# CIARD

## CASE  STUDY

**Ministry of Agriculture and
Fisheries Network (MAFNET) of Oman**

**October 2012 (version 1.0)**

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**ABREVIATIONS AND ACRONYMS**

| | |
|---|---|
| AR4D | Agricultural Research for Development |
| AARINENA | Association of Agricultural Research in Near East and North Africa |
| AGORA | Access to Global Online Research in Agriculture |
| AGRIS | International Information System for the Agricultural Sciences and Technology |
| AGRIS-AP | AGRIS Application Profile |
| AICE | Agricultural Information Centre of Oman |
| AIS | Agriculture Information System |
| CGIAR | Consultative Group on International Agricultural Research |
| CIARD | Coherence in Information for Agricultural Research for Development |
| CIARD RING | CIARD Routemap to Information Nodes and Gateways (R.I.N.G.**)** for Agricultural Research for Development |
| FAO | Food and Agriculture Organization |
| GCARD | Global Conferences on Agricultural Research for Development |
| GFAR | Global Forum for Agricultural Research |
| ICARDA | International Centre for Agricultural Research in the Dry Areas |
| ICM | Information and Communication Management |
| ICT | Information and Communication Technologies |
| MAFNET | Ministry of Agriculture and Fisheries Network of Oman |
| NARIMS | National Agricultural Research Information Management System in Egypt |
| NAIS | National Agricultural Information System in Jordan |
| NAKEMS | National Agricultural Knowledge Management Exchange System of Oman |
| NERAKIN | Near East Rural and Agricultural Knowledge and Information Network |
| NERAKIN-RAIS | Near East Rural and Agricultural Knowledge and Information Network, Regional Agricultural Information System |
| NGO | Non Governmental Organization |
| NRIs | National Research Institutes |
| OAI-PMH | Open Archives Initiative Protocol for Metadata Harvesting |
| PERii | Programme for the Enhancement of Research Information |
| RAIS | Regional Agricultural Information System |
| RADCON | Rural and Agricultural Development Communication Network in Egypt |
| RNE | Regional Office for the Near East, FAO of the United Nations |
| RSS | Rich Site Summary (dubbed: Really Simple Syndication) |

# EXECUTIVE SUMMARY

The Ministry of Agriculture and Fisheries Network (MAFNET) is an integrated, bilingual (Arabic/English), institution-based web platform for information and knowledge sharing and exchange for agricultural research and development for the Ministry of Agriculture and Fisheries (MAF). It is aimed at capturing and disseminating information about: MAF institutes, experts and researchers working in those institutes; publications issued by those researchers; completed or currently active projects; the national plan on agricultural and fisheries research in Oman; success stories resulting from research and development; good practices to be followed and applied; news and events; extension bulletins produced for farmers; laws and agreements as information services for stakeholders; and other modules. It is a knowledge sharing and collaboration platform for the agriculture and fisheries sectors.

National Agricultural Knowledge Exchange Management System (NAKEMS) is a national gateway platform for information and knowledge sharing and exchange for agricultural research and development. MAFNET and NAKEMS were developed in partnership and collaboration with FAO within the framework of the Agricultural Information Centre (AICE) Project (UTF/OMA/006), building on FAO tools and methodologies.

Both systems communicate with each other through a documents repository and harvester for publications/documents module, in addition to RSS feeds and aggregation technology for all modules. The MAF stakeholders are only required to feed the MAF web information management system with content that does not require human intervention, which is transferred to and reflected in the NAKEMS system using document harvester technology based on AGRIS AP and Open Archives to harvest documents, and an RSS aggregator (automatic aggregation of RSS feeds) to harvest all information resources, including publications/documents, available in MAF.

MAFNET and NAKEMS are CIARD partners and have registered their repositories with the CIARD RING. MAFNET and associated institutions are recognized as CIARD partner institutions. MAFNET is playing a significant role in disseminating information and knowledge about MAF at institutional level. NAKEMS is also playing a considerable role at national and regional level and this is the vision of MAF. This position coincides with the CIARD vision *"To make public domain agricultural research information and knowledge truly accessible to all."*

MAFNET has made progress in developing necessary institutional readiness, and approaches to managing digital content, 'opening up' that content, and then communicating and disseminating it. MAF is very willing to continue achieving stepwise progress on this important task in collaboration with FAO. Work on licensing content is yet to be considered.

MAFNET and NAKEMS enjoyed a very strong commitment from MAF top policy makers, management and project coordination team for the success of the project. The project has thus established a new model in the Near East region for a successful information system project in the agricultural sector.

MAFNET and NAKEMS have a very strong base of trained staff that is capable of managing and sustaining the system, thus the project has exceeded the human resources training targets within budget, reflecting very successful financial resources management.

Knowledge has three levels - local, regional and international. The project has made significant efforts to input available information and extension products and research publications. However, the project needs to move from research publications to translating research results into technical packages that can be adopted by farmers to improve the productivity of their production systems. The system also needs to input extension messages that can help farmers to solve their immediate problems.

This case study describes MAFNET. It provides a brief on progress towards openness of agricultural research for innovation, and highlights the lessons learned during its development and deployment to document good policy and practices for public information, open data management and knowledge sharing, that encourage openness of agricultural research for innovation.

# 1. INTRODUCTION

The impact that public knowledge and research can have on agricultural and rural development and natural resources management is limited because most of these outputs are not easily or widely accessible. Each organization follows its own approaches to share and exchange information and adopt different information management practices. There is a great need for coherence in agricultural information management by all the concerned agencies in order to create more impact and use of information and knowledge for agricultural research for development. Creating a global network of truly accessible outputs of research and innovation greatly increases the chances they can be put to use, locally, nationally, regionally and globally. Coherence in Information for Agricultural Research for Development (CIARD) is a multi-stakeholder global initiative working to make agricultural research information publicly available and more accessible.

The Association of Agricultural Research Institutions in the Near East & North Africa (AARINENA), which is mandated to promote the development of National Agricultural Research Systems (NARS) in the WANA region, has been fostering use of ICT/ICM in AR4D in the region through its program AARINENA Regional Agricultural Information System (AARINENA-RAIS), with close support from and partnership with FAO. AARINENA, as a partner of the CIARD initiative, intends to facilitate the CIARD process in the WANA region, with the support of GFAR and FAO, by strengthening the National Information Nodal Points (NINPs) in the NARS in the region to actively engage in the CIARD initiative. As part of Bridging Knowledge Gap activities towards the transformation of AR4D systems, as described in the GCARD Roadmap, AARINENA organized two CIARD regional workshops with the objective of improving partnerships among NINPs so as to strengthen capacities and skills of personnel to promote greater sharing of knowledge for scaling up innovations.

