



DRAFT FOR DISCUSSION

**Electronic Global Forum on Agricultural Research (EGFAR):
“Towards an Agricultural Knowledge System”**

***INFORMATION STRATEGY
for the West Asia and North Africa (WANA) Region***

Prepared by

AARINENA



February 2000

This report has been prepared by:

Ahmed Rafea
Computer Science Department
American University in Cairo

With the support of GFAR (NARS Secretariat) and
FAO/SDRR

1. Introduction

This paper is intended to propose an Agricultural Information Strategy for the West Asia and North Africa Region (WANA).

The second section discusses the importance of Information and Communication Technology (ICT) for the agricultural domain in the region. There is a real need for accurate and up to date information for sustainable development. The resources are limited and should not be wasted in investigating solutions of problems that have been already solved. The outcomes of the research should be transferred to the extension workers and growers to increase production and to conserve the environment as well. ICT can play a very useful role in exchanging and disseminating agricultural information for all agricultural stakeholders.

The third section presents the current status of ICT in the region through three components. The Information and Knowledge systems capacity developed in the region so far. The Internet connectivity status by analyzing questionnaire collected from different countries. The human resources in the region are three categories: developers, information providers and end users. Real developers are scarce in the NARS. Information providers must be trained to provide accurate information and use modern tools in their job. Most of the end users are computer illiterates and therefore awareness ICT courses must be offered more frequently.

The fourth section describes the information strategy in terms of the use of the information system or requirements, its management and used technology. Requirements of the Regional Information system are identified. Management of the IS to be developed in terms of IS development, operation and training is described. The technology to be used must be a combination of Web base technology and stand alone systems technology based on distributing the IS on CD's for locations where Internet connectivity is not available.

The fifth section describes the main components of the Regional Agricultural Information System. These are Management Information System, Access to Regional Information Systems, Access to National Information Systems and link to global information System. For each component, the issues related to system development, resources needed, and when efforts should start, are raised.

2. Importance of Information and Communication Technology

The main objective of using Information and Communication Technology (ICT) in Agriculture in *West Asia and North Africa (WANA) Region* is to facilitate the exchange of information and knowledge among stakeholders. These are National Agriculture Research Systems (NARS), Advanced Research Institutions (ARIs), Non-Governmental Organizations (NGOs), International Agriculture Research Centers (IARCs), Private Sector, Farmers' Organizations, and Donors. This will facilitate the sustainable development of the region.

For this purpose, AARINENA, in cooperation with NARS-Secretariat and the countries of the region, will establish a *Regional Agricultural Information System of WANA Region (RAIS/WANA)*. The specific objective of RAIS/WANA is to facilitate the access to scientific and technological information on agricultural and rural development topics by end-users, as well as the flow of knowledge and information among stakeholders of agricultural research and development. By end-users we refer to researchers, extension workers, farmers, policy-makers, development agents and agro-industrialists. It is important to point out that end-users are both generators and users of information related to the various phases of the production and utilization of knowledge: research, extension, education and innovation in the productive sector. The capacity to access information, and to convert it into useful knowledge, is of paramount importance for the development objectives: poverty eradication, food security, sustainable development and increased productivity and competitiveness.

The stakeholders of Agricultural Research and production in the WANA region have a great problem in getting accurate and timely information. The traditional way of transferring information from research to extension through extension documents and training is not adequate nowadays because the information generated every day cannot be conveyed efficiently using this way. The same argument can be posed for researchers who want to get up to date information concerning their areas of interest. It will be a waste of very valuable resources if research is conducted for something which has already been done somewhere else, may be in a neighbor country or even a neighbor institution. Policy makers need to know research plans, capacities, agricultural production, and other information to plan for needed research and production. This type of information is also needed by development agents to orient funding to the proper direction. Farmers and agro-industries need to have up to date information related to product prices in different markets and these markets capacities.

ICT can help in satisfying these needs. Knowledge based systems and Expert systems technology can be used to encapsulate technical information in a suitable form to transfer it to the extension. Databases can be used to store and retrieve needed information. Computer networks can be used to disseminate this information to the region countries and to get global information through Internet connectivity. Web technology can be used to develop front pages for different institutions through which institution information can be accessed.

