputs, outcomes and impacts at different intervals. Results are

typically defined by a statement describing the desired achievements, and measured through indicators, quantifiable and measurable or observable, as much as possible, accompanied by baseline values and expected targets. The monitoring plan typically specifies the measures, roles and responsibilities that will be used for data gathering, reporting and use in decision-making and communication. An RF also often identifies any underlying critical assumptions that must be in place for the intervention to be successful, i.e., leading to achieving the targeted outcomes and impacts.

The emphasis on concrete outcomes rather than on the completion of activities requires that programme implementers monitor key outcome variables and make midstream corrections as necessary. Furthermore, emphasizing the logic of a complex intervention such as the SARDS 2040 (i.e., all intermediate results needed to achieve the strategic objectives), it enables planners and implementers to harmonize their efforts or identify areas where additional programme activities will be needed.

Therefore, a well-constructed RF is beneficial for monitoring, managing and evaluating because it highlights the key linkages in the theory of change that underpin the interventions, helps establish an evidence-based approach to M&E, helps measure progress towards strategic objectives and helps achieve strategic objectives. This is why the SARDS 2040 RF has been developed.

7.2. Results Framework Development

The SARDS 2040 RF was developed through an iterative process that comprised the following steps (Figure 7.2):

(i) Understanding the problem and assessing the needs that the SARDS 2040 intends to address: this was done in a participatory fashion during the first technical mission, from 30 September to 13 October 2015, when a thorough situation analysis was carried out with key stakeholders (Annex 3); this situation analysis captured around 250 issues to be addressed by the SARDS 2040;

(ii) On the basis of the needs assessment, an initial theory of change for the SARDS 2040 was developed by FAO experts, producing seven background papers (Annex 4) whose contents were preliminarily discussed remotely with a range of key stakeholders between the first and second technical missions. During the second technical mission, development options to address SARDS 2040 issues were discussed and jointly validated by the FAO team, the national team and other key stakeholders (Annex 3) during the participatory workshop from 13 to 21 December 2015;

(iii) Once the programme logic and related theory of change were agreed upon by all stakeholders, the FAO team worked jointly with the main stakeholders,[64] focusing on selecting appropriate indicators to measure intended results at different levels in the chain, setting baseline and target values and exploring the relevance of available data and data collection methods. At this stage, data providers and institutional arrangements for data provision were identified.

[64] This was done both remotely and on-site, with specific sessions during the third technical mission from 31 January to 12 February 2016.

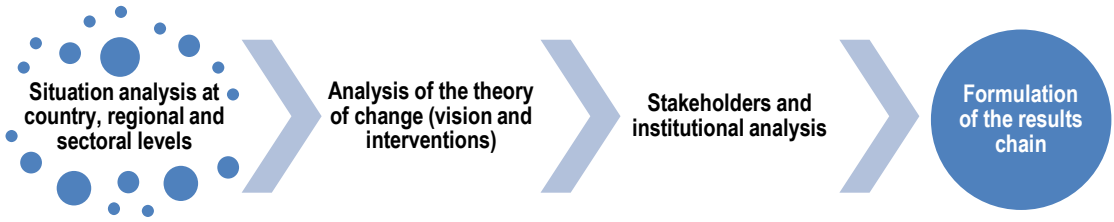

Figure 7.2. Key stages in the formulation of the results chain

7.3. Results Framework Structure and Use

The preferred format and level of detail for RFs vary by the scope and scale of the intervention, but all include the same basic components to guide implementers in achieving, and evaluators in assessing, results. The SARDS 2040 was no exception.

Annex 5A presents the RF matrix where, per each level of the results chain, the relevant indicators, baseline value and corresponding year, 2020 targets (deadline for the first IP implementation), 2040 targets, means of verification (including the data source, key provider institution, other contributing institutions and frequency of data collection), risks and assumptions were identified.[65]

The RF can be used at different stages in developing and implementing the SARDS 2040. It underpins the strategic planning process, fostering ownership and consensus, perfectly matching and reflecting the SARDS 2040 structure (Figure 7.3). As a management tool, it allows progress towards achieving SARDS 2040 results to be assessed. Emphasizing the results chain logic, it favours the harmonization of interventions. Last but not least, it also represents an effective accountability framework for implementation.

[65] This matrix is part of a broader companion document on the SARDS 2040 RF (Zouaghi, 2016) prepared by the FAO team and containing important information – e.g., indicator definitions, methods for computing complex indicators, etc. – and guidelines on how to use the framework for M&E of the SARDS 2040.

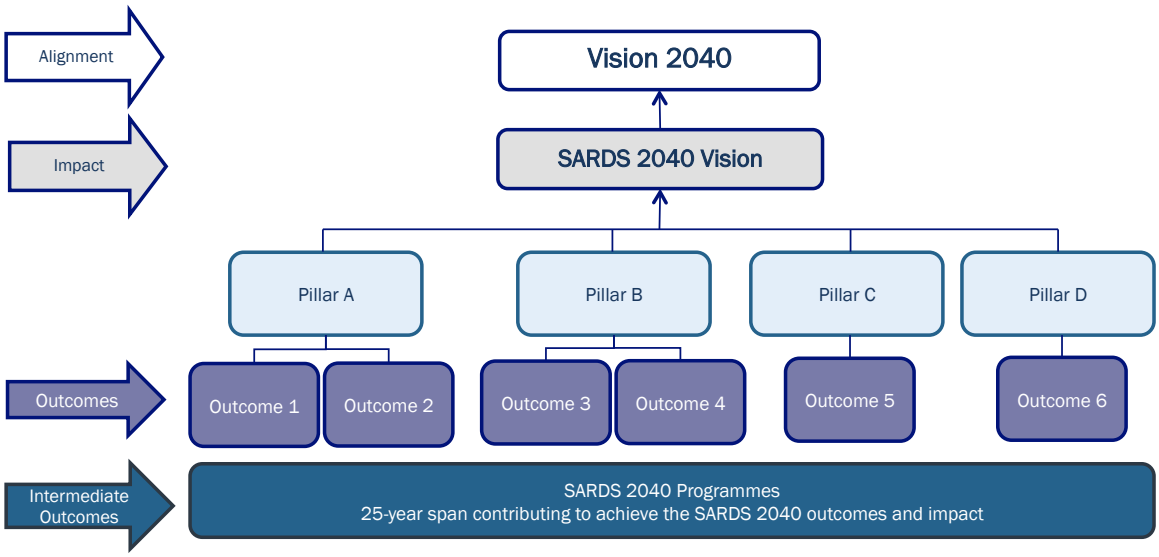

Figure 7.3. Relationship between the RF structure and the SARDS 2040 structure

The SARDS 2040 RF is based on 43 key indicators (Annex 5), including 7 indicators at Impact level, 6 indicators at outcome level and 30 indicators at IO level. Efforts were made to select indicators that are specific, measurable, achievable, relevant and time-bound.[66] However, data were not available for all the RF indicators. In fact, only 23 of the 43 indicators currently have a baseline and targets have been set for only 25 of the 43 indicators.

This situation reflects the current state of information/data availability in the country. From an operational viewpoint, this means that one of the key activities to be carried out over the first 12 to 24 months of SARDS 2040 implementation is filling the information gap, investing in surveys or studies to establish a baseline for those without one. These activities will be part of the M&E system of the SARDS 2040 and IP. A specific monitoring and reporting plan will need to be developed within the first six months of SARDS 2040 implementation, specifying actions, responsibilities and a time frame for reporting and communication.

In conclusion, it is worth emphasizing that the SARDS 2040 RF has not been developed once and for all. As any RF, it is a living management tool, guiding corrective action, facilitating the coordination of development efforts, charting the course for achieving the Strategy's objectives and ultimately serving as the key accountability tool for evaluation.

