



CASE STUDY

**Jordan:
The National Agricultural Information System/Network
(NAIS)**

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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
JAIC	Jordan Agricultural Information Centre
AIS	Agriculture Information System
CGIAR	Consultative Group on International Agricultural Research
CIARD	Coherence of 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
MOA	Ministry of Agriculture of Jordan
MOA NET	Ministry of Agriculture of Jordan's Network
NARIMS	National Agricultural Research Information Management System in Egypt
NAIS	National Agricultural Information System in Jordan
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
RAIS	Regional Agricultural Information System
RADCON	Rural and Agricultural Development Communication Network in Egypt
RING	Routemap to Information Nodes and Gateways (RING)
RNE	Regional Office for the Near East, FAO of the United Nations
RSS	Rich Site Summary (dubbed: Really Simple Syndication)

EXECUTIVE SUMMARY

The National Agricultural Information System/Network (NAIS) of Jordan is an integrated, bilingual (Arabic/English) institutions-based web platform for information and knowledge sharing and exchange for agricultural research and development for the Ministry of Agriculture (MOA). It is aimed at capturing and disseminating information about MOA institutes, experts and researchers working in those institutes, publications issued by those researchers, completed or currently active projects, national plans on agricultural and agricultural research in Jordan, 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 sector.

NAIS was developed in partnership and collaboration with FAO within the framework of the Development of a National Agricultural Information System (NAIS) Project (TCP/JOR/3202), building on FAO tools and methodologies.

In the publications/documents module, NAIS has built documents repository and harvester based on AGRIS AP and the Open Archive protocol. The MOA stakeholders feed the NAIS web information management system with content which is managed automatically and is stored in the documents repository.

NAIS is a CIARD partner and the constituent institutions have registered their repositories with the CIARD RING. NAIS and associated institutions are recognized as CIARD partner institutions.

NAIS is playing a significant role in disseminating the information and knowledge of MOA at institutional level. It is also playing a major role at national and regional level and this achieves a vision of MOA. This role coincides with the CIARD vision "To make public domain agricultural research information and knowledge truly accessible to all."

NAIS has made progress in developing necessary institutional readiness and approaches to managing digital content, 'opening up' that content, and then communicating and disseminating it. MOA 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 NAIS project enjoyed strong commitment from MOA and NCARE senior policy makers, and the management and project coordination team, all of which helped to achieve the success of the project. NAIS has a very strong cadre of trained staff that is capable of managing and sustaining the system. As a result the project exceeded the human resources training targets, and within budget, reflecting a very successful financial resources management effort. The project has thus established a good model to be followed in the Near East region for a successful information system project in the agricultural sector.

The project has made some efforts to input information and extension products and research publications. However, the project still needs to make significant efforts to input further available information and extension products and research publications, and to move from research publications to translating research results into technical packages that can be adopted by farmers to solve their immediate problems, and to improve their productivity of their production systems.

This case study describes NAIS, provides a brief on progress towards openness of agricultural research for innovation, as expressed by the CIARD Manifesto and Checklist. It also 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 and widely accessible. Each organization follows its own approaches to sharing and exchanging information and adopts different information management practices. There is a great need for coherence in agricultural information management by all the concerned institutions at national and regional levels, 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 increase 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 NAIS developments took place with the support and partnership of the Food and Agricultural Organization of the United Nations (FAO), and the Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA) which is mandated to promote the development of National Agricultural Research Systems (NARS) in the WANA region and has been fostering the use of ICT/ICM in AR4D in the region through its program AARINENA Regional Agricultural Information System (AARINENA-RAIS). 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 an objective to improve partnerships and collaboration among NINPs so as to strengthen the capacities and skills of personnel to promote greater sharing of knowledge for scaling up innovations for agricultural development and food security improvement.

1.1 About the Ministry of Agriculture and National Centre for Agricultural Research and Extension

Jordan is classified as a lower-middle income country, with a total population of just five million with an economy that is constrained by limited arable land and scarce water resources. It is high on the list of countries with a water deficit. Only 4.3% of Jordan's 8.9 million hectares land area is cultivatable. About 80% of the country is desert. Jordan has 82,000 hectares of irrigated land, with 81,000 hectares of permanent crops, along with its arable and pasture land. The agricultural sector of Jordan provides earnings for about 20% of the population and employs 7% of Jordanian workers, and agriculture imports are almost three to one in respect to exports (imports: \$2.779 billion to exports: \$1.056 billion).

The economy is heavily dependent on the services sector, such as banking and tourism. In 2003, the agricultural sector constituted only 2% of Gross Domestic Product (GDP) and employed about 10% of the country's labour force (World Bank 2005; FAO 2005). Jordan's agricultural sector, however, has serious environmental problems related to water resources, water pollution, deforestation, and soil erosion (Encyclopaedia of Nations 2005). The primary crops are citrus and other fruits and vegetables, such as tomatoes, eggplants, cucumbers, cauliflowers, and cabbages. Though small, and operated on a nomadic or semi-nomadic basis, livestock is also an important subsector. Animal production accounts for about a third of agricultural output value, and sheep and goats account for about 90% of livestock output.

Slightly less than 10% of Jordan's total land area is cultivated, but only 3% is used for agricultural production and only 1 to 2% is irrigated—mainly in the Jordan Valley and highlands (FAO 2005). This leaves the country heavily dependent on rainfall, a factor that has hindered agricultural growth. Agricultural production was seriously affected by the droughts of the late 1990s, such that agricultural GDP in 2003 was only half the 1991 level. With a view to expanding the irrigated area, the country's economic development plans emphasize soil and water conservation (Encyclopaedia of the Nations 2005).

Although the agriculture sector is small in relation to the overall economy, and despite the country's meagre water and cultivatable land resources, the agriculture sector (with upstream and downstream linkages like agribusiness services and agro-industry) contributes an estimated 28% of gross domestic product and is considered as one of the most important economic pillars for integrated development in Jordan.

The lead agency within the agriculture and rangelands development sector in Jordan is the Ministry of Agriculture (MOA). It plays an important role in addressing the needs of the rural poor in both the highlands and the Jordanian Badia.

The importance of agricultural research was recognized early by the Government of Jordan, and the National Centre for Agricultural Research and Extension (NCARE) was designated and strengthened to be the largest NARS institution in Jordan. It is an autonomous public institution governed by a council chaired by the Minister of Agriculture and is the leading agricultural research institute in Jordan. It has responsibility for applied and adaptive research in all areas of agriculture, and for associated technology transfer to farmers. With a view to linking research with extension, and to making extension more effective, NCARE is being restructured to undertake the extension role formerly undertaken by the Ministry of Agriculture itself. conditions (See appendix 1 for further information on 'research and development organization and personnel' in Jordan).