## 1.1 About the Ministry of Agriculture and Fisheries

The agricultural sector of the Sultanate of Oman employs 7% of the country's labour force, and contributes 16% to its exports.  While it significantly contributes to national food security, and contributes 5% of GDP, the entire food and agricultural sector (including upstream and downstream linkages like agribusiness services and agro-industry) contributes about 29%. Agriculture and fisheries represents 70% of the country's non-oil exports.

Despite the country's meagre water and cultivable land resources, the agricultural sector is considered as one of the most important economic pillars for integrated development in Oman. The Government's economic development policy emphasizes the expansion of the agriculture sector to diversify the economy. The main challenges are shortage of water, salinity, unorganized cropping systems, fragmentation of land units, marketing, and the impact of scientific research.

Oman is famed for producing very high quality agricultural goods, and the highest quality products are usually exported to the neighbouring Gulf Cooperation Council (GCC) countries. However, the agricultural farm is threatened by many problems, including outdated technology and an increase in the salinity of the water. The government has responded to these issues by investing more into the sector. The government's goal is to obtain self-sufficiency in food production by improving agricultural conditions (See appendix 1 for further information on 'research and development organization and personnel' in Oman).

Reliable agricultural information constitutes a cornerstone in the planning of agricultural development and formulating relevant policies for enhancing food security and reducing rural poverty. The availability of this information is critical in order to enable those involved in the agriculture and fisheries sector, whether they are individuals or institutions, to make decisions on a valid and scientific basis.

The Government has recognized the value of the exchange of information and knowledge among key stakeholders in agricultural research and development and the importance of expanding the use of modern information and communication technologies (ICT) and management (ICM) to facilitate sustainable agricultural development in the Sultanate of Oman.

The Government of the Sultanate of Oman requested the technical assistance of FAO, covering a period of three years and starting with a preparatory phase for a period of nine months from June 2009 which was extended to December 2011, with the aim of establishing the agriculture information centre (AICE) and a pilot national agricultural knowledge exchange management system (NAKEMS). The preparatory phase was designed for strengthening the capacity of MAF for effective information management and knowledge

exchange in support of agricultural and rural development and food security policies in Sultanate of Oman. It is worth noting that FAO is providing significant contributions in building information infrastructure and capacity building through the technical cooperation programme of the development of an AICE.

The AICE has been established and is acting as the coordinating unit of MAFNET and NAKEMS, which have been developed to assemble and make accessible all information and knowledge that will:

- Support policy and decision-making in relation to national planning;
- Support research and development, and disseminate the outputs;
- Support extension services;
- Provide an institutional memory for MAF.

Currently, MAF has a systematic approach to the effective management and dissemination of the information it produces. The Ministry's Department of Development Information, which has a staff of 15 and excellent audio-visual facilities, is mainly responsible for the production of a variety of information products (printed publications, videos, radio and TV programmes, posters, leaflets, etc). Several databases and document collections exist in MAF, and they are standardized and easily accessible in MAFNET. MAFNET website is the Ministry website (http://maf.faorne.net) which is maintained by the AICE team. The MAF Department of Information Technology is responsible for maintaining the Ministry's computer hardware and software, and for conducting IT training courses for employees.

The establishment and maintenance of the centre and system will be a long-term project, and will be in line with the ongoing key initiatives of the Information Technology Authority (ITA) in implementing Oman's digital strategy (e-Oman).

## 1.2  About CIARD and the framework

The Coherence in Information for Agricultural Research for Development (CIARD; http://www.ciard.net) is a multi-stakeholder collaborative initiative of all major actors in agricultural research for development related to information management. It is working to make agricultural research information publicly available and accessible to all. This means working with all organizations that hold information, or that create new knowledge, related to agriculture, and helping them to make it more accessible and to disseminate it more efficiently.

The CIARD vision is *"To make public domain agricultural research information and knowledge truly accessible to all."*

The organizations that participate in CIARD endorse the Manifesto, evaluate their information management practices against the Checklist of good practices, share and follow the Pathways towards better accessibility of information, contribute case studies and register their information services in the CIARD RING. These tools and applications have been developed through a series of consultations among, and through the consensus of, CIARD partners. AARINENA is member of CIARD.

Following the CIARD Checklist and Pathways and participating in the CIARD RING contributes substantively to improving the management of agricultural information for open accessibility at the levels of Institute/Organization, National Agricultural Research System, region and international. When used jointly by all NARS organizations at the national level, information flows within a country, because of use of standards, and guidelines and pathways, can be governed better and virtually aggregated enabling more effective use.

The CIARD RING provides a global signpost to publicly accessible agricultural information through the use of a metadata-based directory. Almost a million full text documents, 3 million bibliographic details, and several databases, are registered with the CIARD RING from all over the world.  National RINGS can be developed using the CIARD.RING as a guide and template, in order to improve regional and sub-regional collaboration amongst them.

A West Asia and North Africa Regional Workshop on CIARD was organized by AARINENA, FAO, CGIAR and GFAR in May 2009.  Participants recommended that more advanced training was needed by those

registering as members of CIARD to not only use CIARD concepts effectively but also to advocate and build improved skills to participate better in CIARD and enable users to make more effective use of information, including that accessed through the CIARD RING.

AARINENA, with support from FAO and GFAR, organized and hosted a CIARD Training Workshop in the WANA region in October 2011, in Amman, Jordan. The aim of the workshop was to train participants to become trainers within their organizations and countries, to improve skills to participate better in CIARD and enable users to make more effective use of information, including that accessed through the CIARD RING.

### 1.3 The context for CIARD in the Ministry of Agriculture and Fisheries

The CIARD Manifesto and Values were introduced in 2009 and 2011 to the directors of the Ministry of Agriculture and Fisheries (MAF) research institutes, research scientists and management in the institutions. The directors and the institutions appreciated CIARD and declared formal support for the Manifesto and Values.

Ministry of Agriculture and Fisheries Network (MAFNET) and National Agricultural Knowledge Exchange Management System (NAKEMS) have registered their repositories with the CIARD RING. MAFNET and associated institutions are recognized as CIARD partner institutions.

The AICE centre is well established and equipped with computer facilities, with a server for its website and repository, internet links and data facilities. In addition three new staff were employed to improve capacity. It is an enabling environment to provide proper hands-on training and practice. IT equipment for developing and providing access to digital institutional repositories was provided to pilot institutions. AICE was established according to an implementation plan drawing on inputs from existing Departments within MAF, and functioning as an AGRIS Resource Centre and coordination unit for MAFNET and NAKEMS.

MAF has skilled staff to transform scientific information into different forms which can be used by other stakeholders, or the general public. The Ministry's Department of Development Information has a staff of 15 and excellent audio-visual facilities and is mainly responsible for the production of a variety of information products (printed publications, videos, radio and TV programmes, posters, leaflets, etc).