[66] The acronym SMART as referred to indicators is meant to represent good indicators in so far as they are: *Specific* – i.e. they clearly and directly relate to the result that is to be monitored; *Measurable* – i.e. they are able to quantify or at least suggest the direction of change; *Achievable* – i.e. they are achievable if the performance target accurately specifies the amount or level of what is to be measured in order to meet the result; *Relevant* – i.e. they are a valid measure of the result and state what can realistically be achieved, given available resources; *Time-bound* – i.e. they must be attached to a time frame and state when they will be measured.

8. SARDS 2040 and its Investment Plan

8.1. Purpose of the Investment Plan

A strategy is a policy document defining the vision to which all stakeholders should be aligned to, long-term objectives to be pursued and specific interventions to be implemented, usually grouped in programmatic areas of intervention and/or programmes. An Investment Plan (IP) represents the planning stage of an investment cycle in which the strategy's investment priorities are translated into a shared framework that should be adopted by all key stakeholders at operational and financial level (designing and implementing projects, fundraising, etc.).

Being an integral part of the strategy, the IP budgets the specific interventions to be implemented in the short and medium term as agreed during the strategy formulation, estimating the amount of resources that need to be allocated to the programmatic areas of intervention and/or programmes.

The IP's primary aim is to summarize investment priorities and guide implementation of interventions, striving for agreement with, and commitment from, key stakeholders on the financial and organizational efforts each shall undertake to implement the Strategy. It envisages immediate actions to be carried out by the MAF, to be complemented by other institutions once this agreement has been reached and the different stakeholders are in the position to engage in the design of detailed and coordinated investment projects. At this point, the Strategy's interventions will translate into specific investment operations.

A project cycle then starts as projects are designed, implemented, monitored and continuously adjusted. At the end of a project cycle, the duration of which should be in line with the country's budgeting and programming cycle, an assessment of the overall intervention's contribution to achieving the strategy's vision must be undertaken. Based on the findings of this assessment, the strategy can be updated and a new investment plan for the following cycle discussed and agreed.

Hence, the IP is the operational arm of SARDS 2040. It comprises an investment guiding framework to orient public and private resource mobilization, implementation and M&E arrangements that regularly inform on progress and guide implementation of investments.[67]

8.2. Investment Plan Development

The development of the IP 2016-2020 was an iterative consultation process, embedded in that of the SARDS 2040, and specifically aimed at identifying intervention areas requiring investment. This process was developed through the following steps:

(i) First technical mission (30 September to 13 October 2015): consultation with the MAF and other ministries (MRMWR, MOCI, MOHO, MSD, etc.), its partners supporting private sector development (OFIC, PASMED and ODB) and farmers and private companies in order to understand the mechanisms and responsibilities for the financing of development initiatives in Omani agriculture and rural development and the major opportunities and constraints to growth;

[67] See the SARDS 2040 IP 2016-2020 document for details.

(ii) Second technical mission (9 to 21 December 2015): feedback from the main stakeholders on the concept for the IP 2016-2020 formulation process and agreement on the formulation work. Between the second and third technical missions the national team and FAO team worked on the identification of gaps in, and adaptation of, MAF interventions programmed for the 9th FYP, aligning them with the SARDS 2040 results structure;

(iii) Third technical mission (31 January to 12 February 2016): meeting and discussion with the main stakeholders to: (i) adjust the 9th FYP interventions as well as their implementation, M&E and reporting responsibilities among partners; (ii) identify priorities for investment as well as major risks and mitigation measures; and (iii) discuss next steps for stakeholders in terms of improving project design and establishing a results-based management system.

(iv) Technical peer review process (March 2016): the SARDS 2040, its RF and IP were revised by a team of FAO experts in order to finalize the documents and strengthen their consistency, relevance and effectiveness.

(v) National review process and finalization (April-May 2016): the in-country final review by Omani institutions aimed to finalize, in agreement with the IP's main stakeholders, its content, priorities and relevance to national objectives.

8.3. Investment Plan Structure and Use

The IP 2016-2020 reflects the SARDS 2040 structure. Therefore, the investments included in the IP contribute to SARDS 2040 objectives according to the six outcomes and 21 IOs and consistently with the priorities established for each of them (Figure 8.1).

The IP 2016-2020 is results-oriented. All of the related investments, whether carried out by the public or private sector, ultimately contribute to achieving the SARDS 2040 impact, outcomes and IOs. The IP 2016-2020 interventions are clustered by IOs, thus enabling investments to be identified for successful implementation of SARDS 2040 under each programme.

The IP 2016-2020 comprises the MAF investments planned for the 9th FYP aligned with the SARDS 2040 programmes, as well as PPPs that public investment and policies should encourage/leverage as proposed in the SARDS 2040. It also identifies roles and responsibilities for other institutions for each IO. Therefore, it aims to complement MAF interventions with those of other relevant institutions, through advocacy and continuous policy dialogue.

However, the following aspects of the SARDS 2040, though important for agriculture and rural development in Oman, are not included in the IP 2016-2020:

- pure policy and legal measures, although a risk analysis of investments is made in light of current policies, and investment in policy dialogue and advocacy is included in the IP;
- food storage and sale activities by entities such as the PASFR;
- subsidies that are covered by regular budgetary means such as energy;
- safety net programmes, such as direct transfers from the MSD; and
- reforms and proposed changes of the agriculture education and training system.

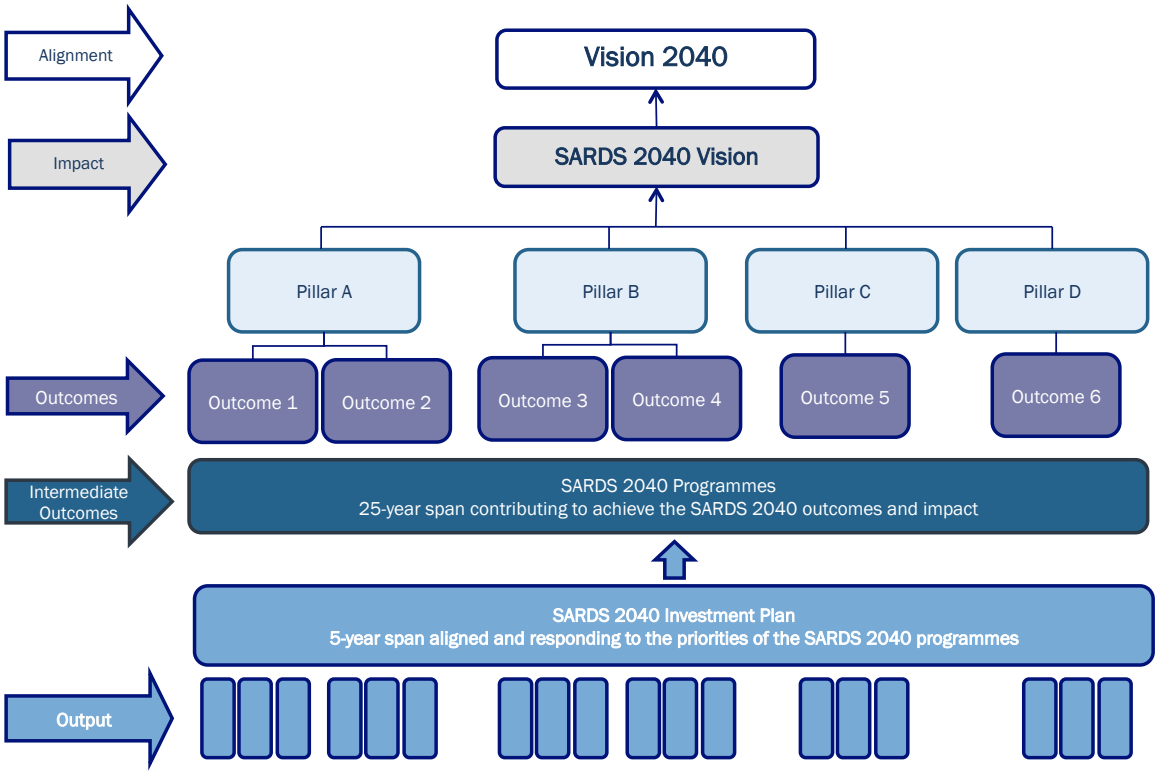

Figure 8.1. Relationship between the IP structure and the SARDS 2040 structure

The SARDS 2040 IPs are based on a five-year time frame aligned with the five-year planning adopted by the Sultanate of Oman. The first SARDS 2040 IP covers the years 2016-2020 and is aligned with the 9th FYP. After this period, on the basis of the results achieved and lessons learned, a new IP will be prepared and implemented for the next five years, and so on until 2040 (Figure 8.2). Although the SARDS 2040 aims to establish a road map for goals to be achieved until 2040, the detailed programming of investments can realistically only be made for a shorter period, as the outcomes of investment in the longer term are not completely predictable and planning needs to adjust to new realities (e.g., change in financing sources and fund availability).