Reliable agricultural information constitutes a cornerstone in the planning of agricultural research and 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. However, the available agricultural information in Jordan has been inadequate as a result of many factors, in particular:

- The array of institutions that collect agricultural data and information, and the diversity of the methodologies they use, which often leads to contradictory and unreliable information;
- The lack of certain types of data and information required in support of the development of the agricultural sector;
- The lack of coordination and collaboration between institutions concerned with data collection and information provision on one hand and information users in the public and private sectors on the other.

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 Jordan.

In order to address this issue the Minister of Agriculture convened a Consultative Workshop in collaboration with FAO on the Development of an Agricultural Information System/Network in Jordan, which was held on 16 July 2002. The workshop brought together senior managers in the Ministry and researchers from various stakeholder organizations in Jordan to discuss the development of a national system for agricultural information. The common vision derived from the workshop was to establish a National Agricultural Information System (NAIS) that would strengthen and improve agricultural information generation, management, dissemination, and exchange for development.

The Development of a National Agricultural Information System (NAIS) project was implemented during the period September, 2007 to June 2011 under two phases (TCP/JOR/3102 and TCP/JOR/3202).

The National Agricultural Information System (NAIS) is now operational and available online (<http://nais-jordan.gov.jo>) as a platform for information dissemination and knowledge sharing. A Jordan agricultural

information centre (JAIC), has been established and is acting as the coordinating unit of NAIS, which is 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 the MOA.

Currently, the MOA, NCARE and other stakeholder partners from various ministries and Government bodies have established a systematic approach to the effective management and dissemination of the information it produces. Several databases and document collections exist in MOA and NCARE, and they are standardized and easily accessible in NAIS. The NAIS website is the Ministry platform for information and knowledge sharing and exchange (<http://nais-jordan.gov.jo>) which is maintained by a NAIS/JAIC team who is conducting training on NAIS for all stakeholders. The ICD of MOA is responsible for maintaining the Ministry's computer hardware and software, and conducting IT training courses for employees. However, this systematic approach is still to be implemented.

1.2. About CIARD and the framework

Coherence in Information for Agricultural Research for Development (CIARD; <http://www.ciard.net>) is a multi-stakeholder collaborative initiative of major actors in agricultural research for development related 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 to help them disseminate it more efficiently and make it easier to access.

CIARD, as a movement, is a collective commitment to promote and sustain the sharing of agricultural research outputs in a global network of truly public collections. It is based on a Manifesto and a common set of Values, to ensure that public domain research outputs in the form of information, data and knowledge form part of a global “knowledge commons” for agriculture. These outputs should be created, assembled, handled and disseminated in ways that ensure that they will be as Available, Accessible and Applicable as possible (<http://www.ciard.net>).

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 (CIARD Routemap to Information Nodes and Gateways for Agricultural Research for Development). These tools and applications have been developed through a series of consultations among, and the consensus of, CIARD partners. AARINENA is a 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 public access at the levels of Institute/Organization, National Agricultural Research System, region and global. When used jointly by all NARS organizations at the national level information flows (because of the use of standards, guidelines and pathways) within a country can be governed better and virtually aggregated, thus enabling more effective use.

The CIARD RING It provides, through the use of a metadata-based directory, a global signpost to publicly accessible agricultural information. Almost a million full text documents, 3 million bibliographic details and several databases are registered with the CIARD.RING from all over the world. Similarly developed national RINGs, using the CIARD.RING as a guide and template, can be used to collaborate better both sub-regionally, such as in South Asia, and regionally, as in the Asia-Pacific, and also globally.

In a West Asia and North Africa Regional Workshop on CIARD 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. These skills are needed not only to use CIARD concepts effectively but also to advocate and build better participation 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, to achieve these ends.

1.3. The context for CIARD in the Ministry of Agriculture and National Centre for Agricultural Research and Extension

The CIARD Manifesto and Values were introduced in 2009 and 2011 to the directors of the Ministry of Agriculture (MOA) and the National Centre for Agricultural Research and Extension (NCARE) 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.

NAIS has developed in collaboration with FAO, within the framework of the NAIS project, and is a CIARD partner and has registered its repository with the CIARD RING. NAIS and associated institutions and partners are recognized as CIARD partner institutions.

The Jordan Agricultural Information Centre (JAIC) of NAIS is well established and equipped with computer facilities - a server for its website and repository, internet links and data display facilities, in addition to three persons employed to improve their ICT capacity. It is an enabling environment to provide proper hands-on training and practice. JAIC has a training laboratory that hosts five workstations ordered by the project and five additional workstations purchased by the Ministry. It also includes an adjacent office for the NPC and an adjacent office for staff of the centre. Ministry departments, NCARE, and other stakeholders from various ministries in Jordan, have IT equipment for developing and providing access to the digital institutional repositories of NAIS. JAIC was established according to an implementation plan drawing on inputs from existing Departments within MOA, and functioning as an AGRIS Resource Centre and coordination unit for MOA network and NAKEMS.

The NCARE Department of Information and Communication Technology, and the NCARE Information Unit of the Information Management of Extension Department, have staff who are mainly responsible for the production of a variety of information products (printed publications, videos, posters, leaflets, etc). NCARE has skilled staff to transform scientific information into different forms which can be used by other stakeholders, or the general public.

Within the framework of NCARE, agricultural extension has a pilot training centre to build the abilities of extension agents. More than 12,000 participants including farmers, agents, agronomists, and technicians have benefited from this training centre. In the meantime, awareness and training resources were produced (12 extension movies, 18 extension letters, and six series of farmer manuals).

However, NCARE is driven more by academic study than by solving production constraints experienced by farmers. Applied NCARE research activities have enabled some limited amounts of technology transfer through written publications, field days for farmers and on farm trials (USAID, 2005).

The private sector is a more reliable source of information on new agricultural technologies and technical advice. However, it tends to favour larger, more capital-intensive enterprises, suggesting a needed role for MOA/NCARE extension in addressing the needs of smaller scale and poorer farmers. Private sector extension services are especially strong in input supply for vegetable seed, fertilizers, and pesticides, but the agents are typically the sales representatives of agrochemical companies. Nevertheless, they supply most of the published information available to growers, conduct seminars and meetings, and offer management advice.

Within the framework of NCARE, NAIS has formal arrangements for repackaging research outputs through its information department. The arrangements among others include using TV and videos, audio and newspapers for communicating research outputs on a monthly basis, in addition to using community-based meetings and events to disseminate the repackaged content on a quarterly 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.

NAIS institutions will have to develop, adopt and validate formal ICM policies and strategies in the forthcoming expansion phase to national level which will start in 2013. MOA has already developed a communication strategy for development information and is proceeding with its implementation.

