

Information Policy for Agricultural Research (IPAR)

August 1999

The Agricultural Research, Education, and
Extension Organization of the Islamic
Republic of Iran

in cooperation with

isnar International Service for National Agricultural Research

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1 Introduction

1.1 The national commitment to IM/IT

Improved IM/IT¹ is a major policy priority of the Islamic Republic of Iran.

In May 1995, President Rafsanjani spoke in Boum-e-Hen of the need for Iran to invest in telecommunications infrastructure. His specific subject was satellite technology. He noted that “Iran must enable the exposure of its culture through satellite signals” and he proposed “the expansion of satellite telecommunications throughout the country”.²

Even as he spoke, a government review of national telecoms policy was underway. In January 1995, the Iran Business Monitor reported that detailed plans for increased investment in telecoms had been developed “after two years of studies by Iran’s High Council on Information Technology (Informatics)”.³ The Minister of Post, Telegraph, and Telephone gave details of these plans the following November when he said that the government would increase its investment in telecoms from Rials 500 billion in the first five-year plan period (1989-1994) to Rials 1000 billion in the second plan (1995-2000).⁴

Top priorities for new investment are to include software R&D,⁵ export promotion,⁶ and network expansion, as well as further extension of the national telephone system. Iran already has one of the most developed telephone infrastructures in Asia. In May 1995, the Deputy Chairman of TCI⁷ noted that there were 5.5 million telephone numbers in the country and that almost 5.0 million more were planned by the end of the second plan period.⁸ The Iranian people-to-telephone ratio of 13.2 compares with ratios of 10.0 in Brazil, 13.5 in Thailand, 20.8 in Egypt, 22.4 in China, 38.6 in the Philippines, 47.7 in Indonesia, 56.1 in Pakistan, and 77.6 in India.⁹

1.2 The AREEO Request to ISNAR

In mid-1997, AREEO¹⁰ asked ISNAR¹¹ to assist in formulating a strategy for IM/IT development in the Iranian NARS.¹² The objective of the strategy was to provide a policy framework within which specific proposals and programs could later be identified, formulated, funded, and implemented.¹³

¹ Information Management / Information Technology.

² *Iran News* (May 20, 1995).

³ *Iran Business Monitor* (January 1995). Quoted by IRNA, Islamic Republic News Agency (February 19, 1995).

⁴ IRNA (November 25, 1995).

⁵ “As indicated in the Second 5-Year Plan, top priority is given to promotion of software application and utilization in the country. The government is duty bound to facilitate the growth of the domestic market and to pave the way further for Iranian firms to gain access to international software markets.” *Hamshahri* (May 6, 1995).

⁶ The Ministry of PT&T has recently completed a US\$ 22 million project to install fiber optic lines in Turkmenistan. The PT&T won this contract in international competition on the basis of its high quality and low cost bid. The lines installed will become part of the “Silk Road” link between Shanghai (China) and Frankfurt (Germany). More than 2000 kilometers of this link will pass through Iran. *Iran Business Digest* (July 28, 1996).

⁷ Telecommunication Company of Iran.

⁸ IRNA (May 24, 1995).

⁹ 1.5–2.1 in Japan, Singapore, South Korea, and Taiwan, and 5.5 in Malaysia. *Asiaweek* (January 16, 1998).

¹⁰ Agricultural Research, Education, and Extension Organization, Ministry of Agriculture, Government of the Islamic Republic of Iran.

¹¹ The International Service for National Agricultural Research. ISNAR is one of 16 centers in the Consultative Group on International Agricultural Research (CGIAR). Its mandate is to work with NARS on issues of agricultural research policy, organization, and management. Its headquarters are in The Hague, The Netherlands.

¹² National Agricultural Research System.

¹³ The TOR for the strategy read as follows. “The goal is to develop a strategy for IM in AREEO. This strategy will address issues relevant to the achievements of four specific objectives: to put information closer to users, to improve the capacity of individual research institutes and centers to store and retrieve information relevant to their mandates, to develop

ISNAR had experience in such a task, as it had completed similar exercises in India (1993-1994), Uganda (1995), and the Philippines (1996-1997).

The Government of the Islamic Republic of Iran is both a member of the CGIAR and a core donor to ISNAR. Development of this IM/IT strategy is the first activity in a multi-year cooperative program between AREEO and ISNAR. Other activities will include joint work on research planning, priority-setting, and monitoring/evaluation. A management training course for senior AREEO officials is scheduled for May 1998.