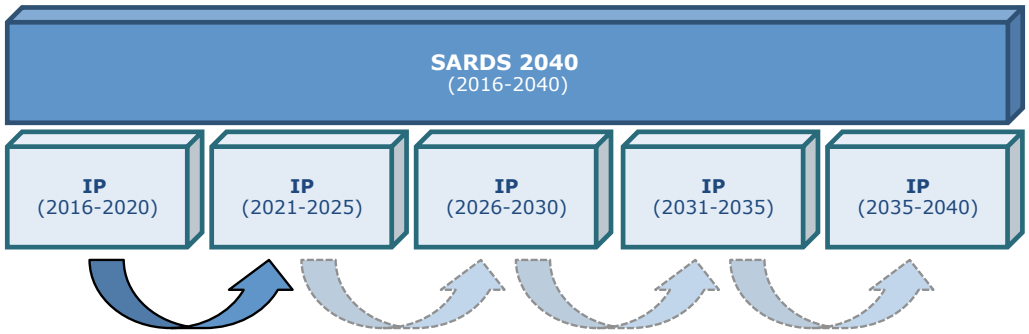

Figure 8.2. Relationship between the IP time frame and the SARDS 2040 time frame

As such, the IP 2016-2020 has the advantage of being fully embedded in the standard budgeting and programming procedures existing in the Sultanate, based on the five-year plans. This provides flexibility for SARDS 2040 implementation, allowing for learning from the previous planning period and for taking into account achievements and possible changes in the operating conditions.

The IP 2016-2020 indicates the necessary actions to achieve SARDS 2040 objectives. As such, it: (i) provides a guiding framework for the implementation of identified investments and projects; and (ii) summarizes the need to mobilize additional resources, including non-governmental investment (private investors, lenders, possible donors).

Specifically, the IP 2016-2020 can be envisioned at three different levels, namely:

1 *Framing and coordinating investments*: it helps frame investments along SARDS 2040 priorities, avoiding overlap and looking for synergies in a consistent framework;

2 *Advocating for investment*: it emphasizes priority areas of investment and highlights possible investment gaps, paving the way for a more comprehensive and effective set of investments in agriculture and rural development; and

3 *M&E investments*: it matches, at investment level, the SARDS 2040 RF; it thus contributes to measuring progress and informing the Government and other stakeholders about SARDS 2040 achievements.

Besides this, the IP 2016-2020 also helps in setting up rules for investing in agriculture and rural development. Building on the information and knowledge generated through M&E activities, it provides the Government with the basic elements to change the rules of the game for investments in agriculture aimed at improving their performance.

9. Concluding Remarks and Recommendations

The fundamental question the SARDS 2040 tries to answer is how can agriculture and rural development from now until 2040 effectively contribute to further development and ultimately to improving the livelihoods and well-being of the Omani people. The proposals included in Chapter 6 provide this answer, keeping a strategic breadth, while the IP 2016-2020 operationalizes these proposals for the first five years of SARDS 2040 implementation.

This last chapter draws some conclusions and provides recommendations that will contribute to achieving the 2040 vision, discussing how agriculture and rural areas will look in 2040, what steps should be implemented to pursue this vision, what will be the likely effects of the SARDS 2040 and what are the key messages of the SARDS 2040 to Omani policy-makers and the society at large.

Intervention Priorities

The proposals included in Chapter 6 represent a coordinated and comprehensive set of interventions able to implement the changes envisioned by SARDS 2040. However, its contents span over 25 years. Carrying out all interventions from the very beginning is simply not feasible.[68] Therefore, a sequencing of interventions must be identified.

A first approximation of this sequencing was done in a participatory fashion, with all key stakeholders identifying and ranking priorities at IO level. However, these priorities should only be indicative, as at a strategy level, it is difficult to select priorities that can be valid for the entire 25 years. Prioritization is much more meaningful at operational level, and this is what was done in the IP 2016-2020 for the first five years of implementation.

Overall, the SARDS 2040 and IP have to sustainably support the development of agribusinesses, engaging with partners with experience in business development, hiring experts to provide specialized technical assistance and providing assistance and incentives to farmers to supply the demand generated by such agribusinesses.

Nevertheless, there are a few interventions whose expected IOs are key for the success of the overall SARDS 2040 because of the urgency of the issues to be addressed and/or their leverage effect on other programmes. The key programmes that can make the difference, and thus identified as top priorities for the next five years in the IP 2016-2020, are the following:

a) **create an enabling institutional environment including a conducive regulatory setup** for the development of agribusiness and agrofood production (IO 6.1); reform the current structure of incentives, moving from generalized subsidies towards 'smart' incentives (IO 6.2); improve the provision of inclusive rural financial services (IO 6.3); enhance the knowledge base for decision-making in agriculture and rural

[68] This is not only because the resources – financial, human, time – available every year are not enough to implement all interventions, but also because there is a preceding order among some interventions (e.g., organizing farmers in water users' groups before allocating water quotas and metering water consumption at watershed level) that technically prevents the possibility from implementing all interventions at the same time.

development (IO 6.4), while also conducting selected studies/surveys to acquire the information/data and knowledge not existing yet in the country; and support the creation of platforms for policy dialogue between private and public stakeholders;

b) **address the issue of sustainable water management in agriculture**, starting from the most important agricultural region of the country, Al Batinah (IO 3.1, most interventions under Outcome 1 and some interventions under Outcomes 2 and 4);

c) **improve food safety and biosecurity standards** in crop (IO 1.4) and animal (IO 2.4) value chains: this is essential if competitiveness is to be enhanced; and

d) **pilot an innovative and integrated rural development approach in Jebel Akhdar** (which covers Outcome 5), assess it and eventually scale it up to other areas in the country.

Strategic Risks

There are of course some risks associated with the achievement of the above objectives. The most important at strategic level[69] include:

- vulnerability to the economic and political risks stemming from the uncertainties in world markets – primarily the oil and gas markets – and the turbulent political situation in the region. This calls for renewed efforts to rapidly and effectively achieve economic diversification, reduce economic dependence on imports and establish a pragmatic foreign policy to increase the country's resilience to external shocks;
- lack of political support and delayed policy action that may impede essential coordination among all relevant stakeholders and undermine the continuity of actions required by the long-term change envisioned by SARDS 2040. All efforts should be made to ensure the needed political support and direction at the highest level (His Majesty the Sultan and the SCP); and
- lack of support by the society at large due to a poor understanding of the role that agriculture and rural development can play in a modern society. Continuous awareness raising, communication campaigns and dialogue with farmer and rural-based organizations as well as civil society organizations are key to changing this situation and favouring a new social contract between consumers and agrofood producers for broad political support for agriculture and rural development.

All of the above calls for a new role to be played by the MAF, both in terms of planning and management responsibilities. The MAF needs to take the lead in planning and implementing its interventions, stimulating related private investments and PPPs, coordinating with other key stakeholders and advocating other institutions to plan and implement priority SARDS 2040 interventions that are beyond the MAF's mandate.