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

NAIS is playing a considerable role in disseminating and improving accessibility of information and knowledge of MOA at institutional, national and regional levels and this is a vision of the MOA authorities and decision makers. This position coincides with CIARD vision.

2. THE “STATE OF OPENNESS OF AGRICULTURAL RESEARCH FOR INNOVATION”

In close collaboration and partnership with FAO, the Ministry of Agriculture (MOA) has established and developed the National Agricultural Information System/Network (NAIS) which consists of the major stakeholders, and is coordinated by the JAIC (Jordan Agricultural Information Centre) of MOA to share agricultural information resources and skills. It is a knowledge sharing and collaboration platform for the agriculture sector and the network is looking forward to bringing on board more partner organizations (other ministries and universities, NGOs and NRIs).

NCARE is considered the scientific body of the Jordanian Ministry of Agriculture (MOA), and the work of this distinguished applied agricultural research institute is based on scientific milestones to provide research results for farmers and other beneficiaries.

The project fulfilled the following three basic criteria for strengthening the capacity of the MOA, NCARE, ACA, UOJ, UOB, MWI, and other stakeholder partners. The aim was to establish an effective and efficient information system that supports agricultural development and food security improvement in Jordan, based on the needs and demands of its stakeholders and integrating the various resources in the MOA in addition to the significant achievement made in strengthening the capacity of institutions and people to provide the system with the right content and to access relevant information.

1. Fill a critical gap: The project developed a relevant, effective, and harmonized National Agricultural Information System (NAIS), which is preserving needed resources and making maximum use of other projects' results and database applications. NAIS was successfully launched as an integrated, bilingual (Arabic/English) institution-based web platform. It aims to strengthen and improve agricultural information generation, management, dissemination and exchange for policy makers, senior managers, and national stakeholder groups in order to strengthen information and knowledge sharing and exchange in the agricultural sector of Jordan. NAIS is a national platform for information dissemination and knowledge sharing and exchange for ARD for target groups and stakeholders in Jordan. The organizational restructuring needed to ensure NAIS's functioning and sustainability was approved and implemented through a decree on the establishment of JAIC with the help of the TCP Project. At the beginning of the project, it was agreed that JAIC would be established virtually but it ended up with JAIC being physically established. The project also made considerable achievements in the establishment of an information network for the agricultural sector and the formulation of an agricultural information strategy. Thus, the project's achievements exceeded the planned outputs.
2. Produce a sustainable outcome: The NAIS established under the project has a very strong base of trained staff that is capable of managing and sustaining the system. The commitment of the MOA to provide support and coordination to the project outputs, the appropriate organizational developments carried out for JAIC, the excellent teamwork of the project staff, and the great interest of the various stakeholder institutions in the establishment of NAIS, are all strong indicators for ownership and ongoing sustainability.
3. Contribute to strengthening of the beneficiary country's capacity: The project has exceeded the human resources training targets within budget, reflecting very successful financial resources management efforts. Four stakeholder workshops were originally planned, but the actual delivery in phases I and II were nineteen stakeholder workshops and one study tour. The total number of workshop participants under the two phases of the project reached 424 trainees. A team of ten technical staff at the ICD/MOA, professional staff and senior managers in the agricultural sector, were trained on modern information management for capacity building and development. During several rounds, more than 400 people (decision

makers, professionals, and researchers) were introduced to the use of modern information technologies and trained in the use of specific system modules. In addition, twelve specialized staff members were trained on document indexing and cataloguing, and the use of the Arabic AGRIS application profile.

2.1 Developing Institutional Readiness

Progress in developing institutional readiness, as defined by CIARD, has been made as NAIS (<http://nais-jordan.gov.jo/>) is now available online and 17 NAIS modules (information systems) are working properly and operational. NAIS is a partner of CIARD and has registered its repository with the CIARD RING. NAIS and associated partners are recognized as CIARD partner institutions. Throughout the NAIS project, NAIS has developed the capacity to achieve and comply with the parts of the CIARD Checklist for institutional readiness.

The Government of Jordan recognized early the importance of the role played by ICTs, and embarked upon a progressive reform of its ICT sector which started in 1994. In 2003 the Government adopted a statement of policy on the ICT sector reflecting Government vision towards liberalizing it. This policy was replaced with a new statement in 2007 which focuses on creating the conditions of effective competition in the ICT sector, as the Government believes that the ICT sector could be developed and fostered by stimulating competition and relying on market forces.

The current policy statement sets forth a number of important goals in the ICT sector and identifies the efforts required in order to ensure the effective accomplishment of those goals. It takes into consideration the perceived needs of the market, the Jordanian economy as a whole, social development factors, and the rapid pace of technological change. It also ensures its alignment with existing legislation, bilateral agreements, the World Trade Organization (WTO) Agreements, the general undertakings made as part of the World Summit on the Information Society (WSIS) Geneva and Tunis goals and plans, and the U.N. Millennium Development Goals.

The National ICT Strategy (NIS) 2007-2011 encapsulates the concerted and ambitious efforts of the public and private sectors in converting the 2007 Policy goals into actionable targets with concrete results over the past years. NIS identifies the roles of all stakeholders from the public sector, i.e. Ministry of Information and Communication Technology (MOICT), Telecommunication Regulatory Commission (TRC), National Information Technology Centre (NITC), other governmental organizations, and the private sector as represented by business associations such as the Information Technology Association (Int@j) and Jordan Computer Society (JCS).

Meanwhile, Jordan launched its REACH initiative in 2000, with the aim of developing its information society and increasing ICT exports, as well as attracting direct foreign investment into the country. The Jordanian Government subsequently devised its National Strategic Plan for the ICT and postal sectors for 2004-2007. The objectives of the plan were to align service prices with citizens' purchasing power in order to increase the number of mobile phone subscribers, and to improve, expand and enhance services using the latest technologies. Other objectives included increasing the number of direct and indirect service providers in the country.

E-Government in Jordan is dedicated to delivering services to people across society, irrespective of location, economic status, education or ICT ability. With its commitment to a customer-centric approach, E-Government aims at transforming the Government and contributing to the Kingdom's economic and social development. In order to achieve this, the availability of ICT and business skills is essential to implement and manage e-services by government employees who are responsible for delivering electronic services in proportion to the technology used and applied in Government institutions.

The e-Government Program's activities for capacity building and human resources include:

- Develop a training strategy and plans to identify necessary training programs for public servants in order to contribute to success of the e-Government Strategy.
- Implement training plans and programs and facilitate the delivery of standardized training programs to applicable Government personnel, focusing on areas of comparative advantage given its expertise and specialized e-Government needs.