3. State of Information and Communication Technology in WANA Region

This section summarizes the state of Information and Communication Technology (ICT) in the WANA Region. The first subsection presents information and knowledge systems developed in the region. The second subsection describes the Internet connectivity in the region. The third subsection discusses the human resources availability in the region.

3.1 Information and Knowledge Systems

Some efforts have been exerted to develop information and knowledge systems in the region. In Egypt, a UNDP and Government project was initiated in 1989 to develop a capacity for building agricultural expert systems in the Egyptian Ministry of Agriculture and to develop two expert systems for cultivating cucumber under plastic tunnel and citrus in the open field. The objective for building agricultural expert systems is to transfer the research results to the extension workers using the expert system technology. Expert systems are well recognized as a tool for encapsulating the knowledge and expertise in a form that enables their users (extension worker, grower, and researcher) to get a customized advice according to their environments. It is different from books or extension document that contains the knowledge in general textual form and leaves the readers to infer what is suitable for their environments. Expert systems can also include heuristic and inherited knowledge and expertise that cannot be found in any text. Based on this project that was executed by FAO, a Central Laboratory for Agricultural Expert System (CLAES) was established in the Egyptian Agriculture Research Center (ARC) in 1991 (www.claes.sci.eg). Since that time CLAES has developed many expert systems either through collaborative projects or through local funds www.claes.sci.eg/projects.htm Currently, there is a project funded by ICARDA for developing a Multimedia Diagnostic Expert System for Faba Bean for the WANA Region. The knowledge forms used to elicit the knowledge from different domain experts will be availed through the Internet and also the expert system itself. So, users can get two types of knowledge sources. The first source is the raw knowledge that needs user inference to reach a decision. The second source is a knowledge based system that can give its user the recommendation based on the inference of a group of human experts whose problem solving expertise and knowledge were encapsulated in the system.

Information Strategy for the WANA Region

In order to transfer this expertise to the region, FAO has supported four missions to other countries in the region through TCDC program. In these mission scientists from CLAES traveled to four countries namely Iran, Syria, UAE, and Oman. ICARDA also supports a short-term regional course on Utilization of Expert Systems in Agricultural Research and Production that was held three times, once a year, until now. The Arab Organization for Agricultural Development (AOAD) has also supported the travel of one scientist to UAE to give them support on developing an Expert System for Palm Trees. CLAES will also receive two trainees from UAE to train them on implementing this system. Egyptian Ministry of Agriculture has proposed a project to create ES centers in the region. This proposal was supported by more than 10 Arab countries but unfortunately it was not implemented because lack of funds.

Web sites are another source of information in the region. AARINENA has recently developed its home page at <http://www.ari.gov.cy/AARINENAp.html> where links are established to different Web sites in the region. The Electronic Global Forum on Agricultural Research (EGFAR) is preparing sub-regional websites that facilitate access to the agricultural research institutions and the information facilities in each sub-region of the WANA region. This can be accessed through the Gateway Function of the NARS Master Website of EGFAR, at <http://www.fao.org/nars>. Through the Gateway function one can have access to the websites of the Maghreb sub-region, the Nile Valley and Red Sea sub-region, the Mashreq sub-region, the Arabian Peninsula sub-region, and the Western Asia Sub-Region.

AARINENA, in collaboration with ICARDA, FAO and CIHEAM, has recently published a study on the profiles of the NARS of the Region. This study will soon be available through the AARINENA website. In addition, to further valorize the information gathered for this study, FAO has agreed to support the preparation of a NARS directory for the region. This work is in progress.

There are also efforts between FAO/SDR and CLAES to implement a Virtual Extension and Research Communication Network (VERCON) in Egypt. VERCON aims to strengthen existing linkages, as well as enable new linkages between the various components of agricultural knowledge and information system. The ultimate goal is to improve the agricultural information and services provided to Egyptian farmers and in particular resource-poor small holder farmers. The VERCON will involve pilot sites in Egypt, which will use the Internet to communicate and exchange information.