Within the framework of MAF, MAFNET has formal arrangements for repackaging research outputs through the Department of Development Information. These arrangements include using TV and video, audio and newspapers, for communicating research outputs on a weekly basis in addition to using community-based meetings and events to disseminate the repackaged content on a monthly basis or whenever possible. They have succeeded in building a national network to repackage their research outputs and to institutionalize this task at national level.

MAFNET institutions will have to develop, adopt and validate formal ICM policies and strategies in the forthcoming expansion phase to national level which starts in 2012. MAF has already developed a communication strategy for development information and proceeding with its implementation.

MAFNET is playing a significant role in disseminating information and knowledge of MAF at institutional level. NAKEMS is also playing a considerable role at national and regional level and this is a vision of the MAF authorities and decision makers. This position coincides with the CIARD vision *"To make public domain agricultural research information and knowledge truly accessible to all."*

MAFNET has made progress in developing necessary institutional readiness and an approach to managing digital content, 'opening up' that content, and then communicating and disseminating it.

# 2. THE "STATE OF OPENNESS OF AGRICULTURAL RESEARCH FOR INNOVATION" IN THE MINISTRY

### 2.1 Institutional readiness

In close collaboration and partnership with FAO, the MAF has established and developed MAFNET, which consists of the major stakeholders and is coordinated by the AICE (Agricultural Information Centre), to share agricultural information resources and skills. It is a knowledge sharing and collaboration platform for the agriculture and fisheries sectors. National Agricultural Knowledge Exchange Management System (NAKEMS) has also been developed as a national gateway platform, in which MAF is a partner, and the network is looking forward to bringing on board more partner organizations (other ministries and universities, NGOs and NRIs).

Progress in institutional readiness for CIARD has been made as MAFNET (http://omanagriculture.net) and NAKEMS (http://nakems.omanagriculture.net) are now available online, and 28 modules (information systems) in MAFNET and 18 modules in NAKEMS are properly working and operational. MAFNET and NAKEMS are partners of CIARD and have registered in the CIARD RING. MAFNET/NAKEMS and associated institutions/organizations are recognized as CIARD partner institutions. Throughout the AICE project, MAF has developed the capacity to achieve and comply with the CIARD checklist for institutional readiness.

The Sultanate of Oman has a grand vision of transforming Oman into a sustainable knowledge-based economy. This vision began with setting the economic vision for the Sultanate towards the year 2020, to which the Digital Oman Strategy, endorsed in March 2003, contributes in terms of developing the Omani Digital Society and e-government. Giving attention to human resources, including the provision of the various tools required to enhance their performance, incentives to develop their capabilities, diversifying their creative talents, and improving their scientific and practical qualifications, are the basis of real development on solid foundations. The head of state directed the Government to simplify processes, adopt technology in its daily operation, and focus on electronic delivery of its services. Accordingly, the e-Oman strategy was put in place in 2006-2010 and was revised to place more focus in the next five years (2011-2015) on the following areas:

1. IT industry Development: Increase competency of Omani IT manpower, enable growing Omani IT businesses particularly Small and Medium Enterprises and creating jobs
2. Enabling Society and individuals: Drive digital literacy and IT skills while enabling society's use of digital technologies and connectivity
3. e-Government and e-services: Increase delivery, integration and quality of electronic Government services and drive their adoption by citizens, residents and businesses

As set in the Royal Decree, the Information Technology Authority (ITA) aims at consolidation and activation of government policies to transform the Sultanate into a knowledge–based economy for achievement of social and economical benefits to Omani society by using this technology "within" the policies of economic diversification and sustained development.

The main factors driving the MAF into this direction:

- The Government has recognized the value of the exchange of information and knowledge among key stakeholders in agricultural research and development and the importance of expanding the use of modern information and communication technologies (ICT) and management (ICM) to facilitate sustainable agricultural development in the Sultanate of Oman.
- The Government has realized that reliable agricultural information constitutes a cornerstone in the planning of agricultural development and formulating relevant policies for enhancing food security and reducing rural poverty. The availability of this information is critical in order to enable those involved in the agriculture sector, whether they are individuals or institutions, to make decisions on valid and scientific bases.

In 2008/2009 the available agricultural information in Oman was inadequate as a result of many factors, in particular:

- Lack of adequate information management and communication between decision makers and researchers in the various sectors in MOA/HQ and staff at MAF/Regional offices, representing a significant handicap to properly addressing the issues of agricultural development.
- Inadequate co-ordination among various agricultural research institutes, programmes and personnel.
- Inadequate linkages between researchers and extension officers in the various research and extension sectors in MAF/HQ and MAF/Regional offices to provide the appropriate advisory services for farmers.
- Variety of institutions that collect agricultural data and information, and the diversity of methodologies used, leading to incomplete, fragmented information.
- Lack of coordination and collaboration between institutions concerned with data collection and information provision on the one hand, and information users in the public and private sectors on the other.
- Lack of certain types of data and information required in support of the development of the agricultural sector.
- Urgent need to establish a virtual network of agricultural institutions including HQ and Regional offices accessible through a national portal.
- Imperative needs for institutional and human capacity building in the field of information management and knowledge exchange.

The MAF did not have a systematic approach to the effective management and dissemination of the information it produces. Several databases and document collections exist in MOA, but they are not standardized and not easily accessible. The Ministry has a website (http://www.MOA.gov.om/ in Arabic; an English version was not available) which is maintained by one person reporting directly to the Undersecretary. The MAF Department of Information Technology is responsible for maintaining the Ministry's computer hardware and software, and conducting IT training courses for employees.

The common vision, derived from the above-mentioned observations, was to establish an agriculture information centre, acting as the coordinating unit of a national agricultural information system, which will be developed to assemble and make accessible all information and knowledge that will:

- Support policy and decision-making in relation to national planning;
- Support research and development, and disseminate the outputs;
- Support extension services;
- Provide an institutional memory for MAF.

The establishment and maintenance of the proposed centre and system will be a long-term project, and will be in line with the on-going key initiatives of the Information Technology Authority (ITA) in implementing Oman's digital strategy (e-Oman).

Within the MAF, the Minister, the Under-secretary of Agriculture, and the Director General of Agricultural Research have championed this development. It was noted that there was great interest of the various stakeholder institutions in the establishment of the AICE and the development of MAFNET and NAKEMS, as manifested during the consultative meetings and training workshops which were well attended and successfully conducted during this project life cycle. The commitment of MAF to provide project support and coordination, and the teamwork of the project staff and coordination team were also evident. However, the successful implementation for content development was led by the Ministry's Department of Development Information.

The digital agenda was not only driven from within the MAF but also was in line with the ongoing key initiatives of the Information Technology Authority (ITA) in implementing Oman's digital strategy (e-Oman) in general and e-government services in particular.

The Sultanate's progress in the field of IT was recognized by the various international reports of the UN and others and also had won numerous awards. It ranked 55th among 192 countries in e-government services and 19th in e-government readiness in the international IT report 2009/2010 issued by the World Economic Forum, advancing 20 points from that in the 2008 report.