The e-Government Program within the period 2003-2010 has trained more than 10,000 Government employees on basic computer skills including programs on ICT literacy, project management, vendor certified training programs and IT professionals. Also about 2000 employees were trained on specialized courses in technology, programming, networking, information security and project management, in addition to other specialized training in the areas of Microsoft, Oracle, Cisco, and other management software and networks in place within the governmental institutions. The program works in collaboration with all stakeholders to develop required skills and to transfer knowledge on an ongoing basis to help support the implementation of e-services.

Jordan's knowledge stations play an important role in providing a variety of services to a wide segment of society. They aim to fulfill broad aims including: Bridging the digital divide between Jordan's provinces, and regions; Overcoming computer illiteracy; and Maximizing the benefits provided by the national information system by granting citizens access to national and international information over the Internet.

As regards the agricultural sector, the Ministry of Agriculture issued, in direct consultation and policy dialogue with the public sector, a cohesive document that would serve as a roadmap and action plan to develop Jordan's agriculture landscape in different subsectors in cooperation with different stakeholders as partners for development. This included a set of actions and projects that, among which, stressed the need for the optimal utilization of information technology, information dissemination and knowledge exchange and several measures were introduced to that effect. These include:

- Technology transfer mechanisms to promote the adoption, promotion and deployment of innovative and modern technologies in agricultural development.
- Keeping abreast with rapid developments in the field of bio- technology.
- Adopt advanced technologies to raise the proportion of self- sufficiency in agricultural products.
- Study agricultural input by using integrated pest management technologies.

As a result of implementing the above mentioned document the Ministry of Agriculture launched two information technology based projects in order to assist the partners and end users benefiting from the agricultural sector to perform better:

National Agricultural Information System (NAIS): Is a national platform for information, knowledge sharing and exchange for agricultural research and development for target groups and stakeholders in Jordan. Objectives:

- To strengthen the capacity of the Ministry of Agriculture and other stakeholders to establish an effective and efficient information system that will support agricultural development and ensure food security in Jordan, based on the needs and demands of its stakeholders and integrating the various resources in the Ministry.
- To serve as an information and knowledge repository/exchange mechanism at the national level and a gateway to the national knowledge systems for Agricultural Research and Development (ARD) in Jordan.

Jordan Integrated Hazardous Substances Information Management and Control System Project (JI-HSIMCS): Is an automated system that serves as a tool for managing and controlling hazardous substances that are imported and manufactured in Jordan. This system will also serve as a source of information about hazardous substances to all concerned ministries and other governmental and non-governmental organizations.

The system includes the following organizations: Ministry of Environment, Ministry of Health, Ministry of Industry and Trade, Jordan Customs, Ministry of Interior, Prohibition of Chemical Weapons Directorate, Public Security Directorate, Civil Defense Directorate, Jordan Food and Drug Association, Aqaba Special Economic Zone Authority (ASEZA). Objectives:

- JI-HSIMCS system will enhance the capacity to manage hazardous substances (HS) among different organizations.
- Improve the documentation of procedures for permitting, transporting, handling and controlling hazardous substances.
- Provide up-to-date statistical information to decision makers, giving them a clear view about the type, use and location of hazardous substances that exist within the border of the Hashemite Kingdom of Jordan.

Within the MOA, the Undersecretary of Agriculture has championed this development. The great interest was noted of the various stakeholder institutions in the development of NAIS and the establishment of JAIC, as manifested during the consultative meetings and training workshops which were well attended and successfully conducted during this project life cycle. The commitment of the MOA to provide project support and coordination, and the teamwork of the project staff and coordination team were also evident.

The main factors driving the MOA in this direction were:

- The Government 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 (ICTs) and management (ICM) to facilitate sustainable agricultural development in Jordan.
- The Government 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 Jordan 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 MOA /Regional offices, representing a significant handicap to properly address issues of agricultural development.
- Inadequate coordination among various agricultural research institutes, programmes and personnel.
- Inadequate linkages between researchers and extension officers in the various research and extension sectors in MOA/NCARE/Regional offices to provide the appropriate advisory services for farmers.
- Variety of institutions that collect agricultural data and information, and 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 Ministry of Agriculture (MOA) did not have a systematic approach to the effective management and dissemination of the information it produced.

The common vision derived from the above-mentioned observations was to establish a national agricultural information system (NAIS) and a national agriculture information centre, acting as the coordinating unit of NAIS that would assemble and make accessible all information and knowledge that would:

- 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 the MOA.

The NAIS system/network and JAIC centre are providing stakeholders with a good agricultural information infrastructure. The sustainability of these achievements requires long-term contributions and commitments for implementing Jordan's agricultural information strategy to achieve a genuine impact on rural and agricultural development.

The digital agenda was not only driven from within the MOA but also was in line with the ongoing key initiatives of the National ICT Strategy (NIS) in implementing Jordan's digital strategy in general and e-Government services in particular.

Jordan ranked 47th in the 2012 Networked Readiness Index, which measures the degree to which economies across the world leverage ICT for enhanced competitiveness, improving by three places since 2011. The Kingdom ranked 47th in government prioritisation of ICT, 40th in intellectual property protection, 49th in software piracy rates, 42nd in availability of the latest technologies, and 58th in political and regulatory environment. In addition, the country ranked 70th in secure Internet servers, 53rd in time required to start a business, 34th in terms of intensity of local competition, 70th in government procurement of advanced technology products, and 49th in terms of mobile network coverage percentage.

The Jordan Kingdom came sixth among Arab states and was preceded by Bahrain, Qatar, the UAE, Saudi Arabia and Oman respectively, according to the World Economic Forum's Global Information Technology Report 2012. However, it is noted that Jordan still needs to work on improving its ICT infrastructure, especially in terms of gaining access to a wider international internet bandwidth. The government should work on integrating ICT in other sectors to enhance the competitiveness of the national economy.

The ICT sector currently contributes about 14% to the country's gross domestic product annually. This could be increased to 30% annually if technology were integrated in other economic sectors as this is currently "very weak".

The positive factors in these digital organizational developments 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 the Under Secretary of MOA, 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 modify the information available on the web site;
- Achieved a large core staff, highly trained, who act as trainers of trainers (TOT), capable of managing the system;
- The project has a very strong base of trained staff that is capable of managing and sustaining the system. The project has developed the capacity to provide inputs in support of policy development and planning activities within MOA. This provided an excellent basis for launching phase two of the project;
- The project enjoyed a very strong commitment from MOA top policy makers, management and project coordination team... The project 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's present and future requirements. The pilot national agricultural information system (NAIS) exceeded its original targets, growing from 4 to 17 information modules, which provided an excellent base for widening the range of outputs from the first phase. Moreover, the project established a strong ICT foundation that can eventually contribute to the improvements of agricultural research and development and farmer livelihoods.