ICARDA has an ICT strategy that is laid on (i) a common electronic communications network, (ii) networked information systems and databases, (iii) building information partnerships, (iv) common technical standards for information products, (v) joint acquisition of inputs and production of outputs, and (vi) appropriate human and financial resources. A program of three steps is being implemented according to this strategy. These three steps are:

- Step 1: Improved speed and efficiency in accessing and exchanging information.
- Step 2: Improved Public Awareness about ICARDA's Work.
- Step 3: Strengthening NARS capabilities in information retrieval, storage and exchange, and fostering technology transfer efforts of ICARDA, through training, networking and resource sharing and developing appropriate print and multimedia products, including Expert Systems, to foster the transfer of technology.

There is also a current project in the Arab Organization for Agricultural Development (AOAD) for building a Database for Agricultural Current Research in Arab Countries (ongoing research projects). AOAD plans to collect information from different Arab countries this year.

CIHEAM also has a program for ICT capacity-building in the region that will be based on four key items:

- Install in each Regional Action Programme (RAP) leader partner institution a web server;
- Supply partners with Internet utilities, PC's and modems and where applicable also support infrastructure works (cabling).
- Develop at CIHEAM level, through a proper software the framework for an intranet
- Implement training activities to support this capacity building Programme, both at level of users and web masters.

3.2 Internet Connectivity

Although there is a lot of missing data in the collected questionnaires, analyzing these data could give some indicators on the level of ICT in the sub-regions. The number of questionnaires received was only for 11 countries. Analyzing table 9 (Annex I) reveals that:

- There is a discrepancy in the cost of installing and running leased lines in the region. The highest cost is in the Nile Valley (Egypt specifically). This may be due to the International connection bandwidth which is the highest in the region (15Mbs)
- No ISDN is available in the region
- VSAT and Radio Links are only available in two sub-regions
- Dial up prices are almost the same with one exception which is in Mashreq sub-region
- The number of Institutions connected to the Internet in West Asia and Nile Valley sub-regions is almost the same followed by Mashreq sub-region.
- The best Internet International connectivity exists in the Nile Valley sub-region (Egypt) followed by Maghreb sub-region (Malta) and then Mashreq sub-region (Cyprus)
- The highest number of users and ISP's existed in the West Asia Region followed by Nile Valley, Maghreb and then Mashreq. It should be noticed that the estimated number of users is not in the Agriculture sector only.

Table 10 (Annex I) reveals that the number of International and Regional Organization permanently connected to the Internet is 6 in the whole region. The number of International and Regional Organization connected through dial up is 5.

3.3 Human resources

There are three players in ICT namely developers, information providers, and end users. There is a need to develop the skills of these three categories.

In most agricultural institutions in the region, there are no professional information systems developers. Therefore, nonprofessionals are responsible of the information system in the organization. This leads to developing unreliable systems. In Egypt, there is a presidential decree that urges any organization to have an information center. Employees in these centers are not up to the level because the low salaries in the government do not attract ICT professionals to work in these centers. The successful systems were developed through projects funded by International Organizations. These projects hired professional to do the work. I believe that this problem exist in all the regional countries.

The information providers are trained on using developed systems. However, the problem is that in most of the countries, each organization wants to treasure its information not share it. There is a need to change this attitude in the regional countries. The current tools that help to avail the information on the Web can enable each institution to use this technology in disseminating its information. This needs training information providers like researchers,

economists, and other stakeholders, on using these tools. Currently, this capacity does not exist.

The end users in most of the regional countries are computer illiterate and have barriers in using the computer. Hence, they cannot access information on the Internet or even packages on CD's and other media.

4. Strategy for Agricultural Information in the WANA

4.1 Objective of the Regional Information Strategy

The general objective of a *Regional Information Strategy* is to provide a general framework for action, as well as specific guidelines for the establishment of a regional system (i.e. adoption of common protocols and policies, development of e-mail connectivity, strengthening internet access in the rural sector, etc.).

More specifically, the goal of the proposed Information strategy is to provide guidelines on three subjects.

Users. Who will be the main users of new information resources? What different types of content do these users need? What will they use this information for?

Management. How can the Organization best organize its information? Who will be responsible for planning, implementation, and evaluation? How much structural and/or procedural reform will be required?

Technology. What mix of delivery/access media in the range of printed, CD-ROMs, Internet, and Wide-Area-Networks (WANs) will be most appropriate in terms of both uses/users and costs/benefits?