Essential here are the MAF's actions within and outside the Ministry. Internally, this calls for significant investments in developing human capacities (more and better trained staff) in key areas (planning, management, statistics, information and communication) and streamlining responsibilities deriving from the SARDS 2040 mandate (and possibly changing the internal MAF structure). Externally, the MAF's engagement in policy dialogue with institutions having widely recognized political weight and a mandate in the

[69] The most important of them and the relevant mitigation measures in the short to medium term are discussed in the IP 2016-2020.

national context (e.g., SCP, the Office of the Vision 2040, RCA, etc.) is key, as well as effective inter-institutional coordination involving all relevant stakeholders (primarily MRMWR, MECA, MOHO, MOCI, MOT and MHC) for SARDS 2040 streamlining and implementation.

Implementation Arrangements

The SARDS 2040 is a strategy whose breadth extends beyond the mandate of the MAF. Therefore, its implementation requires the strong involvement of a large number of departments and institutions. The MAF will be the institution responsible for coordination, monitoring and evaluation, while the Supreme Council for Planning (SCP) will oversee of its implementation and achievement of results.

Effective SARDS 2040 implementation will require the engagement of leading institutions in the country such as the Diwan of the Royal Court (DRC), the Royal Court Affairs (RCA), and the Office of the Vision 2040. Many investments and policy reforms that do not fall under the MAF's specific mandate will require the establishment of specific committees or working groups for policy dialogue and reform, comprising a number of relevant ministries and chaired or coordinated by members of higher-level institutions.

In this framework, the MAF is responsible for initiating and convening inter-institutional coordination and policy dialogue on the different subjects to be addressed by the SARDS 2040 (e.g. other institutions, ministries, PPPs), taking, as appropriate, a leading role, or delegating these functions to higher-level institutions such as the office of the SCP or the RCA. In fact, the MAF as the main implementing agency will have direct responsibility in planning and managing the SARDS IP.

Although structural or organizational changes of MAF are not deemed as necessary, ad-hoc temporary technical advisors, or capacity development projects will be required to develop individual and organizational capacities within the MAF to implement the SARDS 2040 programmes. Furthermore, it is proposed that within the MAF the responsibility for project planning, design, implementation and M&E be attributed according to the level of result.

Therefore, the responsibility of SARDS 2040 implementation is as follows: the officers responsible for the implementation of individual projects report to the IO coordinator (Director General or Director) who ensures overall supervision and, in turn, reports to/advises the outcome manager (MAF Undersecretary for Agriculture assisted by the Director-General of Planning).[70]

Agriculture and Rural Areas by 2040

Chapter 3 highlighted the main challenges Omani agriculture faces. The last Agricultural Census reported some structural features of the sector that mirror these challenges, namely: the very low average size per holding; the fundamental structural dualism of Omani agriculture characterized by many micro and small farms and few large farms; the existence of only a small share of professional and organized farmers; the old age of most farmers; the minuscule share of farmers who obtain loans; the overwhelming role

[70] More detailed operational arrangement on how to implement SARDS 2040 interventions are discussed in Chapter 5 and 6 of the SARDS IP.

of foreign unskilled labour in operating farms; and the overall low appeal of agriculture for young Omanis.

The purpose of the SARDS 2040 is to: increase the average size of operations and decrease the polarisation between small and large farms; increase the share of professional and organized farming; and increase the share of younger, better trained, more innovation-oriented farmers. In a sentence, help farmers realize their potential as responsible and successful agricultural entrepreneurs and organize them, as well as other operators, in the value chains.

But what will be the impact of these changes on the major agricultural systems? Currently there are four main agricultural systems in Oman: (i) larger-scale, efficient commercial farms; (ii) small-scale, efficient diversified holdings; (iii) traditional, village-based, mixed agriculture systems; and (iv) pastoral systems, mostly based in the Dhofar rangelands. The SARDS 2040 aims to: (i) expand and further develop commercial farms; (ii) transform small-scale, diversified holdings, making a number of them[71] more efficient and market-oriented; (iii) support the multi-functional traditional agriculture that provides public goods (landscapes, biodiversity, cultural values and identity); and (iv) rehabilitate the Dhofar rangelands, making the management of pastoral systems more sustainable and linking animal husbandry to the market.

Overall, the SARDS 2040 supports farmers (small and large, family and commercial, women and men) to empower them to form autonomous and efficient organizations that develop a range of services (facilitating access to and management of natural resources, input and output markets, information and communication, policy-making processes). The SARDS 2040 provides a portfolio of options, letting the farmers decide whether to stay in agriculture or leave the sector and/or decide which kind of agriculture they wish to pursue according to their attitudes, professional skills and entrepreneurial abilities.

At the end of the process, the agriculture and rural sector will be more balanced, sustainable and dynamic, while the countryside will be less “agricultural production–based” and more “rural activities-based” (both on-farm and off-farm), with farms producing not only agricultural commodities, but high-quality, high-value produce and services (multi-functional farms). This is already happening in some Omani contexts, but it is expected to become more widespread in the future: the SARDS 2040 will accompany and favour this process as it will increase the livelihood opportunities of rural households and contribute to a more balanced regional development.

Contribution of Agriculture and Rural Development to Well-being

In the current public debate, agriculture is perceived as a marginal sector because people look at it only in terms of its contribution to the GDP; however, agriculture and rural development are more than this. Agriculture and rural development’s contribution to the society’s well-being can be assessed at an economic, social and environmental level.

[71] In fact, it is impossible to transform all of them: the process of agriculture modernization and intensification is an opportunity that is usually seized by the most dynamic farmers.

Economic contribution

The average share of agriculture to the GDP over the period 2012-2014 was 0.8 percent. This refers to the restricted definition of agriculture as mere production of agricultural goods. However, a relevant contribution of agriculture to economic growth is also in terms of the provision of raw materials used by the food processing industry. If we adopt this broader definition (i.e., agricultural production plus agroindustry, landscaping activities, etc., cf. FAO, 2009), the most recent estimate (average 2000-2006) of the contribution of agriculture to Oman's GDP jumps to 3.1 percent (or 5.4 percent if we consider the share of it to non-oil GDP).[72]

However, the economic importance of agriculture is well beyond the crude monetary value of final production. Agriculture is a sector that currently provides more than half of Oman's food needs in value terms. Nevertheless, agrofood imports are massive. Therefore, although full self-sufficiency is not a feasible policy option in Oman, any reduction in imports and increase in exports for selected products – namely the ones for which there is an advantageous domestic resource cost, not to mention the very few showing comparative advantages – can have a very positive impact in terms of alleviating the balance of trade. If agricultural production is turned toward higher value added products, as suggested in the SARDS 2040, any strategy of import substitution or export expansion will be even more advantageous.

Last but not least, the economic value of agricultural production cannot be restricted to the mere value of goods exchanged in the market. Agriculture is the most important sector providing public goods in rural areas – such as landscape, biodiversity, etc. – that have to be considered as positive externalities to other economic sectors such as tourism.

Social contribution

The importance of agriculture from the social viewpoint is also underestimated. If people look just at the sector's contribution to total employment, agriculture accounts only for 5.2 percent. However, agriculture's social contribution should be assessed, considering its current – and even greater – potential contribution in terms of reducing inequalities. In fact, it is well known that agricultural growth is much more equitable than non-agricultural growth (WB, 2008).

Even more important is the possible contribution of agriculture and rural development in reducing regional imbalances. Promoting synergies between farm and non-farm rural activities is the best strategy for providing attractive livelihood opportunities to people living in rural areas, including youth, and reducing migration to urban centres. This is already happening in some areas of Oman and it is expected to be even more so in the near future.