The negative factors in these digital organizational developments are as follows:

- Slow internet infrastructure has led to poor communication and slow project progress. MOA needs to strengthen the capacity of the internet bandwidth to overcome the existing constraints;
- There is a need to extend the institutionalization of project structures for effective knowledge exchange in support of agricultural and rural development;
- While some efforts have been made to input research publications, there have been limited efforts to transform 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 has its prime focus on solving these problems; and

Analysis of NAIS activities using the CIARD Checklist towards developing institutional readiness is as follows:

	CIARD Checklist Items	NAIS
1.	Introduce and gain support for the CIARD Manifesto and Values in your institution.	The CIARD Manifesto and Values were introduced to the Ministry of Agriculture (MOA) and National Centre for Agricultural Research and Extension (NCARE) management and to more than 300 research scientists and experts from MOA, NCARE and two universities (Balqaa and Jordan) at the national and regional workshops organized in 2008 - 2011. There has been formal indication of support for the Manifesto and Values from NCARE and other NAIS partner institutions.
2.	Have your institution recognized as a CIARD partner	NAIS is a CIARD partner and has registered its repository with the CIARD RING. However, individual NAIS partner institutions are yet to indicate that they should be recognized as CIARD partner institutions.

	CIARD Checklist Items	NAIS
3.	Adopt a formal institutional information/communication strategy	A national information strategy for agricultural science and technology has been formulated in compliance with the National Agricultural Development Strategy. The ICM policies and strategies are clearly defined and spelled out in the information strategy developed in 2010 but it is yet to be implemented and validated by NAIS partner institutions.
4.	Develop the capacities of your institution to achieve the CIARD Checklist	<p>NAIS (http://nais-jordan.gov.jo) is now available online and 17 modules (information systems) are working properly and operational. The NAIS software application is hosted in the application server at MOA. All other hardware items including the second server designated for NAIS Development are also hosted at MOA.</p> <p>IT equipment for developing and providing access to digital institutional repositories was provided to pilot institutions. Jordan Agricultural Information Centre (JAIC) has been established according to an implementation plan drawing on inputs from existing departments within MOA, and functioning as an AGRIS Resource Centre.</p> <p>The JAIC centre is physically well established which is designated as the NAIS coordinating centre. JAIC has a training laboratory that hosts five workstations ordered by the project and five additional workstations purchased by the Ministry. The JAIC training centre was well furnished and equipped with computer facilities, a server for its website and repository, internet link and data display facilities. In addition three people were employed to improve their ICM/ICT capacity. It is an enabling environment to provide proper hands-on training and practice.</p> <p>NCARE Information and Library Unit has developed its capacities during the NAIS project to enable proper functioning as an AGRIS Resource Centre with good IT facilities and well trained staff.</p> <p>NAIS has a very strong base of trained staff that is capable of managing and sustaining the system. The project has exceeded the human resources training targets, within the original budget, reflecting very successful financial resources management.</p> <p>Further, information professionals and IT specialists were equipped with skills to enable them to create and manage metadata and associated digital documents, manage NAIS websites, develop institutional repositories, and understand issues relating to open archive and Open Access initiatives.</p>
5.	Develop national/local partner networks to share resources and skills.	NAIS has been established for the agricultural sector, consisting of the major stakeholders, and coordinated by JAIC/MOA, to share agricultural information resources and skills. It is also a national knowledge sharing and collaboration platform. The network is

	CIARD Checklist Items	NAIS
		<p>looking forward to bringing on board more partner institutions. Developed stakeholders skills in the application of information management systems and tools, featuring the NAIS Network Operation, Management, and in-depth NAIS modules design and implementation 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 NAIS network; and raised awareness of strategic aspects of information and knowledge in the context of development of the NAIS Network CIARD.</p> <p>The national counterparts, consisting of the National Project Coordination unit, and national project institutions composed of stakeholders, trainers and ICD staff, are doing an excellent job and are working well as a team. The project Steering Committee, under the leadership of the Secretary General, MOA, is also very active in providing guidance and support to NAIS.</p> <p>The NAIS project established an enabling environment for cooperation and coordination as MOA played a significant role in establishing a collaborative arrangement with project stakeholders from other ministries and Government bodies to make an enabling environment for cooperation. This was shown through the interest of the various stakeholder institutions in establishing a National Agricultural Information System, their willingness to cooperate and contribute to this project, as well as the commitment of MOA to provide support and coordination.</p> <p>The interest of the various stakeholder institutions (Ministry of Water and Irrigation, Agricultural Credit Association, and Ministry of Environment, and others) in the establishment of the NAIS, and their willingness to cooperate and contribute; the commitment of MOA to provide support and coordination; the excellent teamwork of the project staff and national project institutions composed of stakeholders/trainers; the project Steering Committee's active role in providing guidance and support to the project under the leadership of the Secretary General, MOA; and the new project proposal for NAIS expansion, are all evidence for ownership and sustainability.</p> <p>The establishment of NAIS is a long-term goal which will have to be achieved in several stages. As a first step, a sustainable information system infrastructure was designed, drawing on the requirements that were identified during a consultative workshop. It is expected that its full implementation will lead to the efficient utilization of human, material and financial resources. All seventeen (17) modules enabling the dissemination and monitoring of activities carried out in agricultural development programmes, research, extension and training programmes, have been developed.</p>

2.2 Availability, accessibility and applicability of research outputs

Analysis of NAIS activities using the CIARD Checklist towards availability, accessibility and applicability of research outputs is as follows:

	CIARD Checklist Items	NAIS
6.	Ensure that your research outputs are available digitally	<p>NAIS partner institutions are scanning and capturing research outputs in digital formats. Institutions like NCARE 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.</p> <p>MOA and NCARE 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.</p> <p>All types of documents/objects are still required to be captured, building on an overall digital plan/strategy proposed by MOA and NCARE and approved by the Steering Committee and all stakeholders.</p> <p>The organization's digitization programme will include older documents that were originally produced in pre-digital formats (e.g. print on paper).</p> <p>The MOA and NCARE organizations and other stakeholder partners have a formalized, managed system (module) within NAIS for this data capture as part of an overall digital strategy in collaboration with FAO staff who played a significant role in encouraging stakeholders to commit to this. Further decision maker support was obtained to continue the project and even to extend it to phase two. Stakeholders were pleased and proud to see their outputs available and disseminated on the internet.</p> <p>NAIS stakeholders will also have to decide to proceed with the programme of digitization.</p> <p>NAIS stakeholder institutions still need to make significant efforts to digitize and input information and extension products and research publications, and 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.</p>
7.	Develop institutional or thematic repositories of your outputs as open archives.	<p>The NAIS central repository is an open archive; institutions using NAIS as arepository are fully in compliance with Open Archives protocols. Some NAIS partner institutions have institutional repositories that are not yet open archives and these are accessible</p>