The Sultanate won the UN award for public service, which is considered the highest global appreciation award in the field of e-services awarded to distinguished service projects. This is besides 34 awards for e-projects of various government institutions. The Sultanate, through the ICT and e-government strategy,

which is in line with the approved international standards of the World Organization of the Information Society, sought to realize the millennium goals related to the sector.

The Sultanate of Oman has embarked upon its ambitious strategy/journey in transforming Oman by empowering its people, through the e-Oman initiative, besides opening up thousands of job opportunities for nationals in the IT sector. The goal includes a significant improvement in the quality of services the Government provides to its citizens.

The positive factors in these digital organizational developments that have taken place are as follows:

- The strong commitment of Government demonstrated by its budgetary allocations to the project, within the context of e-Government, as directed by policy makers in the country,
- Development of technology that is capable of meeting the current and future needs of the project,
- With the support provided by H.E. the MAF Minister, project staff have been able to play a strong leadership role in managing the project coupled with a clear understanding of the project objectives and goals,
- Strong access of ministry staff to input and modification of the information available on the web site,
- The project has a very strong base of trained staff that is capable of managing and sustaining the system, thus the project has exceeded the human resources training targets, within the same budget reflecting a very successful financial resources management effort. The project has developed the capacity to provide inputs in support of policy development and planning activities within MAF. This provides an excellent basis for launching phase two of the project without further delays,
- The project enjoyed a very strong commitment from MAF top policy makers, management and the project coordination team. The project has thus established a new model in the Near East region for a successful Information System project in the agricultural sector.
- The project has by far exceeded all its planned targets and has developed an information exchange system with multiple modules capable of meeting the project present and future requirements. The pilot MAFNET exceeded its original targets from 11 to 44 modules. The pilot NAKEMS has been developed, which provides an excellent base for widening the range of outputs from the first phase. Moreover, the project has established a strong ICT foundation that can eventually contribute to the improvement of agricultural research & development and of farmer's livelihoods.

The negative factors in these developments have been as follows:

- Slow internet infrastructure has led to poor communication and slow project progress. MAF needs to enhance the capacity of the servers supporting the system to overcome the existing constraints,
- There is a need to strengthen the institutionalization of project structures for effective information management and knowledge exchange in support of agricultural and rural development,
- The project has also suffered from the hesitation by the fisheries department in joining the project initially. This hesitation has caused further delays in integrating the system to become inclusive of all the departments of the Ministry,
- While great efforts were made to input research publications, there have been limited efforts in transforming the research publications into technical packages that can help farmers solve their constraints,
- While the first phase did not include any focus on solving farmers problems and the sustainability of production systems, the second phase will have its prime focus on solving these farmers problems, and
- While the MAF web system/network has unlimited capacity to cover the knowledge and information system necessary for supporting production systems of the plant, animal, and fisheries sectors, the fisheries sector has been so far absent from the site. There is need to integrate the information related to regional and districts levels.

Analysis of MAFNET activities towards developing institutional readiness, using the CIARD Checklist:

| | Checklist Items | MAFNET |
|---|---|---|
| 1. | Introduce and gain support for the CIARD Manifesto and Values in your institution. | The CIARD Manifesto and Values were introduced to the directors of the MAF's research institutes in 2009. In addition, workshops held in MAF in 2011 with significant participation of associated institutions also introduced the Manifesto and Values to research scientists and management in the institutions. The directors and the institutions appreciated CIARD, and declared formal support for the Manifesto and Values. |
| 2. | Have your institution recognized as a CIARD partner | MAFNET is a CIARD partner and has registered its repository in the CIARD RING. MAFNET and associated institutions are recognized as CIARD partner institutions. |
| 3. | Adopt a formal institutional information/communication strategy | MAFNET institutions will have to develop, adopt and validate formal ICM policies and strategies in the forthcoming expansion phase to national level which starts in 2012. MAF has already developed a communication strategy for development information and is proceeding with its implementation. |
| 4. | Develop the capacities of your institution to achieve the CIARD Checklist | MAFNET (http://omanagriculture.net) is now available online and 28 modules (information systems) are properly working and operational.<br><br>IT equipment for developing and providing access to digital institutional repositories was provided to pilot institutions. MAF Agricultural Information Centre (AICE) of Oman has been established according to an implementation plan drawing on inputs from existing Departments within MAF, and functioning as an AGRIS Resource Centre and coordination unit for MAFNET and NAKEMS.<br><br>The AICE centre is well established and equipped with computer facilities and three staff employed to improve ICT capacity. It is an enabling environment to provide proper hands-on training and practice.<br>Further, information professionals and IT specialists were equipped with skills to enable them to create and manage metadata and associated digital documents, manage MAFNET websites, develop institutional repositories, and understand issues relating to open archives and Open Access initiatives. |
| 5. | Develop national/local partner networks to share resources and skills. | MAFNET has been established, consisting of the major stakeholders, and coordinated by the AICE of MAF, to share agricultural information resources and skills. It is a knowledge sharing and collaboration platform for the agriculture and fisheries sectors. NAKEMS has also been developed as a national platform; MAF is only a partner and the network is looking forward to bringing on board more partner organizations.<br><br>A good model was provided in developing NAKEMS as a national system that includes MAF and other national organizations and partners in Oman in order to keep NAKEMS as a genuine national gateway system. Meanwhile, the MAF web information management system dedicated only for MAF and its institutions was developed and operational online. Both systems communicate with each other through web services technology. The MAF stakeholders are only required to feed the MAF web information management system with content which will then be reflected in the NAKEMS system by harvesting and an RSS aggregator.<br><br>Developed stakeholder skills in the application of information |

| | Checklist Items | MAFNET |
|---|---|---|
| | | management systems and tools, to facilitate information generation, management, dissemination and exchange. Raised stakeholders' awareness for improving linkages and sharing information and knowledge between researchers and other stakeholders using the MAFNET network; and raised awareness of strategic aspects of information and knowledge in the context of development of MAFNET. <br><br> The project made considerable progress with regards to all project components and clearing all relevant issues as project duration and work plan revision, AICE Centre establishment, hardware items for building network infrastructure, training activities, institutional restructure and development for improving networking and content development. All the project components are implemented. For the remaining part of the project's duration heavy emphasis was placed on stakeholders' contributions for content development in MAFNET network. <br><br> The interests of the various stakeholder institutions in establishing an Agricultural Information Centre, their willingness to cooperate and contribute to this project as well as the commitment of the MAF to provide support and coordination, are evident for ownership and sustainability. |