Appropriate information technology leads to improved information management. This in turn will lead to stronger research planning, monitoring, and evaluation. So better research will be obtained and more benefit to the farmers will be realized.

4.2 Requirements of the Regional Agricultural Information System

The RAIS is required to fulfill the following requirements:

- Facilitating access to publications and to research results that are generated by research centers and scientific institutions.
- Integrating local *knowledge* into information systems. The issue here is that of combining universal knowledge (science) with local wisdom, which can play a very important role in assuring sustainable development.
- Providing interaction between researchers and extension services. If close interaction is assured between these two actors, extension services can play a major role in the process of knowledge brokerage.
- Facilitating access by local end-users to global information facilities (i.e. FAO/WAICENT, EGFAR, CABI, CGIAR databases).
- Promoting partnership through availing current research projects conducted in the region and research programs of National Agricultural Institutions.
- Developing Websites for stakeholders in the region and linking it to other information systems.

4.3 Strategic Alternatives

In effect, there are strategic alternatives for each component of the strategy namely Users, Management, and Technology.

4.3.1 Determine User Needed Systems

Users as defined here above are: researchers, extension workers, farmers, policy-makers, development agents and agro-industrialists. Each class of users has its own requirements. Therefore one strategic alternative is to adopt a formal approach and to go into detailed analysis of the information needs of each class. Then, a formal requirement analysis of the needs of all classes is conducted to come up with complete specifications. This approach is impractical and very time consuming. The other approach is pragmatic approach, which is based on what we have already in the region. Two examples of this approach are given herewith. For researchers, there is the AGRIS and CARIS systems which started some years ago. These systems collect information from countries and store it centralized in the FAO HQ. If a capacity is built in the region, then this information could be collected at the regional level. In fact, the two levels may strengthen each other: having a capacity in the region to analyze this information will enrich the input of the countries of the region to the AGRIS and CARIS databases. The second example is for extension workers. There is the traditional system of extension documents we are all acquainted with. If this system is modernized using electronic media and expert systems, this will increase their effectiveness to respond to the needs of farmers and other end-users. There are two projects currently being implemented in CLAES applying this approach. One of them represents scaling down from the global level to regional level and the other one represents scaling up from national level to the regional level. CLAES has a letter of Agreement with FAO to develop a prototype regional information system by taking the current data at FAO HQ, in FAOSTAT and desertification systems, and pull out of it the regional data. The extracted database can later grow independent of the global data. The second project is in collaboration with ICARDA to develop a regional expert system for Faba beans based on the national experience in developing the same system for the local conditions.

4.3.2 Management

Management of the RAIS includes several issues namely: organization body that will take care of all activities related to development, system operation, and training.

Organization Body: As one of the objectives of AARINENA is to promote the exchange of agricultural, scientific and technical experience and information in the region, AARINENA should be responsible for this information system. The concept of sub-region and region is based on geographical aspect. However, as concerning ICT the storage of data in a regional country does not imply that it is the nearest place because actual connectivity to the Internet may be done through European or American country. If AARINENA office could work as an ISP for the countries in the region, faster access will be provided for the sub-regional and regional IS's. Collaboration with FAO, ICARDA, CIHEAM and other international, regional and national institutions that have IT capacities is highly recommended.

Development: In developing IS in the region, there is a tendency in training non-IT professionals on using software development tools in order to build information system. This trend produces unreliable systems except in cases where the system is simple and there is a powerful tool for producing it. A second approach is to contract IT professionals to produce the information system under close supervision of the owner. I believe that a combination of these two approaches can be followed based on the complexity of the system. Making use of what has been developed is essential in this strategy. IT institutes and centers in the region should participate in the development activities. Therefore, at least two IT specialists should

be working for AARINENA office in order to develop simple systems and/or following up the development of complex system that should be built by an IT organization.

In addition to the proposed approach, there should be a methodology for IS development in any country of the region such that when a new system is identified, clear steps are to be taken. This methodology should determine guidelines, standard, and normative frameworks for the following: The requirement specifications, the system design that includes the I/O design forms or the Web page design, the data base design, the application programs design, implementation tool based on the type of the information system to be implemented and the platform on which the implementation will take place, testing methodology, and integration with other IS's.