Last but not least, the contribution of agriculture in terms of nutrition and health is key. The provision of safe and nutritious food – primarily fruits and vegetables, but also meat and dairy products – to Omani consumers is essential for a balanced diet and combating the phenomena of obesity and overweight, which are rapidly increasing among the Omanis (MOH, 2014).

[72] This is consistent with estimates in other countries having a comparable level of development, where the computation of the backward and forward linkages between agriculture and the rest of the economy is around 2-3 percentage points of the GDP.

Environmental contribution

From the environmental viewpoint, agriculture also has a say. The sector currently contributes 22 percent to the total ecological footprint (GFN, 2015), mostly due to cropland (14.1 percent) and grazing (8.2 percent). Reducing this footprint, through a more efficient use of water but also switching to renewable energy sources (primarily solar) in energy intensive activities such as greenhouses and livestock production plants, will contribute significantly to the country's environmental sustainability.

Agriculture may also be a source of resilience for many people, contributing to the diversification of income sources at household level and through the production of food for self-consumption. Moreover, the conservation of some public goods (such as landscape and biodiversity) or common goods (such as the *aflaj* systems) also adds to the environmental importance of agriculture.

SARDS 2040 and Vision 2040

All of the above are already happening in the Omani countryside, and will be even more so 25 years from now, because of the changes that economic growth brings about, but also from the impact of SARDS 2040 interventions that accommodate and support this natural evolution. Probably the best way to conceive the contribution of agriculture and rural development to the well-being of Omani society is to compare the SARDS 2040 content with the pillars of the Vision 2040 (Table 9.1), which shows the perfect match between the two. The SARDS 2040 is aligned to Vision 2040 and is able to contribute significantly to all aspects considered therein.

Table 9.1. Comparison between the Vision 2040 and the SARDS 2040

Vision 2040 pillars	SARDS 2040 components
Creating wealth through economic diversification and private sector partnership	SARDS 2040 Vision
Safeguarding national security	SARDS 2040 Vision
Developing technical and entrepreneurial capabilities	Outcomes 1 and 2
Building world-class infrastructure and urban systems	Outcomes 1 and 2
Preserving environmental sustainability	Outcomes 3 and 4
Ensuring equitable regional development	Outcome 5
Enhancing family and community well-being	Outcome 5
Upholding Omani culture and identity	Outcome 5
Improving governance effectiveness	Outcome 6

Key Messages

The most important messages from the SARDS 2040, which are important to convey to policy-makers and the wider public, are the following:

1) SARDS 2040 is aligned with the Vision 2040 and is able to significantly contribute to all aspects considered therein.
2) Agriculture and rural development contribute to the well-being of the Omani people beyond the share of agriculture in the GDP, through:
   - reduced regional imbalances;
   - enhanced environmental sustainability;

- improved nutrition and health; and
- inclusion of youth and women in socio-economic development patterns.

3) As a result, the food sector, within which agriculture plays a central role, and rural development cannot be ignored in any diversification strategy.
4) The most important challenges addressed by SARDS 2040 are:
   - how to transform agricultural commodity production units (farms) into units producing a portfolio of high-quality goods and services (multi-functional farms);
   - how to help farmers realize their potential as responsible and successful agricultural entrepreneurs; and
   - how to develop efficient and equitable collective action organizations, both as civil society groups that will strengthen social capital and contribute to sector advocacy, and as professional groups (cooperatives, unions, associations) that will contribute to enhancing sector competitiveness in a sustainable way.
5) In doing so, it is necessary to:
   - address the major institutional-related issues in order to promote an enabling environment (institutions and social capital, regulatory and legal frameworks, investment climate) to achieve the highest potential payoff from planned interventions;
   - support the organization of the sector (farmers, water users, processors); and
   - give priority to public investment with high potential leverage on private investment.
6) In order to unlock the potential of agriculture and rural development, strong institutional coordination is required within the MAF and between the MAF and other ministries – such as the MRMWR, MECA, MOM, MOT, MHC, MSD, MOHO, MOH – and municipalities.

Unlocking the huge potential of agriculture and rural development is not simple and requires addressing issues that are both within and outside the sector boundaries, but this is the change the country needs.

The next 25 years represent a tremendous window of opportunity to mark a change not only for the agriculture and rural sector but also for the development of the whole country. The SARDS 2040 is the tool the Sultanate of Oman has devised to contribute to this change in agriculture and rural development.

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Annexes

Annex 1A – Composition of the national team

Steering Committee

- **HE. Dr. Fuad bin Jafar Al-Sajwani**, Minister of Agriculture and Fisheries
- **H.E. Ahmed Nasser Al-Bakri**, Undersecretary of Agriculture (MAF), Chairman of the National Team
- **Muneer Hussain Al-Lawati**, Director General of Planning and Development (MAF), Vice-chairman of the National Team
- **Khalid Mansoor Al-Zidjali**, Director General of Fisheries Harbors (MAF), Former Chairman of the National Team

Executive Members

- **Naufal Hameed Rasheed**, Minister's Office (MAF), Technical Team Leader of the National Team
- **Ibrahim Yaqoob Al-Naamani**, GD of Planning and Development (MAF), Director of the SARDS Project

National Team Members

- **Nashwan Abdalwhab Abdalaziz**, Agriculture and Fisheries Development Fund (AFDF)
- **Safwat Ahmed**, GD of Animal Wealth (MAF)
- **Mohammed Alsayis**, GD of Animal Wealth (MAF)
- **Nabeel Hassen Al-Bahrani**, Director of Irrigation and Agricultural Land (MAF)
- **Abdalaziz Salim Al-Harthi**, Director of Research Administration (TRC)
- **Julanda Ahmed Al-Mawali**, Director of Central laboratory of Animal Health (MAF)
- **Khalifa Salim Al-Kuyumi**, Minister's Office (MAF)
- **Ali Hussin Al-Lawati**, The Research Council (TRC)
- **Ibrahim Yaqoob Al-Naamani**, GD of Planning and Development (MAF)
- **Badar Ali Al-Qumshooi**, GD of Animal Wealth (MAF)
- **Yousef Mohamed Al-Raisi**, GD of Agricultural and Livestock Research (MAF)
- **Suliman Mahfoodh Al-Toobi**, Director of Plant Quarantine Department (MAF)
- **Hamadan Salim Al-Wehabi**, GD of Agricultural and Livestock Research (MAF)
- **Rashid Abdullah Al-Yahyaai**, Sultan Qaboos University (SQU)
- **Asim Talib Al-Zadjali**, GD of Marketing & Investment for Agriculture and Livestock (MAF)

- **Said Al-Zadjali**, Ministry of Environment & Climate Affairs (MECA)
- **Satish Kumar**, Minister's Office (MAF)
- **Saleem Nadaf**, GD of Agricultural and Livestock Research (MAF)
- **Naufal Hameed Rasheed**, Minister's Office (MAF)
- **Slim Zakri**, Sultan Qaboos University (SQU)