1.3 The Strategy Development Team

The joint AREEO/ISNAR team created to develop the strategy consisted of five persons.

- The team leader and specialist in management information: Dr. Byron Mook.¹⁴
- An international specialist in scientific information: Dr. Stephen Rudgard.¹⁵
- An international specialist in information technology: Mr. Paul O’Nolan.¹⁶
- An Iranian specialist in scientific information: Dr. Abbas Gerami.¹⁷
- An Iranian specialist in information technology: Mr. M. Massoud Tavallai.¹⁸

During its time in Iran, the team benefited from the advice and support provided by numerous members of AREEO. We wish to record here our special appreciation to three persons.

- Dr. Abbas Keshavarz (Deputy Minister of Agriculture and Head of AREEO).
- Dr. Mohammad H. Roozitalab (Deputy for Planning and Support, AREEO).
- Mr. H.A. Davanlou (Head, Department of International Scientific & Research Affairs).

In addition, our thanks to the Head and staff of the ICARDA/Iran¹⁹ project office in AREEO HQ. Their standing offer of office space and email facilities made our work easier.

1.4 Visits to Research Organizations and IM/IT Specialists

The team worked together in Iran for three weeks.²⁰ During that time, members visited seven of the eleven AREEO institutes,²¹ the Ministry of Agriculture,²² numerous information-related agencies in

regular procedures and mechanisms for those institutes and centers to share information; and - as a result of the first three - to improve the capacity of those institutes and centers to plan, monitor, and evaluate their research programs.”

14 Senior Program Officer, ISNAR. Former Director of Information Management Services at ISNAR, and leader of the IM/IT strategy development teams in India and the Philippines.

15 Director, Information for Development Program, CAB International, United Kingdom.

16 Head, Computer Services, ISNAR.

17 Head, Scientific Information and Documentation Office, AREEO.

18 Officer-in-Charge, Computer Division, AREEO.

19 The International Center for Agricultural Research in the Dry Areas. Like ISNAR, one of the 16 centers in the CGIAR. Its headquarters are in Aleppo, Syria.

20 October 6, 1997 through October 26, 1997. Dr. Rudgard participated for the first ten days and Mr. O’Nolan for the second ten.

21 Plant Pests and Diseases Research Institute
Soil and Water Research Institute
Seed and Plant Improvement Research Institute
Sugar Beet Seed Institute
Agricultural Engineering Research Institute
Rice Research Institute of Iran
Citrus Research Center

22 Statistics and Computer Department
Computer Center
Center for Agricultural Planning and Economics

other ministries,²³ universities,²⁴ as well as both public-sector and private-sector organizations involved in IT.²⁵

-
- ²³ Iran Information and Documentation Center (IranDoc)
Iranian Research Organization for Science and Technology (IROST)
Jahad Sazandegi Scientific Information Services (JSIS)
Iran Fisheries Research and Training Organization (IFRTO)
- ²⁴ Tehran University (Faculty of Agriculture)
Sharif University of Technology
Gilan University
- ²⁵ Telecommunication Company of Iran (TCI)
Institute of Physics and Mathematics (IPM)
SinaSoft
Neda Rayaneh Institute (NEDA)
Apadana

2 A Complex Organizational Environment

2.1 Understanding the IM/IT Situation

Many organizations in Iran undertake IM/IT activities of potential relevance to AREEO. The challenge for the team was to answer the following four questions:

- Who are they?
- What are they doing?
- What do they plan to do?
- What do they have to offer to AREEO (and *vice versa*)?

Efforts to address these questions were more difficult than anticipated. The level of inter-organizational communication is not high, and few people therefore have an overview of the entire Iranian IM/IT situation. At almost every one of our visits in the first two weeks, respondents sprung surprises. For example: “Did we know that organization A had a telecoms network connecting its headquarters with its field sites?” or: “Were we aware that organization B had email capabilities via organization C?” or: “Had we heard that organization D had developed databases on its scientific book and journal holdings?”

Whenever we heard such questions, we noted them and tried to schedule a visit to the “new” organization mentioned. Not until the third week, however, did the surprises become less.