Once a system is completed at any country in the region, experience should be transferred and the same system is to be adopted in any other country that needs the system. In this way, we will guarantee compatibility while evolving. This needs a strong link between all the countries in the region.

System Operation: System operation includes hosting, maintaining and deploying the system. In order to host the IS, a Web server should be availed at the AARINENA office with high bandwidth link to the Internet in addition to workstations for the IT specialists. Software for developing Web pages and Databases should also be provided. A procedure should be established for maintaining the site on regular basis. Keeping information on the system users and their addresses in order to inform them regularly with any changes and to send them new versions in case of distributing the system on CD's.

Training: *training of human resources* on various aspects related to information management and to the development of national information systems in agriculture and in research and development is very important. These training activities in the WANA region should be organized by AARINENA with the support of FAO and other National, Regional and International Organization interested in ICT. There are various training efforts that are taking place in this field, for example, there is a regional short-term training course for the Utilization of Expert Systems for Agricultural Research and Production which is held annually by ICARDA and CLAES. It is important to coordinate the efforts made by the different agencies in order to assure integrity and coherence among them.

4.3.3. Technology

The technology used in RAIS should be a combination of Web technology and Stand alone application distributed on CD's in locations, which have no access to the Internet. The Web pages should be used as a front page to integrate all types of information systems available under certain category. Each system should be developed to be available in the two forms. This approach is followed by FAO WAICENT system. In the meantime, efforts should be exerted to:

- Increase the awareness of the importance of enhancing ICT infrastructure in the countries.
- Support lead countries in strengthening their international connectivity and national and institutional infrastructure to be models for other countries.

There should be coordination with CIHEAM in this regard as there is a project to provide lead institutes in the region with ICT equipment like Web Servers and others.

5. Structure of the Regional Agricultural Information System

The Regional Agricultural Information System for the WANA region (RAIS/WANA) should consist of the following components in order to respond to the objectives and requirements identified in section 4.1 and 4.2:

- A Management Information System (MIS)
- Access to Regional Information and Knowledge Systems in Agricultural Research and Development
- Access to the National Agricultural Information Systems (NAIS)
- Link to Global Databases and Information Systems and to the Regional Information Systems (RAIS) of other regions

The VERCON concept proposed by FAO and which will be tested in Egypt (there is a TCP project proposal that is expected to be funded very soon) can be generalized on the Regional level. VERCON concept is based on providing a network that enables each stakeholder group engaged in research and development to provide their information and expertise to other stakeholders and to use the knowledge and expertise of other stakeholders. Each of the above identified system could be part of the Regional VERCON augmented with chatting rooms for each group of specialists, mailing lists for each group.

The following subsections will describe each of the above-identified systems, system development, resources needed, and lastly when efforts should start.

5.1 Management Information System (MIS)

5.1.1 Description

The *Management Information System (MIS)* of RAIS/WANA should consist of five databases with the objective of monitoring agricultural research and development (R&D) in the region, and of facilitating regional cooperation in this area. The following web-enabled databases should be developed:

- One) *Data base for all the NARI's in the region:* This database should contain the information related to each NARI including its name, its mission, director, address, email, web site (if any). The study prepared by FAO, ICARDA, CIHEAM, AARINENA for the National Agricultural Research Systems in the region could be the basis for building such database
- Two) *Database on Regional/Sub-regional Research Networks:* This database should contain information on the research networks that exist at both the region-wide level, as well as at the sub-regional level. Access to these networks will be facilitated, either through the Webpage of the network, if it exists, or through e-mail contact with the coordinator of the network. ICARDA web site has information about some research networks in the region, therefore a link to ICARDA site could be established <http://www.cgiar.org/icarda/Research/Research2/network.htm>. However the information in the ICARDA site is not complete. For example it does not contain the name of Network coordinator and email address.
- Three) *Databases on Research Projects:* CARIS is an information system that contains Agricultural Research Projects on global level. The data for CARIS are collected from different countries. In each country, there is a focal point for collecting this

information. This focal point could be strengthened to store these data at the national level. This information can be conveyed to the RAIS/WANA from the countries in the region to build a database on the regional level that links the national local focal points. FAO experience in managing this process can help in this regard. The regional database interrelating these national databases is to be complemented by a regional (centralized) database that will concentrate only on covering research projects that are carried out through regional/sub-regional networks and/or regional/sub-regional research projects. It should be pointed out that if the project of the Arab Organization for Agricultural Development (AOAD) is implemented, this project should constitute the starting point for this database. The AOAD has offered to fund this project.