## 2.2 Availability, accessibility and applicability of research outputs

Analysis of MAFNET activities towards availability, accessibility and applicability of research outputs – using the CIARD Checklist:

| | Checklist Items | MAFNET |
|---|---|---|
| 6. | Ensure that your research outputs are available digitally | All MAFNET institutions have the capacity to digitize their research documents. Institutions have put in place a mechanism for capturing born digital documents. Document workflows to facilitate the capture of research documents in digital format at source have also been implemented. <br><br> All types of documents/objects being captured build on an overall digital plan/strategy proposed by FAO and approved by steering committee and all stakeholders in 2009. <br><br> The organization's digitization programme includes older documents that were originally produced in pre-digital formats (e.g. print on paper) <br><br> The MAF organization has a formalized, managed system for this data capture as part of an overall digital strategy in collaboration with FAO staff that played a significant role in encouraging stakeholders to proceed in this direction and getting the decision makers' support to continue the project, and even to extend it for phase two as planned. In addition, stakeholders were pleased and proud to see their outputs available and disseminated on the internet. . It was astonishing to see that one of their videos related to extension was seen by 3000 people and the media centre was visited by 81,000 visitors in December 2011. |

| | Checklist Items | MAFNET |
|---|---|---|
| | | |
| 7. | Develop institutional or thematic repositories of your outputs as open archives. | All 21 institutions in MAFNET developed institutional repositories based on AGRIS tools and methods (Web-DIMS and AGROVOC) and are Open Archives.<br><br>The MAFNET network institutions are yet required to develop and document a policy to govern all aspects of the repository's activity regarding what types of information are captured, how long they are kept there, what formats the data must be in, quality control, copyright control, and so on. It is anticipated to proceed with the development of an information strategy in the second phase (2012- 2013) and information policy will be documented within the framework of information strategy development. It is worth noting that during the inception workshop of phase one in 2009, stakeholders identified key issues regarding information needs (internal and external), availability and accessibility within the framework of the establishment of an agricultural information centre. During the project implementation workshops and consultative meetings, the focus was on software requirement specifications including type of information to be captured, type of data format required and quality control. Copyright was not raised because at this stage there was no data to worry about.<br><br>The assessment of the use of the repository (documents deposited, hits, downloads, etc) in a planned way was not in phase one. It is anticipated to plan this issue in phase two (2012-2013) to allow for informed decisions to be made on how to manage it and develop it further.<br><br>Great efforts were made to input into MAFNET, during the first phase (2009-2011), 100% of information products related to agriculture including extension bulletins/brochures, leaflets, posters, videos, and audios, projects, experts, success stories, news, and events in various disciplines. However, the first phase was not capable of meeting expectations and saw limited input of data (50%) and especially of research and extension data. While great efforts were made to input research publications, there have been limited efforts in transforming the research publications into technical packages that can help farmers solve their constraints.<br><br>A work plan was prepared proposed by FAO in collaboration with the project technical steering committee and implemented by stakeholders groups based on the source of knowledge generated by various departments in MAF, in addition to the institutional restructure and development proposed by FAO. A comprehensive Training of Trainers programme was provided for stakeholders in various disciplines in MAF to build their capacity and to ensure sustainability. Online Question and Answering Services in content development were opened for all stakeholders, for support. FAO advised the MAF authority to recruit two persons (one man and one woman) in the agricultural information center at the beginning of phase one. Now they have 4 full time persons (three women and one man) who are well trained and dedicated. In addition, another 3 persons from the Ministry's Directorate of Agricultural Research and 10 persons from the Ministry's Department of Development Information are also committed for work on feeding the network on a daily basis with many information products including generating success stories for knowledge sharing for development. |

| | Checklist Items | MAFNET |
|---|---|---|
| | | The concept of 'open' information was accepted by everyone in MAF as they believe very much in information dissemination and knowledge sharing. Everyone was in full agreement with this argument and nobody was against it. |
| 8. | Use international metadata standards, data exchange protocols and agricultural vocabularies and thesauri. | FAO developed Document Information Management System (Web-DIMS) which is an institutional document repository that contains all the information about publications and keeps track of publications authored by researchers and other experts. Each publication has specific data such as abstract, authors, keywords and full text, if available. Web-DIMS is a fully dynamic web-based application developed using an advanced open source software technology (MySQL open source software, Agricultural metadata element set, AGRIS Application Profile, AGROVOC Thesaurus Arabic/English/French, xml metadata, AGRIS AP, multiple import and export in AGRIS AP format, a certified Open Archive Initiative) for facilitating Interoperability and promoting coherence in knowledge management and information exchange among NARS and for increasing the visibility and diffusion of the institutionally produced publications at national level.<br><br>This system was one of the components integrated in MAFNET that is being used in all the Oman MAFNET institutions. MAFNET is fully compliant with New AGRIS Initiative and international standards.<br><br>*Web-DIMS* is a web-based, fully multilingual (Arabic/English/French) documents repository system at institutional level for capturing and disseminating information on technical reports, publications and documents produced by the entire institution. The *WEB-DIMS* system provides a front-end for browsing and searching and a backend for storing and updating publications data. |
| 9. | Develop a clearly defined licensing policy for your outputs | MAFNET partner institutions are yet to review and redefine the licensing policies for their research outputs.<br><br>However, the researchers are encouraged to publish their works with publishers who are either open access publishers, or allow the author flexibility in the deposit of the work in open access repositories. |
| 10. | Optimise the structure and the content of your web sites for search engines. | The MAFNET website has been optimized for search engine access. Google Custom Search Engine was used to create a search engine and host it on the site using the Custom Search element to optimize the MAFNET website search engine access. An XML sitemap was created to assist search engine spiders in crawling and indexing the site. *Google* XML Sitemaps reveals the structure of the site's content in a transparent way for search engines and notifies them periodically on the updates.<br><br>Outputs such as documents, projects, experts, and institutions are optimized so that metadata and full content can be harvested and shared across different platforms and applications, and they can be incorporated into other systems and services. It is designed and built to make outputs easy to find and share and open as much as possible, so others are free to use, reuse, and redistribute them, with appropriate acknowledgement and without restrictive legal, technological or financial barriers. |
| 11. | Share your metadata by participating in | Metadata from the network members of MAFNET is harvested automatically by the Knowledge Harvester Ring and the CIARD RING. |