	CIARD Checklist Items	NAIS
		<p>over local intranets.</p> <p>All the stakeholder institutions in NAIS developed institutional repositories based on AGRIS tools and methods (Web-DIMS and AGROVOC).</p> <p>The NAIS network institutions are still required to implement and document policies regarding what types of information are captured, how long it is kept there, what formats the data must be in, quality control, copyright control, and so on. It is anticipated to proceed with the implementation of information strategies in the second phase (2013- 2015) and information policy will be documented within the framework of information strategy development and implementation.</p> <p>NAIS has been developed in close consultation with NAIS stakeholders. It was built based on NAIS stakeholders' needs assessment. Information needs for stakeholder groups were identified and a software requirements specification (SRS) was developed to provide a brief description of the features that could be provided by NAIS.</p> <p>It is worth noting that during the inception workshop of phase one in 2009, the main conclusion of the inception workshop was that “lack of awareness of, and lack of access to, information”, rather than “lack of information” is the main problem. Most of the information required is available somewhere, but there is a need for better mechanisms to access and share the existing information. Stakeholders identified key issues regarding information needs (internal and external), and availability and accessibility within the framework of the development of NAIS. During the project implementation workshops and consultative meetings, attention was given to software requirement specifications including the type of information to be captured, the type of data format required, and quality control. Copyright was not raised because at this stage there was no data to worry about.</p> <p>During the project inception workshop it had been agreed that the NAIS system would be composed of at least the following six modules: documents/publications, institutions, experts, projects, news, meetings and events. At the end of the project, the following 17 structurally-linked NAIS modules were completed to satisfy stakeholders requirements and are accessible through the bilingual (English/Arabic) NAIS website (http://nais-jordan.gov.jo): documents/publications, institutions, experts, projects, news, meetings and events, good practices, successful stories, country reports, laws and regulations, treaties and agreements, rural women knowledge base, media centre, desert locust, work opportunities, collaborative partners, e-library in addition to RSS and online collaboration and social networking tools such as Facebook, Twitter, YouTube, and Flickr.</p> <p>NAIS has built a Documents Repository and Harvester, based on AGRIS AP and Open Archive protocols, in the</p>

	CIARD Checklist Items	NAIS
		<p>publications/documents module. The MOA stakeholders feed the NAIS web information management system with content which is then stored in the documents repository.</p> <p>Standards and procedures for information system management in NAIS, specifically for data quality, processing and dissemination, were developed and adopted in compliance with relevant regional and international standards. Software requirements specification (SRS) was submitted to and approved by project counterparts and stakeholders and NAIS was implemented accordingly.</p> <p>The assessment of the use of the repository (documents deposited, hits, downloads, etc) in a planned way was not taking place in phase one. It is anticipated to plan this issue in phase two (2013-2015) to allow for informed decisions to be made on how to manage it and develop it further.</p> <p>Some efforts were committed to inputting into NAIS during the first phase (2009-2011) - involving extension bulletins/brochures, leaflets, posters, projects, experts, success stories, news, and events in various disciplines. However, the first phase was not capable of meeting expectations due to the limited input of especially research and extension data. There have been limited efforts in transforming the research publications into technical packages that can help farmers solve their constraints.</p> <p>A work plan was prepared, proposed by FAO in collaboration with the project technical steering committee and implemented by stakeholder groups, based on source of knowledge generated by various departments in MOA in addition to the institutional restructuring and development proposed by FAO. A comprehensive Training of Trainers programme was given to stakeholders in various disciplines in MOA 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 MOA to recruit two persons (one man and one woman) to JAIC at the beginning of phase one. Now they have 2 full time persons (one woman and one man) who are well trained and who are dedicated to the Centre in addition to another 3 persons from NCARE who are also committed to feeding the network with information products.</p> <p>The concept of 'open' information was accepted by everyone in MOA and stakeholder partners and this position coincides with the CIARD vision.</p>
8.	Use international metadata standards, data exchange protocols and agricultural vocabularies and thesauri.	NAIS and NAIS partners are using the central NAIS e-repository which is using Web-DIMS (fully compliant with AGRIS tools and methods) AGRIS AP and the AGROVOC Thesaurus. NAIS is fully compliant with New AGRIS Initiative and international standards. It supports multiple import and export in AGRIS AP format.

	CIARD Checklist Items	NAIS
		<p>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 the researchers and 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, , multiple import and export in AGRIS AP format, and certified Open Archive Initiative protocols) 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.</p> <p>This system was one of the components integrated into MOA Network that is being used in all the NAIS institutions.</p> <p>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. WEB-DIMS system provides a front-end for browsing and searching and a backend for storing and updating publications data.</p>
9.	Develop a clearly defined licensing policy for your outputs	<p>NAIS partner institutions are yet to review and re-define the licensing policies for their research outputs</p> <p>However, 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.</p>
10.	Optimise the structure and the content of your web sites for search engines.	<p>The NAIS website has been optimized for search engine access. Google Custom Search Engine was used to create a search facility and host it on the site using the Custom Search element to optimize the NAIS 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 updates.</p> <p>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,</p>

	CIARD Checklist Items	NAIS
		with appropriate acknowledgement and without restrictive legal, technological or financial barriers.
11.	Share your metadata by participating in international information systems	<p>Metadata on NAIS central repository is harvested automatically by the Knowledge Harvester Ring and the CIARD RING. AGRIS Network can harvest these 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 NAIS.</p> <p>Researchers are encouraged to publish their work in Open Access journals. The researchers are also 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.</p> <p>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 current phase. Advocacy workshops on this issue are required in the forthcoming phase in addition to setting up this policy as part of the information strategy still required to be done. The research outputs of the organization are indexed and harvested in AGRIS international database.</p> <p>The research outputs of the organization are indexed and catalogued using AGRIS AP and harvested online in AGRIS international database using Open Archives protocols (not Qualified Dublin Core Protocol).</p>
12.	Use 'social networking' media and applications to share your outputs.	The use of social network media for sharing research outputs in the NAIS partner institutions is yet to be implemented. However NAIS has an RSS feed provider and aggregator on the website. A forum and blog have been implemented on the site but they are not widely and extensively utilized. Focus will given to these tools in the expansion phase of NAIS in 2013.
13.	Build formal and informal networks to repackage your outputs.	<p>NAIS has not yet moved into repackaging the outputs of research. NCARE has responsibility for applied and adaptive research in all areas of agriculture, and for associated technology transfer to farmers. As both an important producer and user of agricultural information, NCARE is a major partner in the establishment of the NAIS. Other important stakeholders are the Department of Statistics, the Ministry of Water and Irrigation, and Faculties of Agriculture. NCARE is using community based meetings and events to disseminate repackaged content.</p> <p>It is worth noting that sources of public extension within (MOA include (a) NCARE, which is a typical general system of extension.</p>