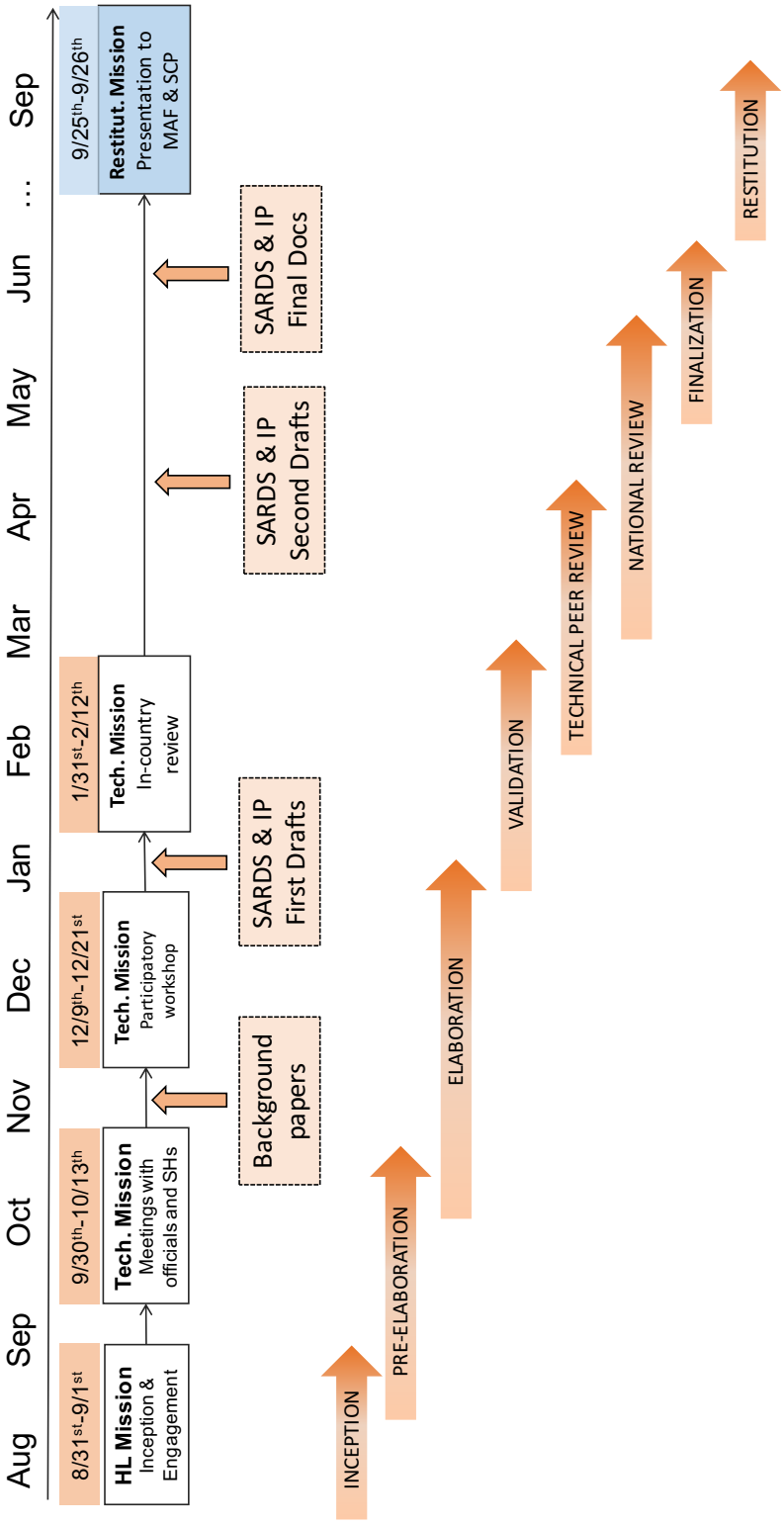
SARDS Documents reviewers

- **Safwat Ahmed**, GD of Animal Wealth (MAF)
- **Mohammed Alsayis**, GD of Animal Wealth (MAF)
- **Yosuf Hamad Al-Buloshi**, Oman Vision 2040 Office
- **Abdalaziz Salim Al-Harthi**, Director of Research Administration (TRC)
- **Khalifa Salim Al-Kuyumi**, Minister's Office (MAF)
- **Ibrahim Yaqoob Al-Naamani**, GD of Planning and Development (MAF)
- **Suliman Mahfoodh Al-Toobi**, Director of Plant Quarantine Department (MAF)
- **Hamadan Salim Al-Wehabi**, GD of Agricultural and Livestock Research (MAF)
- **Asim Talib Al-Zadjali**, GD of Marketing & Investment for Agriculture and Livestock (MAF)
- **Satish Kumar**, Minister's Office (MAF)
- **Saleem K. Nadaf**, GD of Agricultural and Livestock Research (MAF)
- **Naufal Hameed Rasheed**, Minister's Office (MAF)

Annex 1B – Composition of the FAO team

- **Donato Romano**, Economist, Team Leader (University of Florence, Italy)
- **Tommaso Alacevich,** Investment Planning Specialist (FAO)
- **Luis Dias-Pereira**, Investment Planning Specialist (FAO)
- **David Picha**, Agribusiness & Value Chain Specialist, Horticulture (Louisiana State University, USA)
- **Inna Punda,** Agribusiness & Value Chain Specialist, Livestock (FAO)
- **Ahmed E. Sidahmed**, Livestock Production and Health Specialist (FAO)
- **Christopher Ward,** Senior Natural Resource Management Specialist (University of Exeter, UK)
- **Chakib Zouaghi,** Investment Support Officer *(*FAO)
- **Nada Zvekic**, Communication Specialist (FAO)

Annex 2 – SARDS 2040 development process



Annex 3 – List of stakeholders

• **Alaa Al-Hamadani**	MAF
• **Abdalaziz Salim Al-Harthi**	MAF
• **Abdullah Ali Al-Qumshooi**	MAF
• **Abdullah Faraj Huthaili**	MAF
• **Ahmed Ibrahim Al-Naabai**	MAF
• **Ahmed Khamis Al Ghaithi**	MAF
• **Ahmed Salim Al-Najjar**	MAF
• **Ahmed Yousef Al-Bulishi**	MAF
• **Ali Abdullah Al-Jabri**	MAF
• **Ali Hussin Al-Lawati**	TRC
• **Ali Mohsin Al Shanfari**	MAF
• **Ali RashidAl Abri**	MAF
• **Ali Salim Al Badi**	MAF
• **Amal Ibrahim**	MOH
• **Amer Abdulhakim Rawas**	MAF
• **Aseen Saif Al-Kalbani**	MAF
• **Asim Talib Al-Zadjali**	MAF
• **Aysha Ali Al-Hinai**	MAF
• **Azza Al-Rwas**	MAF
• **Badar Abdullah Al-Siyabi**	MAF
• **Badar Khalfan Al-Mamari**	MAF
• **Badar Salim Al-Quyudhi**	MAF
• **Baqer Al-Lawati**	MAF
• **Basim Al-Kalbani**	MAF
• **Btool Mousa Al-Mulaji**	PASMED
• **Ehab Mostafa Shaat**	MAF
• **Eida Mohammed Almkabbaliah**	MAF
• **Eisa Rashid Al-Gharibi**	MAF
• **Emad Shehata**	MAF
• **Fahd Humaid Al-Rabani**	MAF
• **Fiza Al-Ruaisi**	MAF
• **Frank O. Regan**	OFIC
• **Hadi Al-Lawati**	MAF
• **Haitham Badr Al Khanjari**	MAF
• **Halima Al-Azri**	AFDF
• **Hamadan Salim Al-Wehabi**	MAF
• **Hammod Al-Hashmi**	MAF
• **Hamoud Hilal Al-Khanjari**	MAF
• **Hilal Al-Abri**	NCSI
• **Ihab Mostafa Shaat**	MAF
• **Ishaq Omar Al-Jabri**	MAF
• **Issa Saleh Al-Naabi**	ODB
• **Jalal Al-Qassmi**	MAF
• **Jamaan Robee Bait Robeea**	MAF
• **Jamal Al-Shethani**	SCP