|  | Checklist Items | MAFNET |
|---|---|---|
|  | international information systems | AGRIS Network can harvest metadata automatically from the Knowledge Harvester. RSS aggregator (automatic aggregation from RSS feeds) is used to automatically harvest metadata of news, events, institutions, projects, researchers and experts, good practices, success stories, country reports and other modules in MAFNET.<br><br>Researchers are encouraged to publish their work in Open Access journals<br><br>The researchers are encouraged to publish their work in journals which are part of collections which are freely available or available at low cost, to researchers in developing countries e.g. AGORA, PERii, etc.<br><br>There is a need to set up a policy to encourage researchers to publish in Open Access and other 'high visibility' places. This policy was not introduced in the first phase which was mostly an introductory phase for building information infrastructure in MAF institutions. Advocacy workshops on this issue are required in the forthcoming phase in addition to setting up this policy as part of an information strategy.<br><br>The research outputs of the organization are indexed and harvested in AGRIS international database.<br><br>The research outputs of the organization are indexed and catalogued using AGRIS Application Profile and harvested by AGRIS international database using OAI-PMH (Not Qualified Dublin Core Protocol). |
| 12. | Use 'social networking' media and applications to share your outputs. | The use of social network media for sharing research outputs in the MAFNET partner institutions is yet to be implemented. A forum and blog have been implemented on the site and they will be utilized in the expansion phase in 2012. YouTube was also introduced for MAFNET stakeholder institutions. |
| 13. | Build formal and informal networks to repackage your outputs. | MAF has 15 skilled staff available in the Development Information Department who transform scientific information into different forms which can be used by other stakeholders, or the general public. The Department has excellent audio-visual facilities and is mainly responsible for the production of a variety of information products (printed publications, videos, radio and TV programmes, posters, leaflets, etc). The project provided good opportunities for a functional physical communication infrastructure to be developed with suitable software adapted to current and future needs. Moreover, a core of senior staff has been trained and preliminary organization and management structure has been established. In addition MAFNET and NAKEMS have been developed, which provide an excellent base for widening the range of outputs from the first phase.<br><br>Within the framework of MAF, MAFNET has formal arrangements for repackaging research outputs through Development Information Department. The arrangements include using TV and videos, audio and newspapers for communicating research outputs on a weekly basis, in addition to using community based meetings and events to disseminate the repackaged content on a monthly basis or whenever possible. They have succeeded in building a national network to repackage research outputs and to institutionalize this task at national level.<br><br>Knowledge has three levels - local, regional and international. The project has made significant efforts to input information and extension |

| Checklist Items | MAFNET |
|---|---|
| | products and available research publications However, the project needs to move from research publications to translating research results into technical packages that can be adopted by farmers to improve the productivity of their production systems. The system also needs to input extension messages that can help farmers to solve their immediate problems.<br><br>For these outputs to be developed the project needs to institutionalize a committee that groups the research and extension managers to formulate these technical packages and extension messages for farmers. Such a committee would also be responsible for the selection of relevant regional and international research findings to be inputted into the system to expand users' access to relevant knowledge sources. |

# 3. KEY ISSUES AND CONCLUSIONS

**3.1 Benefits and challenges**

An agriculture information centre (AICE), has been established and is acting as the coordinating unit of MAFNET and NAKEMS, which have been developed to assemble and make accessible all information and knowledge that will: support policy and decision-making in relation to national planning; support research and development, and disseminate the outputs; support extension services; and provide an institutional memory for MAF. The interest of the various stakeholder institutions in establishing an Agricultural Information Centre, their willingness to cooperate and contribute to this AICE/MAFNET project, as well as the commitment of MAF to provide support and coordination, all contribute to ownership and sustainability.

MAFNET was designed as an integrated information management system aiming at strengthening research through the sharing of information. It enables agricultural researchers and experts to carry out research more effectively by creating access to research information from Oman and elsewhere. It is expected that its full implementation will lead to efficient utilization of human, material and financial resources. The system will also prevent duplication of research, enhance coordination among various agricultural research personnel, and assist research directors in monitoring the achievements of current research plans as well as in formulating new ones.

MAF's Researchers are working in participatory networks with other key stakeholders (Government, farmers, extension, etc.). Through MAFNET innovation, in this context, will be stimulated by working in such participatory groups from the initial stages of research planning through to the end results of communicating outcomes to serve farmers' needs and requirements.

Knowledge has three levels, local, regional and international. The project has made significant efforts to input information and extension products and research publications. However, the project needs to move from research publications to translating research results into technical packages that can be adopted by farmers to improve their productivity. The system also needs to input extension messages that can help farmers to solve their immediate problems.

For these outputs to be developed the project needs to institutionalize a committee that groups the research and extension managers to formulate these technical packages and extension messages for farmers. Such a committee would also be responsible for the selection of relevant regional and international research findings to be inputted into the system to expand users' access to relevant knowledge sources'.

The system needs to input the fisheries sector research and extension data since fisheries so far has not yet joined AICE. This would require the designation of specific institutional structures within the fisheries sector that will be in charge of this task. The project should provide capacity building for the core staff of the fisheries sector to perform these tasks efficiently.

Within MAF there is a very vocal and active group working on gender issues in the Sultanate. Their programmes and projects need to be reviewed to ensure maximum synergies with the other programmes of MAF. For this to happen we need to consider establishing a gender board within MAF that includes managers of other departments within MAF as well as outside such as universities, NGOs, private sector, and civil society institutions. This board will ensure that technical packages and extension messages inputted into the system are gender sensitive and take into account the needs of both male and female users. Currently the programme focuses on promoting small scale enterprises among women, which is commendable, however gender needs to address other issues as well to gain strength among the communities of men and women.

MAFNET is playing a significant role in disseminating information and knowledge of MAF at institutional level. NAKEMS is also playing a role at national and regional level and this is a vision of MAF authorities and decision makers. This position coincides with the CIARD vision *"To make public domain agricultural research information and knowledge truly accessible to all."*

MAFNET has made progress in developing necessary institutional readiness and approaches to managing digital content, 'opening up' that content, and then communicating and disseminating it. MAF is very willing

to continue achieving stepwise progress on this important task in collaboration with FAO. Work on licensing content is yet to be considered.

The AICE/MAFNET/NAKEMS project has a very strong base of trained staff that is capable of managing and sustaining the system, thus the project has exceeded the human resources training targets The project has developed the capacity to provide inputs in support of policy development and planning activities within MAF. This provides an excellent basis for phase two of the project.

As the MAFNET/NAKEMS system was launched in March 2012, the major challenge for MAF and ARC for sustainability is to enforce institutional development introduced during the project and to ensure that the stakeholders actually will start reaping the potential benefits, and will be able to continue to do so in the future. The next challenge will be to expand MAFNET so as to include relevant research institutions from outside the ARC, and thus turn it into a truly national system.

The project enjoyed a very strong commitment from MAF top policy makers, management and project coordination team for the success of the project. The project has thus established a new model in the Near East region for a successful Information System project in the agricultural sector.

While private sector activities in farming, fisheries and forestry are very strong, there is very little connection between research and extension agendas with these activities. There is a need to encourage the private sector to invest in research and extension either directly or indirectly to generate relevant technical packages and extension messages that can boost productivity and profits. MAF will have to open up its institutional structures to include representatives of the private sector and the universities as well as civil society organizations.