	CIARD Checklist Items	NAIS
		<p>It has a relatively limited number of field and subject matter specialist staff. Based on the 1997 Agricultural Census (Department of Statistics [DOS], 1999), the ratio of extension agent to farmer is 1: 920; (b) the National Research Centre which undertakes limited technology transfer activities; and (c) the production oriented projects, which provide technical information, financial aid, and subsidized inputs to target groups in the context of the agricultural development approach.</p> <p>Other public extension services are provided through: (a) the Agricultural Credit Corporation which follows the system of controlled credit and provides technical guidance to the borrowers; (b) the farmer organizations, such as cooperatives and unions, which provide very limited services in size and scope; (c) the non-governmental organizations which provide limited technical and financial support to certain groups, especially to women farmers; and (d) the private for profit sector which includes the commercial agricultural companies, and private consultants. Extension services offered by the private companies, though sales-oriented and spatially limited to areas with commercial farming are better in quality and more effective.</p> <p>MOA and NCARE have well-trained staff to transform scientific information into different forms which can be used by other stakeholders or the general public. These skilled staff are available in NCARE and JAIC. The project provided good opportunities for: (1) A good, functional physical communication infrastructure has been developed and suitable software adapted to the current and future needs has been deployed. Moreover, a core of staff has been trained and preliminary organization and management structures have been established; and (2) NAIS provides an excellent base for widening the range of outputs from the first phase.</p> <p>Within the framework of NCARE there are formal arrangements for repackaging research outputs through the Information Department. The arrangements include using TV and videos, audio and newspapers for communicating research outputs on a monthly basis, in addition to using community based meetings and events to disseminate 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.</p> <p>Knowledge has three levels, local, regional and international. The project has made some efforts to input information and extension products and available research publications, however the project still needs to make significant efforts to input information and extension products and research publications, and 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</p>

	CIARD Checklist Items	NAIS
		<p>immediate problems.</p> <p>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. Special focus will be given to this important issue in the expansion phase of NAIS (2013 – 2015).</p>

3. KEY ISSUES AND CONCLUSIONS

The NAIS project has succeeded in strengthening the capacity of the Ministry of Agriculture (MOA) to establish an effective and efficient information management system that supports agricultural development and food security improvement in Jordan, based on the needs and demands of its stakeholders and integrating the various resources in the MOA. Significant achievement was made in strengthening the capacity of institutions and people to provide the system with the right content and to access relevant information.

The project outputs (results) were delivered and the project achieved its objectives and, in some cases, exceeded them. NAIS was designed and successfully launched as an integrated, bilingual (Arabic/English) institutions-based web platform to strengthen and improve agricultural information generation, management, dissemination and exchange for policy-makers, senior managers and national stakeholder groups and for strengthening information and knowledge sharing and exchange for agricultural research and development for MOA. It is a knowledge sharing and collaboration platform for the agriculture sector in Jordan.

NAIS is playing a significant role in disseminating the information and knowledge of MOA at institutional, national and regional levels and this is a vision of the MOA authorities and decision makers. This position coincides with the CIARD Vision.

NAIS enjoyed a very strong commitment from MOA and NCARE top policy makers, management and project coordination team to achieve success for the project. The NAIS project has a very strong base of trained staff that is capable of managing and sustaining the system. This provides an excellent basis for launching phase two of the project.

MOA 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. MOA and NCARE are very willing to continue to achieve stepwise progress on this important task in collaboration with FAO. Work on licensing content is yet to be considered in the future.

The full establishment of NAIS is a long term goal which will have to be achieved in several stages. As a first step, a sustainable information system infrastructure was designed, drawing on the requirements that were identified during a consultative workshop. It is expected that its full implementation will lead to the efficient utilization of human, material and financial resources. All seventeen (17) modules were developed, enabling the dissemination and monitoring of activities carried out in agricultural development programmes, research, extension and training programmes.

NAIS still needs to make significant efforts to input information and extension products and make research publications available, and 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.

3.1 Benefits and challenges

JAIC has been established and is acting as the coordinating unit of NAIS, which has 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 MOA. The interest of the various stakeholder institutions in establishing JAIC and NAIS, and their willingness to cooperate and contribute to this JAIC/NAIS project, as well as the commitment of the Ministry of Agriculture to provide support and coordination, are evidence for long term ownership and sustainability.

NAIS is 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 Jordan and elsewhere. It is expected that its full implementation will lead to efficient utilization of human, material and financial resources. The system should 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.

Researchers in NCARE and MOA are working in participatory networks with other key stakeholders (Government, farmers, extension, etc.). Through NAIS, 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.

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'.

Within the MOA there is an active group working on gender issues in Jordan. Their programmes and projects need to be reviewed to ensure maximum synergies with the other programmes of MOA. For this to happen there is a need to consider establishing a gender board within MOA that includes managers of other departments as well as other organizations 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.

The NAIS system was launched in March 2012. Now the major challenge for the MOA 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 NAIS so as to include relevant research institutions from outside the ARC, and thus turn it into a truly national system.

While the private sector activities in farming 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 their productivity and profits. MOA and NCARE will have to open up their 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 the NAIS Project 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 significance of the need to network with face-to-face meetings; (ix) partnership with national institutions, 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. NAIS is a partner of CIARD and has registered its repository with the CIARD RING. NAIS and associated

institutions/organizations are recognized as CIARD partner institutions. MOA and NCARE have 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 MOA and NCARE are to enforce institutionalization and the 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 MOA 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 NAIS project, as well as the commitment of MOA NCARE and other associated institutions in various ministries in Jordan to provide support and coordination, are all evidence for continuing ownership and sustainability.
- **Locally adapted content and context**

NAIS contains agricultural research information and other information resources produced in Jordan. The content of each module is mapped to the relevant MOA/NCARE institutions. Personnel from each institution are responsible for data entry and verification, in order to ensure commitment and quality of content. The records in the "Publications" module are reviewed by well trained personnel in NCARE to ensure they are correct and conforming to necessary standards.
- **Sustainability:** Capacity building, institutional development, organizational restructure, collaboration and team work all played important roles to overcome difficult issues and reach a sustainable phase. Business plans should be prepared and implemented to ensure sustainability and subsequent self-financing. Government support and/or external funding are being sought for the expansion and sustainability. Special focus should be given to organization restructuring in MOA to establish an information unit for each individual institution to facilitate content development and information flow.
- **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 proactive 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 MOA, is also active in providing guidance and support to the NAIS project.