Our overall conclusion is that AREEO is in neither a better nor a worse position than other organizations in terms of what it knows (or does not know) about IM/IT. The majority of managers in most organizations are ill-informed about recent IM/IT developments. They have had little opportunity to learn what benefits various IT components might bring, what they might cost, and how they might or should be managed. Furthermore, they have had little experience with personal computers, email, or the Internet.

This lack of exposure has had the following effects in most of the organizations that we visited (including AREEO):

- Minimum planning. As managers have not had much experience with IM/IT, they have not developed visions of where they would like their information resources and capabilities to be in 5-10 years. Without visions, it has been difficult to plan.
- *Ad hoc* development. In the absence of IM/IT strategies, investments have often been haphazard. Librarians described to the team how they had bought books and subscribed to journals without an analysis of who would use them or whether they were available elsewhere. Computer users told of developing software applications on platforms that were either out-of-production or outdated.
- Lack of system integration. The main result of this *ad hoc* development has been minimal coordination both within and between organizations. IT vendors often seem to have persuaded managers to buy hardware and software that have turned out to be old and/or incompatible. Libraries within 300 meters of each other have subscribed to the same journals and CD-ROMs.
- Isolated initiatives. This also a positive point. Many managers and scientists have shown remarkable initiative in the introduction of new IM/IT. The team discovered in various places a considerable amount of new hardware that had been assembled into small LANs.²⁶ It met enthusiastic programmers who had taken old software packages and modified them for their

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Local Area Networks.

own organizations. It found librarians who had bought CD-ROMs and established search-on-request procedures. It found several attempts to organize email. The team was continually impressed by the IM/IT commitments, energy, and resourcefulness of many of the people it met.

Conclusion #1. AREEO does indeed need an overall IM/IT strategy,²⁷ in addition to a series of detailed IM/IT implementation plans.

Conclusion #2. In comparison to many other national research organizations, AREEO is well-placed. The constraints on its IM/IT development are primarily ones of policy - and not of resources, expertise, or bureaucracy.

Conclusion #3. An important prerequisite for IM/IT development is that AREEO make a conscious attempt to keep abreast with national and international developments. At the present time, this effort relies largely on personal contacts. Partly as a result of the current strategy exercise, the AREEO commitment to IM/IT is now reasonably well-known in both the public and private sectors.

2.2 Putting Together the “Jigsaw Puzzle”

The task facing AREEO is to put together a national coalition to assist in IM/IT development for agricultural research. Many organizations will be involved, each of which has either a physical or an intellectual resource that AREEO needs.

The team believes that the best analogy is one of a “jigsaw puzzle”. Each necessary resource is one piece of this puzzle (e.g., authority over telecoms policy, Internet connectivity, ownership of scientific databases, MIS experience). Some organizations are in a position to contribute more than one piece, though such a situation is the exception rather than the rule. Conversely, some pieces can be contributed by more than one organization; but again, such a situation is the exception.

Noted below are some of the puzzle pieces. The organizations in parentheses have experience in the fields listed and are candidates to fit their pieces in.

Information Technology

- National telecoms policy (PT&T)
- Allocation of telephone lines (TCI)
- Future Internet connectivity (DCI)²⁸
- Current Internet connectivity (IPM)
- VSAT experience (universities outside Tehran, e.g. Gilan)
- Dial-up experience (IROST)
- Local-area network experience in multiple buildings (universities, e.g., Sharif)
- Local-area network experience in one building (MOA)
- Public/private service provision (Neda Rayaneh Institute)
- Private sector service provision (Apadana)
- Software expertise (SinaSoft)

²⁷ Section 1.2.

²⁸ Data Communication of Iran (a subsidiary of TCI).

Scientific and Technical Information

- National agricultural statistics (MOA)
- International literature databases (ASIDC)²⁹
- National literature databases (IranDoc)
- Current awareness services (research information services, e.g., JSIS)
- CD-ROM searches (research institutes, e.g., IAERI)³⁰
- Document delivery (research institutes, e.g., PPDR)³¹

Management Information

- Project Planning (Agricultural Research Projects Coordination Bureau, AREEO)
- Project Monitoring/Evaluation (Monitoring and Evaluation Bureau, AREEO)
- Budgeting (Planning and Budget Department, AREEO)
- Accounting (Accounting Department, AREEO)

²⁹ Agricultural Scientific Information and Documentation Center (AREEO).

³⁰ Iran Agricultural Engineering Research Institute.