- Four) Databases on Research papers: The same as in (d) but for research papers (AGRIS).
- Five) *Economic and statistical Database*: FAOSTAT is a database available from FAO global database. The data are collected from focal points in countries all over the world. If we follow the same idea for CARIS and AGRIS, regional database could be established.

5.1.2 System Development

The MIS should be co-ordinated by AARINENA in collaboration with NARS's. AARINENA should initiate the development procedure for the NARI's database using the FAO/ICARDA study and the Research Network database using information available about these networks in ICARDA. Web sites should be built for each country even on the AARINENA host such that these web sites could be transferred to the local hosts when they are ready. As concerning current research projects and research papers, the data should be collected from the NARS's. Therefore, this should be done in very close cooperation with the focal points for collecting these data now for FAOSTAT, CARIS and AGRIS. To build a prototype for these systems, data concerning each country in the region could be extracted from FAO database and a regional database is to be built linking national databases. AOAD can also play a role as they have a project for building a database for current research in the Arab World.

5.1.3 Resources Needed

In order to implement the MIS component, web servers are needed in AARINENA and in focal points of the countries that have Internet connectivity such as Egypt, and Iran. Other countries that have extensive research projects are to be identified. Development cost is also needed. A suitable Organization from the Region is to be contracted to build the MIS. Training cost is also needed. The training should include short term training courses in the countries' focal points to train the national employees on feeding data to the different databases. The resources mentioned here do not include AARINENA human resources that should follow this up.

5.1.4 When Effort should start

Efforts should start right now to get funding for human resources for developing the NARI's database and the Regional Research Networks database using the web server of AARINENA to host them. The other three databases need web servers in the countries' focal points and training of human resources to feed the data. Therefore, efforts should start once funding is secured. However, efforts could start in countries, which have web servers in some of their institutions to host the local database. This needs only coordination at the national level. Seed fund is needed to start such effort in one or two countries in collaboration with AARINENA and FAO.

5.2. Access to Regional Information and Knowledge Systems in Agricultural Research and Development

5.2.1 System Description

The second major component of the RAIS/ WANA is constituted by the various specialized regional and sub-regional information systems that exist on topics related to agricultural research and technological development. The databases in the previous section (MIS) is to be established by AARINENA, and they will be directly managed by the regional information system. In the case of this component RAIS/WANA only plays the function of a “regional reference center”, linking to those information and knowledge systems that *already exist*. This will facilitate access to them (this is a gateway function). The following specialized systems are examples to be integrated into the regional information system:

One) Knowledge Based Systems: There is current effort between CLAES and ICARDA to develop Regional Expert Systems for Faba bean and Wheat. These systems will be availed on the Internet soon. The forms that contain the knowledge extracted concerning the diagnosis and control of different disorders will also be availed.

Two) Sub-regional Information Systems and Databases: The WANA region has five sub-regions. The Electronic Global Forum on Agricultural Research (EGFAR) is preparing sub-regional websites that facilitate access to the agricultural research institutions and the information facilities in each sub-region of the WANA region. This can be accessed through the Gateway Function of the NARS Master Website of EGFAR, at <http://www.fao.org/nars>. Through the Gateway function one can have access to the websites of the Maghreb sub-region, the Nile Valley and Red Sea sub-region, the Mashreq sub-region, the Arabian Peninsula sub-region, and the Western Asia Sub-Region.

5.2.2 System Development

AARINENA should take the responsibility of keeping these pages up to date. A mechanism should be established such that any national and/or regional organization that develops a new information system is to inform AARINENA. For the time being the sub-regional web pages contains only links to national web pages. In the future, this should be the place for linking sub-regional systems.

5.2.3 Resources Needed

Resources required for this system are only to maintain the web page of AARINENA each time a new system is developed.

5.2.4 When Effort should start

Effort should start right now to find out the sub-regional sites in the region and to establish the required links.