• **Jamal Nasser Al-Fahdi**	Oman Vision 2040 Office
• **Kaseeb Salim Almany**	MAF
• **Khair Al-Busaidi**	MAF
• **Khalaf Sulaiman Ombosaidy**	MAF
• **Khalfan Al-Farsi**	MAF
• **Khalid Mohammed Alshaili**	MAF
• **Khalifa Salim Al-Kuyumi**	MAF
• **Mahammed Ali Al-Shandodi**	MAF
• **Mahmud Rabia**	MAF
• **Maryum Al-Hinai**	SQU
• **Mohammed Al-Khumyasi**	MOF
• **Mohammed Alsayis**	MAF
• **Mohammed Al-Shanfari**	MAF
• **Mohammed Fadhel Al-Buloshi**	MAF
• **Mohanad Hassan Ali**	MUNM
• **Mubarak Ahmed Kaufann**	MAF
• **Musalem Mohammed Al-Alwai**	MAF
• **Nabeel Hassen Al-Bahrani**	MAF
• **Naeem Thani**	MAF
• **Nashwan Abdalwhab Abdalaziz**	AFDF
• **Nasra Al-Riyami**	MAF
• **Nasser Ali Almrshodi**	MAF
• **Nasser Said Al-Jabri**	MAF
• **Nasser Salim Al-Wahaibi**	MAF
• **Naufal Hameed Rasheed**	MAF
• **Nawal Al-Abri**	MCI
• **Nooriya Al-Kharusi**	MCI
• **Raja Abdulaziz Al-Raisi**	RCA
• **Rashid Abdullah Al-Yahyai**	SQU
• **Rashid Khalfan Rashid Al-Sobhi**	MRMWR
• **Saad Al-Khurosi**	PRS
• **Safwat Ahmed**	MAF
• **Said Abduallah Al-Harthi**	MAF
• **Said Abdullah Al-Abadi**	MAF
• **Said Al-Hatali**	MRMWR
• **Said Al-Shiyadi**	PASFR
• **Said Al-Zadjali**	MECA
• **Said Mohammed Al-Adawi**	MAF
• **Said Saif Al Amiri**	MAF
• **Said Saif Al-Wardi**	MAF
• **Saif Ali Al-Khamisi**	MAF
• **Saleem K.Nadaf**	MAF
• **Saleh Rabi Al-Khadury**	MAF
• **Salim Al-Abdali**	OFIC
• **Salim Abdullah Al-Rasbi**	MAF
• **Salim Al-Abri**	AFDF
• **Salim Al-Ghamari**	MAF
• **Salim Al-Khatri**	MAF

• **Salim Al-Mamari**	MAF
• **Samya Al-Ghnami**	MOH
• **Sathis Kumar**	MAF
• **Saud Al-Farsi**	MAF
• **Saud Saif Ali Al-Habsi**	MAF
• **Sheikhan Nasser al Abri**	MAF
• **Slim Zakri**	SQU
• **Suleiman Abdullah Al-Alawi**	MAF
• **Suliman Mahfoodh Al-Toobi**	MAF
• **Sundus Al-Maqbali**	MAF
• **Tala Al-Awasi**	MAF
• **Tariq Helmi**	MRMWR
• **Thunai Obid Al-Shekaili**	MAF
• **Wafa Salim Al-Hadhrmi**	MAF
• **Yahya Al-Hinai**	RCA
• **Yosuf Al-Buloshi**	Oman Vision 2040 Office
• **Yousef Mohammed Al-Raisi**	MAF
• **Zaher Al-Sulaimani**	OWS
• **Zahir Abdullah Al-Busaidi**	MAF

Annex 4 – List of background papers

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Annex 5 – Results Framework matrix

***Disclaimer**: The figures reported in this matrix reflect the availability of data/information as of 30 May 2016. For indicators whose figures will not be available at the time of SARDS 2040 approval, specific actions (surveys/studies) must be implemented to fill the information gap over the first 12 to 24 months of SARDS 2040 implementation.*

RESULTS	No.	INDICATOR	Baseline	Year	Target 2020	Target 2040	Frequency (Years)	Source of Verification (to be collected by MAF)	Risks and assumptions
Impact - A sustainable, profitable and innovative agriculture and rural sector contributing to food security and to the achievement of the Oman'overall development objectives	**G1**	Average annual growth rate of agricultural GDP in real terms (3 years moving average) (%)	**2,8%**	2012-2014	3,0%	3,0%	1	NCSI DG Economical Statistics	
	G2	Share of agricultural value added to GDP (%)	**0,8%**	2011-2014	0,9%	2,0%	1	NCSI DG Economical Statistics	Oil price can affect the target figures
	G3	Agro-food trade balance to GDP (%)	**1,4%**	2014	1,5%	2,5%	1	NCSI DG Economical Statistics	Oil price can affect the target figures
	G4	Agriculture GDP per worker in agriculture (constant 2010 thousands OMR/worker)	**1,5**	2014	1,7	3,1	1	NCSI DG Economical Statistics	
	G5	Level of water overdraft in agricultural areas (milllion m3)	**630**	2013	580	280	5	MRMWR	
	G6	Age-standardized prevalence of people (+18 Y) consuming less than 5 total serving (=400 gr) of fruits and vegetables per day (%)	**68,4%**	2008	54,7%	13,7%	5	MOH, NCSI/MAF from world health survey	This indicator only partly depends on MAF action. It is a joint effort of MOH and MHE and requires a strong coordination among these institutions
	G7	Number of reported cases of food borne illnesses among humans (N per 1,000,000)	**103**	2015	99	87	1	MOH, WHO	This indicator only partly depends on MAF action. It is also affected by import. It is a joint effort of MOH, MRMWR, and MOCI and requires a strong coordination among these institutions
Outcome 1 - Crop sector competitiveness increased	**O1**	Value of high-value crop production (3 years moving average) for main crops (OMR)	**TBD**	2016	TBD	TBD	3	MAF	Disaggregated by date palms, mango, alfa alfa, tomato, cucumber
Intermediate Outcome 1.1 Technical and organizations innovations promoted, high-value varieties developed, crop yi and nutritional quality improved	**IO 1.1.A**	Increased crop productivity (3 years moving average) for main crops (t/feddan)	**9**	2013	11	16	1	NCSI	Disaggregated by date palms, mango, alfa alfa, tomato, cucumber
	IO 1.1.B	Share of GlobalGap certified farms (%)	**close to 0% (only 10 farms)**	2016	0.5%	5,0%	3	MAF, MOCI	Regulatory aspects, incentives and capacity development activities are preconditions
Intermediate Outcome 1.2 Postharvest losses reduced, product market period improved, product value-added developed and market opportunities enhanced	**IO 1.2.A**	Number of registered and functioning agribusinesses (cooling and storage and processing facilities) in the country (N)	**TBD**	2016	TBD	TBD	3	MAF, MRMWR, MOCI	
	IO 1.2.B	Number of Geographic Indications established (N)	**TBD**	2016	TBD	TBD	3	MAF, MRMWR, MOCI	
Intermediate Outcome 1.3 Stringent food safety and biosecurity measures for crop products enforced	**IO 1.3.A**	Farm-to-market product traceability system for selected crop products established (Y/N)	**No**	2016	Yes	Yes	3	MAF, MRMWR, MOCI	A plan must be devised for planning interventions. Achivements must be assessed aginst the targets of this plan
	IO 1.3.B	Incidence of food contamination cases on total controls (%)	**TBD**	2016	TBD	TBD	3	MAF, MRMWR, MOCI	Standards and control system are preconditions to data collection