### 3.2 Key lessons

Key lessons learned during the implementation phase of MAFNET and NAKEMS included: (i) the need to create an enabling environment that recognizes the value of connectivity; (ii) institutionalization of networks; (iii) networks depend on and work with people and not on technology alone; (iv) locally adapted content and context; (v) the need to ensure sustainability and self-financing; (vi) acquiring a knowledge-sharing culture that is based on collaborative methods and exchange mechanisms; (vii) the need to network facilitation with face-to-face meetings; (viii) partnership with national, regional and international organizations. The elaborations on these key lessons are as follows:

- **Enabling Environment:** An information and communication technology policy that recognizes the value of connectivity and the importance of telecommunications infrastructure is necessary before implementing an institutions-based network-style system. MAFNET and NAKEMS are partners of CIARD and have registered its repository with the CIARD RING. MAFNET/NAKEMS and associated institutions/organizations are recognized as CIARD partner institutions. MAF has continued to develop the capacity for institutional readiness for openness of agricultural research for innovation to achieve and comply with the CIARD Checklist.

- **Institutionalization:** Implementation of the network should be seen as a new way of working within institutions and not simply as a project. As such, it needs to be embedded at the institutional level – fully part of work procedures, in staff work plans and budgets, and systematically monitored to assess results and impact. The major challenge for MAF and ARC is to enforce institutionalization and institutional development introduced during the project and to ensure that the stakeholders actually will start reaping the above-mentioned potential benefits, and will be able to continue to do so in the future. The MAF decision makers are fully aware of this important issue and are working on it using stepwise modality. The network will not be sustainable if it is not managed and if benefits are not fully recognized. Champions at all levels are a driving force.

- **People, Not Only Technology:** Networks work with people. People need trust to work together and share their information and knowledge. An appropriate mix of human and technological dimensions should be put in place. Technology must be user-friendly and accessible and serve the users' needs. Trust, useful information and knowledge, with appropriate support from good communication, will make the network a success. The interest of the various stakeholder institutions in establishing an Agricultural Information Centre, their willingness to cooperate and contribute to this AICE/MAFNET project as well as the commitment of the MAF to provide support and

coordination, are evident for ownership and sustainability. The project has a very strong base of trained staff that is capable of managing and sustaining the system, thus the project has exceeded the human resources training targets.

- **Locally adapted content and context:** MAFNET contains agricultural research information and other information resources produced in Oman. The content of each module is mapped to the relevant MAF/ARC institutions. Personnel from each institution are responsible for data entry and verification, in order to guarantee commitment and quality of content. The records in the "Publications" module and other information products (institutions, experts, and projects, success stories, good practices, rural women, laws and agreements, facts and figures, news and events, focal points, and other modules) are reviewed by trained personnel to ensure they are correct and conforming to standards.

Knowledge has three levels, local, regional and international. The project has made significant efforts to input research publications, however it needs to move from research publications to translating research results into technical packages that can be adopted by farmers to improve the productivity of their production systems. The system also needs to input extension messages that can help farmers to solve their immediate problems.

For these outputs to be developed the project needs to institutionalize a committee that groups the research and extension managers to formulate these technical packages and extension messages. Such a committee would also be responsible for the selection of relevant regional and international research findings to be inputted into the system to expand users' access to relevant knowledge sources.

The system needs to input the fisheries sector research and extension data since fisheries so far has not yet joined AICE. This will require the designation of specific institutional structures within the fisheries sector that will be in charge of this task. The project should provide capacity building to the core staff of the fisheries sector to perform these tasks efficiently.

- **Sustainability:** Capacity building, institutional development, organizational restructuring, collaboration and team work played important roles in overcoming difficult issues and reaching a sustainable phase. Business plans should be prepared and implemented to ensure sustainability and self-financing after completing the project. Government support and/or external funding are being sought for expansion and sustainability. Special attention should be given to organization restructuring in MAF to establish an information unit for each individual institution to facilitate content development and information flow. It represents a major challenge for ownership and sustainability. The project enjoyed a very strong commitment from MAF top policy makers, management and project coordination team for the success of the project. The project has thus established a new model in the Near East region for a successful information system project in the agricultural sector. The project has developed the capacity to provide inputs in support of policy development and planning activities within MAF. This provides an excellent basis for phase two of the project.

- **Knowledge Sharing Culture:** Knowledge sharing is often a challenge because of the inclination to work in "closed" environments. A culture conducive to sharing requires the commitment of senior management and cross-functional collaborative planning. A knowledge sharing culture should be fostered through a strategy that might include capacity building in collaborative methods, communication for development tools, and exchange mechanisms.

- **Network Facilitation:** Exchange and information flows need to be promoted between the system stakeholders. A pro-active coordination team can promote and facilitate information exchange and communication among the actors. Face-to-face meetings are also crucial to capitalize on exchange and stimulate new ways of working. A dynamic human network is a fundamental aspect of the rural network model. The national counterparts, consisting of the National Project Coordinator and national project stakeholders/trainers and national consultants, are working well as a team. The project Steering Committee, under the leadership of the National Project Coordinator and the Under-Secretary of MAF, is also active in providing guidance and support to the AICE/MAFNET project.

- **Partnership:** The benefits of national partnerships in the development of networks are: (i) a collaborative system and effective communication, (ii) exchange of information and knowledge, (iii)

enhanced technical cooperation, (iv) reduced costs of operation, (v) synergies in information management, and (vi) use of agreed standards, methodologies and tools. It is anticipated to extend the stakeholders horizontally in the expansion phase of MAFNET as it has been decided to establish 150 rural knowledge centres through the new proposed project "Oman Rural and Agricultural Development Communication Network" and to work closely in partnership with other organizations such as the Ministry of Environment, the Ministry of Municipality and Water Resources, and the University of Sultan Qaboos in Oman.

Within MAF there is a very vocal and active group working on gender issues in the Sultanate. Their programmes and projects need to be reviewed to ensure maximum synergies with the other programmes of MAF. For this to happen we need to consider establishing a gender board within MAF that includes managers of other departments within MAF as well as outside such as universities, NGOs, private sector, and civil society institutions. This board will ensure that technical packages and extension messages inputted into the system are gender sensitive and take into account the needs of both male and female users. Currently the programme focuses on promoting small scale enterprises among women, which is commendable, however gender needs to address other issues as well to gain strength among the communities of both men and women.

While the private sector activities in farming, fisheries and forestry are very strong, there is very little connection between research and extension agendas with these activities. There is a need to encourage the private sector to invest in research and extension either directly or indirectly to generate relevant technical packages and extension messages that can boost productivity and profits. MAF will have to open up its institutional structures to include representatives' of the private sector and the universities as well as civil society organizations.