5.3 Access to the National Agricultural Information Systems (NAIS)

5.3.1 System Description

Some countries in the region have important information facilities that have been responding to different information needs of farmers and other end-users in these countries. These institutions that provide information services at the local level can be integrated into *National Agricultural Information Systems (NAIS)*, in order to improve the complementarity between them and to seek to develop common services or integrated services to the end-user that may increase their effectiveness. These national information centers play a very important role, since they are the information agents that are closest to the farmers and to other end-users. Thus they play a critical function in the whole regional information system, both in terms of facilitating access to agricultural information by end-users, and in strengthening the input the various countries of the region make into regional and global information databases and systems. A few of them are now establishing homepages in the web in order to use Internet to coordinate their activities. In the case of Egypt, for example, the following national information facilities can be mentioned, which are already web-enabled:

- Central Laboratory for Agricultural Climate, see: <http://clac.claes.sci.eg/>
- Agricultural Technology Transfer and Utilization Project, see <http://www.atut.gov.eg/>
- Egyptian Agricultural Library, see: <http://nile.enal.claes.sci.eg/>
- Central Laboratory for Agricultural Expert System, see: <http://claes.sci.eg/>. This laboratory will avail its expert systems soon on the Internet.

These information services in this country could be integrated into a National Agricultural Information System (NAIS), aimed at increasing the effectiveness of these various services in terms of reaching the end-users. This would also facilitate interaction with the WANA-RAIS.

5.3.2 System Development

AARINENA should take the responsibility of keeping the links to these pages up to date. A mechanism should be established such that any national that develops a new information system is to inform AARINENA. For the time being the NAIS's are few.

5.3.3 Resources Needed

Resources required for this system are only to maintain the web page of AARINENA each time a new system is developed.

5.3.4 When Effort should start

Effort should start right now to find out the national sites in the region that provides specialized information systems and to establish the required links.

5.4 Link to Global Databases and Information Systems

5.4.1 System Description

The fourth component of RAIS/WANA is related to facilitating access to global databases and information systems (i.e. EGFAR, AGRIS, WAICENT, other CGIAR centers, Global

Information Strategy for the WANA Region

Research Networks, etc.), as well as to the Regional Agricultural Information Systems (RAIS) of other regions (i.e. Asia/Pacific-APAARI, Sub-Sahara Africa-FARA, Latin America and Caribbean, Europe-EIARD/InfoSys,). Through this function, RAIS/WANA will be integrated with the emerging *Global Knowledge System on Agricultural Research for Development (GKSARD)*. A key role is being played by EGFAR, in facilitating the link with the information resources of the various stakeholders of agricultural research for development. See EGFAR's website at: www.egfar.org. Through the NARS symbol one can reach the NARS Master Website, and from there one may reach any of the NARS-related information facilities in agricultural research.

5.4.2 System Development

AARINENA should take the responsibility of keeping the links to these pages up to date.

5.4.3 Resources Needed

Resources required for this system are only to maintain the web page of AARINENA each time a new system is developed.

5.4.4 When Effort should start

Effort should start right now to find out the global sites that provides agricultural information systems and to establish the required links.

Appendix I

Current Situation of Information and Communication Technology in the WANA Region

The description of the current status of National Information and Communication Technology, is based on the results of questionnaires disseminated to consultants in the region to acquire the current status of ICT in different sub-region .

Another source of information in the region is the International and Regional Organizations. The description of the current status of regional organizations is based on their WEB sites such as ICARDA CIHEAM and/or contacting via email, telephone or faxes.

Current Status of ICT in NARS in the WANA Region

West and Central Asia (Iran, Turkey and Pakistan.)

Table 1 Cost of Internet Connectivity

Internet Connectivity Type	Average Installation Cost(\$)	Average Monthly Rent(\$)
LS IP(28.8k to 128 k)	1817(min 500 max 3500)	604 (min 80 max 1600)
ISDN	Not available	Not available
VSAT (19.2 k to 64k)	3000 (min 2500 max 3500)	1875 (min 250 max 3500)
Radio Links (Pakistan only)	7500	600
Dial Up	27 (min 20 max 35)	30 per month (min 20 max40) 2 per hour (min 1 max 4) 638 per year (min 170 max 1000)

Table 2 National Institutions Connectivity

Type of Connectivity and Web site Availability	Number of National Institution
Dial Up	11
Permanent	8
Home Pages	8