- **Partnership:** The benefits of national partnerships in the development of networks are: (a) A collaborative system and effective communication, (b) Exchange of information and knowledge, (c) Enhanced technical cooperation, (d) Reduced costs of operation, (e) Synergies in information management, and (f) Use of agreed standards, methodologies and tools. It is anticipated to extend the stakeholders horizontally in the expansion phase of NAIS as it has been decided to establish 150 rural knowledge centres through the new proposed project “Jordan Rural and Agricultural Development Network”. NAIS will work closely in partnership with other organizations, such as the Ministry of Irrigation and Water Resources, the Ministry of Environment and Water Resources and the University of Balqaa, University of Jordan.

Annex 1. Research Outputs and Audiences

Table 1. Research Outputs in Ministry of Agriculture Network

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

Table 2. Audiences for Ministry of Agriculture and Fisheries Network

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

Appendix 1.**Research and development organization and personnel**

The Hashemite Kingdom of Jordan 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 Kingdom of Jordan with a specific mission and objectives.

During 1996-2003, total agricultural research staff and expenditures in Jordan rose steadily. In 2003, the country spent close to \$13 million (in 2000 prices) on agricultural research and development (R&D) with 15 agencies involved in agricultural R&D in Jordan in 2003 and 250 full-time researchers employed in these agencies. Compared to many other countries in West Asia and North Africa, Jordan distinguishes itself by having a very high research intensity ratio—not uncommon for a country with a low agricultural GDP share, a small population and high per capita income (IFPRI ASTI Survey Data on Jordan (Nienke, M. Beintema, Abdel Nabi, Fardous, and Jamal, Alrusheidat, 2004).

The establishment of scientific agricultural research institutions in Jordan dates back to 1958, when the Scientific Research and Agricultural Extension Department was established. In 1985, the Department reorganized and was renamed the National Centre for Agricultural Research and Technology Transfer (NCARTT), its role being to coordinate agricultural research and carry out both applied research and technology transfer at the national level. In 1993, NCARTT was operated as a semi-autonomous institution with administrative and financial independence. In 2007, NCARTT was reorganized and merged with the Agricultural Extension Directorate of the Ministry of Agriculture, and is now called the National Centre for Agricultural Research and Extension (NCARE).

Presently, NCARE comprises a main headquarters in Amman and a well-distributed network of 7 regional research centres (located in Dair Alla, Ramtha, MOA raq, Mshaggar, Rabba, Tafilleh, and Shobbak), 13 extension field units, and 13 research stations throughout Jordan to cover all agro-ecological zones of the country. There are 50 PhD, and 80 MSc scientific staff, as well as 125 research assistants (BSc), and 80 extension agents working at NCARE.

NCARE receives its core funding from the Government. Other direct funding is received from national and international donors to finance the implementation of proposed projects. NCARE is the only government agency involved in agricultural research in Jordan. Consequently, it has a broad mandate, including conducting and coordinating research, adapting and transferring technologies, and building the country's agricultural research capacity. As NCARE is responsible for transfer of technologies to the farmers, it has a newly established agricultural extension system that operates at national, provincial and farm levels.

There are many agricultural development centres (ADCs) throughout Jordan where farmers are trained on various aspects of farming including improvement of agricultural resources. The Higher Council for Science and Technology (HCST), an autonomous institution established in 1983 and governed by a council chaired by the Crown Prince, is responsible for the national scientific policy, but has a marginal role in agricultural research; it mainly funds agricultural research activities carried out by various institutions of the NARS. There are also agricultural colleges and specialized agricultural cadres working on technologies related to agricultural production. Most research and extension personnel have been exposed to the Farming Systems Approach adopted by NCARE Research Centres. The higher education sector plays a significant role in agricultural research in Jordan. The oldest and most important of these agencies is the University of Jordan, Faculty of Agriculture, where staff spend a substantial amount of their time on research (50 percent in 2003). Various private companies are also engaged in agricultural research—focusing primarily on fertilizer, fruit, and vegetable research—but the research capacity of each company is very small.

NCARE has responsibility for applied and adaptive research in all areas of agriculture, and for associated technology transfer and extension activities for farmers. The NCARE research has focused on crops such as olives, wheat, and barley, tomatoes, pulses, grapes, citrus and other crops, crop genetic improvement, water issues and climate change, livestock (pastures and forages, poultry, dairy, and beef), other natural resources, and postharvest activities. NCARE is the supportive pillar for the agricultural sector to achieve sustainability, protect the environment and achieve food security. As both an important producer and user of agricultural information, NCARE is a major partner in the establishment of the NAIS. Other important potential stakeholders are the Department of Statistics, the Ministry of Water and Irrigation the Ministry of Environment and Faculties of Agriculture.

Jordan's agricultural research agencies participate in a significant amount of collaborative research nationally, regionally, and on an international basis. While national linkages have traditionally been limited, for example, a review of Jordan's research and technology transfer activities during the late 1990s identified considerable gaps, NCARE and the various agricultural colleges have begun to collaborate on a project basis. Since 2000, NCARE has signed agreements with universities, the Royal Society for Science and Technology, the Agricultural Engineer's Association, the Farmers Union, and many other agencies. In addition, NCARTT professionals teach at the universities, and many MSc students and PhD candidates conduct thesis research in collaboration with NCARE.

At the regional level, NCARE collaborates with agricultural research agencies in neighbouring countries. Activities have generally been initiated through NCARE's participation in the Association of Agricultural Research Institutions in the Near East and North Africa (AARINENA) and through joint projects with either the Arab Centre for the Study of Arid Zones and Dry Lands (ACSAD) or the Arab Organization for Agricultural Development (AOAD). At the international level, NCARE and the faculties of agriculture collaborate with various centres of the Consultative Group on International Agricultural Research (CGIAR), particularly the Syria-headquartered International Centre for Agricultural Research in the Dry Areas (ICARDA). NCARE also collaborates with public research agencies in other Arab countries, and with research centres in Syria, the Palestinian Authority, Egypt, Tunisia, the United Arab Emirates, Lebanon, and many other countries. The agricultural colleges also have collaborative projects with regional universities and others in Europe and the United States. JUST's Faculty of Agriculture, for example, has partnerships with NCARTT, ICARDA, International Plant Genetics Resources Institute (IPGRI), and Jordan Badia R&D Program, as well as various universities abroad.

All collaborators (donors) supporting research programmes are in agreement with MOA and NCARE regarding the need to improve research activities and methodologies. NCARE 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.

Jordanian farmers are keen and receptive in demanding new ideas and technology. The willingness of farmers to participate in on-farm trials and to learn, demonstrates their interest to contribute to the development and dissemination of new technologies on pasture. There are opportunities to further improve forage and pasture species seed production technologies. The Government extension agents in NCARE support farmers through: (1) training and encouraging farmers to use new production technologies, green houses, 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.