RESULTS	No.	INDICATOR	Baseline	Year	Target 2020	Target 2040	Frequency (Years)	Source of Verification (to be collected by MAF)	Risks and assumptions
Outcome 2 - Livestock sector competitiveness increased	**O2**	Value of livestock production (3 years moving average) disaggregated by value chain (OMR)	**TBD**	2016	TBD	TBD	3	MAF, MOCI, MRMWR	Disaggregated by meat (red and white), dairy, eggs and honey
Intermediate Outcome 2.1 - A more productive, market-oriented and sustainable red meat and dairy industry developed	**IO 2.1.A**	Number of functioning and certified dairy and meat processing units (N)	**Dairy: 1 Meat: 0**	2016	Dairy: 3 Meat: 2	Dairy: 3 Meat: 3	3	MAF, MRMWR, MOCI	
	IO 2.1.B	Share of the domestic animal products (dairy, chicken meat, table eggs, red meat) in the Omani food retai (%)	**TBD**	2016	TBD	TBD	3	MAF, MRMWR, MOCI	
Intermediate Outcome 2.2 - National poultry industry competitiveness and sustainability enhanced	**IO 2.2.A**	Percentage of poultry (broiler and layer) operations achieving the minimum performance indicators index (%)	**TBD**	2016	TBD	TBD	3	MAF, MRMWR, MOCI	KPI: 2015: SME=173, LE=260 2020: SME=256, LE=336 2040: SME=394, LE=495
Intermediate Outcome 2.3 - Apiculture practices and technologie organization of producers, value-addition and marketing enha	**IO 2.3.A**	Value (at constant prices) of honeybee products certified as meeting the national quality and safety standards (OMR)	**TBD**	2016	TBD	TBD	1	MAF	
Intermediate Outcome 2.4 - Stringent food safety and biosecurity measures for animals and animal products enforced	**IO 2.4.A**	Farm-to-market product traceability system for selected animal products established (N)	**No**	2016	Yes	Yes	3	MAF, MRMWR, MOCI	A plan must be devised for planning interventions. Achivements must be assessed aginst the targets of this plan
	IO 2.4.B	Incidence of livestock and animal sources food positive pathogen cases on total controls (%)	**TBD**	2016	TBD	TBD	1	MAF, MRMWR, MOCI	
Outcome 3 - Sustainable magament of natural resources in agriculture enhanced	**O3**	Value of AGR production per unit of water used in agriculture (OMR/m3)	**TBD**	2016	TBD	TBD	1	MOCI DG Specification and metrology	
Intermediate Outcome 3.1 - Income per unit of water used in agriculture maximized	**IO 3.1.A**	Percentage of watershed area under management of water users associations (%)	**TBD**	2016	TBD	TBD	1	MAF, MRMWR	
	IO 3.1.B	Percentage of wells metered and regulated (%)	**< 1%**	2015	10%	100%	1	MAF, MRMWR	
Intermediate Outcome 3.2 - Capture, re-use and storage capacity of water to agriculture increased	**IO 3.2.A**	Volume of water from non-conventional sources used in agriculture (million m3)	**TBD**	2016	TBD	TBD	1	MAF, MRMWR	
Intermediate Outcome 3.3 - Soil fertility improved	**IO 3.3.A**	Area of salinized soils (feddan)	**TBD**	2016	TBD	TBD	1	MAF, MRMWR	
Intermediate Outcome 3.4 - Agro-biodiversity conserved	**IO 3.4.A**	Total number of agricultural landraces conserved in situ and ex situ (N)	**TBD**	2016	TBD	TBD	5	TRC, MAF, MRMWR	

RESULTS	No.	INDICATOR	Baseline	Year	Target 2020	Target 2040	Frequency (Years)	Source of Verification (to be collected by MAF)	Risks and assumptions
Outcome 4 - Resilience of agriculture and rural livelihoods to climate change and natural disasters improved	**O4**	Agricultural chapter under the national strategy for climate change implemented (Y/N)	**No**	2015	Yes	Yes	1	MAF, MRMWR	
Intermediate Outcome 4.1 Climate change adaptation and natural disaster risk management integrated into agricultural a rural development policy, investment and programmes	**IO 4.1.A**	Number of agricultural plans, projects or programmes including climate change and natural disaster adaption provisions (N)	**N/A**	2016	TBD	TBD	5	MAF, MECA, MRMWR	Conditional upon streamlining of agriculture under the National Strategy for Climate Change
Intermediate Outcome 4.2 Climate change mitigation and agricultural carbon footprint improved	**IO 4.2.A**	Proportion of agribusinesses units using renewable energy sources (%)	**TBD**	2016	TBD	TBD	5	MAF, MECA, MRMWR	
Outcome 5 - Rural communities empowered and rural livelihoo opportunities improved	**O5**	Average income gap between urban and rural income (%)	**41%**	2009	40%	30%	5	SCP	Source is the Oman Human Development Report, based on the Household Expenditure and Income Survey. The
Intermediate Outcome 5.1 Rural economic activities diversified and livelihood opportunities improved	**IO 5.1.A**	Number of nights spent by in agro-touristic farms (N)	**TBD**	2016	TBD	TBD	5	MAF, MOT	
	IO 5.1.B	Number of SMEs registered in rural areas (N)	**TBD**	2016	TBD	TBD	5	MAF, MOT, MOCI	
Intermediate Outcome 5.2 Local cultural heritage and traditiona social values preserved and valued	**IO 5.2.A**	Number Aflaj or other relevant rural cultural heritage rehabilitated and operational (N)	**1.284 aflaj**	2010-2015	1.400	1.800	1	MRMRW, MOHC, MOT, MAF, UNESCO	Disaggregated by aflaj and other relevant cultural heritage items
Outcome 6 - Enabling institutional environment for agriculture rural development strengthened	**O6**	One-stop-shop facility for agro-food projects (Y/N)	**No**	2015	Yes	Yes	1	MAF, MECA, MRMWR	
Intermediate Outcome 6.1 Institutional and regulatory framework enhanced and enforced	**IO 6.1.A**	Amendmends to specific laws and regulations (%)	**No**	2015	100%	100%	1	MOM, MAF, MOCI, MRMWR, RCA	Amendments with sepcific reference to the following laws/regulations: labour, land, associations. A plan must be devised for planning interventions. Achievements must be assessed against the targets of
Intermediate Outcome 6.2 Economic environment enhanced	**IO 6.2.A**	Share of subsidies to agriculture distributed through smart incentives schemes (%)	**0%**	2016	20%	90%	5	MAF, MOF, MOCI	
Intermediate Outcome 6.3 Provision of inclusive financial servic improved	**IO 6.3.A**	Additional agricultural SMEs with an outstanding loan or line of credit (%)	**TBD**	2016	+10%	+25%	1	OCCI	Financial sector develops tools attractive to agricultural SMEs; economic environment in agriculture is favourable to investments
	IO 6.3.B	Purchased agriculture insurance (% working in agriculture, age 15+)	**0%**	2016	10%	50%	1	Global Findex indicator (World Bank); OCCI	Agricultural insurance is introduced in Oman between 2016-2020
Intermediate Outcome 6.4 Knowledge base for agriculture and rural development governance strengthened	**IO 6.4.A**	SARDS 2040 and IP annual reports regularly issued (Y/N)	**N/A**	2015	Yes	Yes	1	MAF	
	IO 6.4.B	National AGR and RurDev Statistics produced according the standards promoted by the Global Strategy to Improve Agricultural and Rural Statistics (Y/N)	**No**	2016	Yes	Yes	1	MAF	A plan must be devised for planning interventions. Achievements must be assessed against the targets of this plan
Intermediate Outcome 6.5 An effective innovation system for a competitive and sustainable agriculture implemented	**IO 6.5.A**	Satisfaction of beneficiaries with the public advisory/extension service (disaggregated by nationality, age group and gender) (%)	**TBD**	2016	60%	80%	5	MOM, MAF, MOCI, MRMWR, RCA	Survey-based: specific questions on various aspects, including innovation of the extension system, changes induced by innovation adoption, etc.
Intermediate Outcome 6.6 Social support to agriculture and rur development enhanced	**IO 6.6.A**	Share of population with a satisfactory level of awarness on food security, nutrition, water scarcity, climate change, environmenntal sustainability (%)	**TBD**	2016	60%	80%	5	MOM, MAF, MECA, MOCI, MRMWR, RCA, MOHealth	

Number of indicators	Baseline	%	Target 2020	Target 2040	%
To be determined (TBD)	20	47%	18	18	42%
Available	23	53%	25	25	58%
Total number of indicators	**43**	**100%**	**43**	**43**	**100%**

RF Level	Number	Number of indicators	Number of indicators per result
Impact	1	7	7,0
Outcomes	6	6	1,0
Intermediate Outcomes	21	30	1,4
Total elements in the chain of results	**28**	**43**	**1,5**