The international bandwidth in this sub-region is ranging from 40kbs to 64kbs. The number of Internet users is estimated to be 300,000. The number of ISP' is 190

Arabian Peninsula

No filled questionnaires were received

Mashreq (Cyprus, Lebanon and Jordan)

Table 3 Cost of Internet Connectivity

Internet Connectivity Type	Average Installation Cost(\$)	Average Monthly Rent(\$)
LS IP(28.8k to 64 k)	900 (min 800 max 1000)	343 (min 25 max 900)
ISDN	Not available	Not available
VSAT (19.2 k to 64k)	Not available	Not available
Radio Links (Pakistan only)	Not available	Not available
Dial Up	25 (min 20 max 30)	104 per month

Information regarding dial up cost is missing in the questionnaires. The figures shown are approximation of what we could get. The operating cost of dial up is only given in Lebanon questionnaire and most probably is not correct because it is too much.

Table 4 National Institutions Connectivity

Type of Connectivity and Web site Availability	Number of National Institution
Dial Up	8
Permanent	2
Home Pages	1

The international bandwidth in this sub-region is ranging from 28.8kbs to 4Mbs. The number of Internet users is estimated to be 52,000, most of them is in Cyprus. The number of ISP's is 6.

Nile Valley and Red Sea (Egypt and Yemen)

In effect the questionnaire of Yemen is missing a lot of information

Information Strategy for the WANA Region

Table 5 Cost of Internet Connectivity

Internet Connectivity Type	Average Installation Cost(\$)	Average Monthly Rent(\$)
LS IP(28.8k to 64 k)	4067	2133
ISDN	No available information	No available information
VSAT (19.2 k to 64k)	3000	2300
Radio Links (Pakistan only)	3200	300
Dial Up	20	24 per month 1 per hour

Table 6 National Institutions Connectivity

Type of Connectivity and Web site Availability	Number of National Institution
Dial Up	10
Permanent	8
Home Pages	6

The international bandwidth in Egypt is 15Mbps. Number of Internet users is estimated to be more than 100,000, most of them are in Egypt. The number of ISP's is 45.

Maghreb (Lybia, Morocco and Malta)

In effect the questionnaire of Libya and Morocco is missing a lot of information.

Table 7 Cost of Internet Connectivity

Internet Connectivity Type	Average Installation Cost(\$)	Average Monthly Rent(\$)
LS IP(28.8k to 64 k)	150	2000
ISDN	No available information	No available information
VSAT (19.2 k to 64k)	No available information	No available information
Radio Links (Pakistan only)	No available information	No available information
Dial Up	30	25 per month

Table 8 National Institutions Connectivity

Type of Connectivity and Web site Availability	Number of National Institution
Dial Up	1
Permanent	1
Home Pages	1

The international bandwidth in Malta is 10Mbps. Number of Internet users is estimated to be 100,000, most of them are in Malta. The number of ISP's is 8.

Table 9 Status of Internet connectivity in the region

	West and Central Asia		Arabian Peninsula	Mashreq		Nile Valley and Red Sea		Maghreb	
LS IP	1817	604	N/A	900	343	4067	2133	150	2000
ISDN	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
VSAT (19.2k to 64k)	3000	1875	N/A	N/A	N/A	3000	2300	N/A	N/A
Radio Links	7500	600	N/A	N/A	N/A	3200	300	N/A	N/A
Dial Up	27	30	N/A	25	104	20	24	30	25
Dial up connectivity	11		N/A	8		10		1	
Permanent	8		N/A	2		8		1	
Home Pages	8		N/A	1		6		1	
Int. B.W.	40 to 64		N/A	28.8 to 4M		15M		10M	
No. of Users	300,000		N/A	52,000		>100,000		100,000	
No. of ISP's	190		N/A	6		45		8	

Current Status of ICT in International and Regional Organization in the Region

Table 10 Connectivity of Regional and international Organization in the Region

	West and Central Asia	Arabian Peninsula	Mashreq	Nile Valley and Red Sea	Maghreb
Dial up connectivity	3	N/A	1	1	0
Permanent	3	N/A	1	2	0
Home Pages	2	N/A	1	1	0