## Annex 1. Research Outputs and Audiences

Table 1. Research Outputs in MAFNET

| Research Outputs in Ministry of Agriculture and Fisheries Network (MAFNET) |
| --- |
| • Books, chapters or monographs<br>• Articles in scholarly journals or conference proceedings<br>• Teaching resources<br>• Theses<br>• Research reports commissioned<br>• Annual reports<br>• Papers or articles (informal, non-peer reviewed)<br>• Film/Audio/Video (describing research outputs)<br>• Film/Audio/Video (describing extension outputs)<br>• Radio or Television reports (describing research outputs)<br>• Databases and Datasets (e.g. statistics, maps,  chemical formulae, geospatial information) |

Table 2. Audiences for MAFNET

| Audiences for Ministry of Agriculture and Fisheries Network (MAFNET) |
| --- |
| • National researchers (Government, university, private sector)<br>• Extension agents<br>• Farmers, producers (individual and associations)<br>• Non-governmental organisations and other civil society groups<br>• Academic groups (lecturers and students)<br>• International Researchers (CGIAR centers and other international research institutes)<br>• Public policy-makers<br>• General public |

**Annex 2. Relations between NAKEMS and MAFNET Using RSS Aggregator**
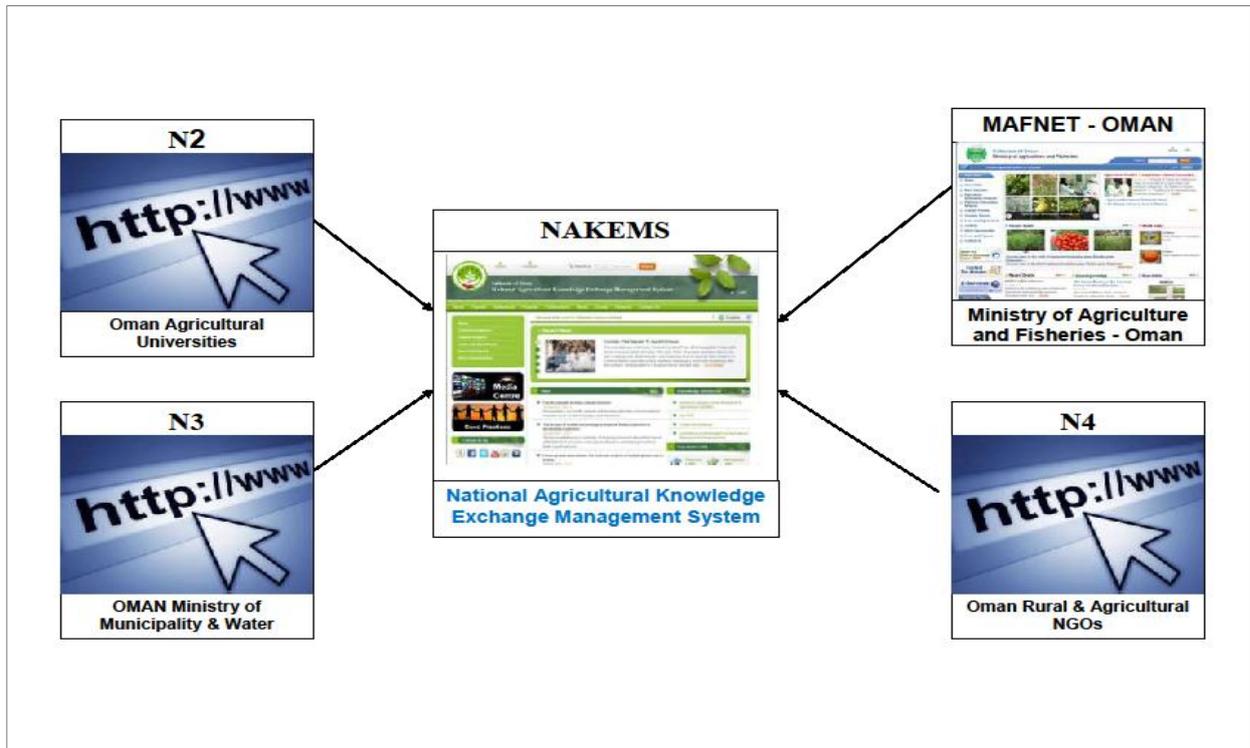
## Appendix 1.

**Research and development organization and personnel**

The Sultanate of Oman Government recognizes the importance of agricultural research to meet National Food Policy Objectives, which, at a minimum, aim at self-sufficiency in food production. Agricultural Research Stations were established in different areas of the Sultanate with a specific mission and objectives.

The Directorate General of Agricultural Research (DGAR), under the Ministry of Agriculture and Fisheries, has its headquarters in Muscat and several Research Stations or Farms (RSF). DGAR addresses the research problems of commodities or factors of production, while the sub-RSF focus on identification and diagnosis of production problems in various agro-ecological zones and adapt technologies for increased production at the farm level.

Pasture and animal production research is carried out at several RSFs including those dealing specifically with range research and arid land improvement. While most pasture research is undertaken by DGAR, some limited work is carried out collaboratively with international and regional organizations, the universities, and NGOs interested in pastures and livestock development. Donors and technical agencies, such as FAO, UNDP, World Bank and ACSA, fund research and development programmes targeting improvement of Oman's pasture resources.

MAF is responsible for transfer of technologies to the farmers. Oman has a well-organized agricultural extension system that operates at national, provincial and farm levels. There are many agricultural development centres (ADC) throughout Oman where farmers are trained on various aspects of farming, including improvement of forage resources. There are agricultural colleges and specialized agricultural cadres working on technologies related to forage production. Most research and extension personnel have been exposed to the Farming Systems Approach adopted by MAF.

All collaborators (donors) supporting research programmes are in agreement with MAF regarding the need to improve research activities and methodologies. Al-Rumais Agricultural Research Station is well connected with a number of regional and international research organizations as shown by the large number of collaborative research activities, including seed technology and biodiversity of pasture plants.

Technologies for the improvement of pasture resources have been developed and are available for small-scale farmers. Promising pasture grasses, legumes and fodder seeds are available for intensive and extensive pasture improvement in various agro-ecological zones. Various management and utilization packages have been developed. Notable breakthroughs have also been made in the fields of animal nutrition, livestock management, disease control, artificial insemination practices and animal breeding. A large number of pasture grasses, legumes and fodders have been collected in Oman and stored in the National Gene Bank at Al-Rumais Agricultural Research Station.

Oman has keen and receptive farmers demanding new ideas and technology. The willingness of farmers to participate in on-farm trials, and to learn, demonstrates their interest in contributing to the development and dissemination of new technologies for pastures. There is opportunity to further improve forage species seed production technologies.

Some pasture research work is being undertaken by the technical staff of the Seeds and Genetic Resources Laboratory in Oman in collaboration with ICARDA. The Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA) has participated in printing and distribution of research results.

The Government extension agents in the Ministry of Agriculture and Fisheries (MAF) support farmers through: (1) training and encouraging farmers to use new production technologies, greenhouses, agricultural mechanics, modern irrigation systems, plant protection & post harvest technologies; (2) conveying research results to farmers; and (3) educating farmers to use scarce resources efficiently.