³¹ Plant Pests and Diseases Research Institute.

3 Scientific and Technical Information (STI)

3.1 Objectives and Issues

AREEO is a research organization.³² Research depends on information. AREEO scientists clearly need to keep up-to-date if their research is to be both relevant and effective. They must be able to find out as quickly as possible what farmers need, what past research has done to address those needs, and what other scientists are currently doing.

The traditional way in which scientists have met such information requirements has been to visit libraries. AREEO researchers have used libraries to *identify* what information they should consult and then to *access* that information. A major resource for information identification has been abstracts and one of the main points of access has been journals.³³

A major strategic goal for AREEO will be to strengthen its Library and Information Services (LIS). This AREEO commitment will involve pursuit of the following four general objectives:

- Improved structures, procedures, and technology for the handling of information.
- Improved capacity of scientists to identify the information they need.
- Improved capacity for them to access that information.
- A more explicit “service orientation” within the AREEO LIS community.³⁴

More specifically, these objectives may be translated into attention to at least the following seven action areas:

1. Organization.³⁵ Section 3.2.2.
2. Current awareness services. Section 3.2.3.
3. Search services. Section 3.2.4.
4. Document delivery services. Section 3.2.5.
5. National bibliographic databases. Section 3.2.6.
6. Publications (both hardcopy and electronic). Section 3.2.7.
7. Coordinated book, journal, and CD-ROM acquisition.³⁶ Section 3.2.8.

³² The following brief organizational history is taken from *AREEO At One Glance*, Tehran, AREEO, 1995. “The establishment of some agricultural research institutes in Iran dates back to more than 50 years ago. The research institutes were generally independent and some had their own branches in different provinces. In 1975 the Agricultural and Natural Resources Research Organization (ANRRO) was established as a central entity to formulate policies, make decisions on research priorities and coordinate the activities of the existing research institutes ... In 1990, the research institutes related to the range, forest and animal sciences were transferred from the Ministry of Agriculture to the Ministry of Jihad-e-Sazandegi. Meanwhile the Agricultural Research Organization was also reorganized and merged with the Agricultural Education and Agricultural Extension Organization leading to the formation of the Agricultural Research, Education, and Extension Organization (AREEO).”

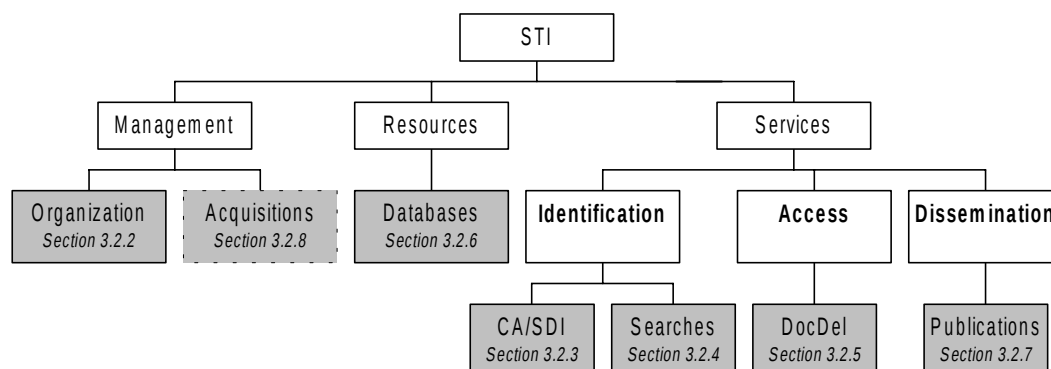
³³ In the 1990s, even though new IT is rapidly changing the structure of libraries, the basic functions of IM remain the same. One team member has noted that all of IM in any scientific field basically comes down to three tasks: finding information, handling information, and disseminating information.

³⁴ The development of such a user-oriented culture must be a *top* AREEO priority. The potential user group for agricultural research information is a large one, ranging from policy-makers in the MOA (and above) to managers in AREEO HQ, to field and bench scientists. The team found most staff in AREEO libraries to be reactive rather than proactive. The preference was to wait for users to come, rather than to seek out new clients, new needs, and new activities.

³⁵ ASIDC is the main repository library of AREEO. It was established more than 20 years ago and is located at AREEO HQ in Tehran. Its collection includes approximately 22,000 books (2/3 in Farsi), 320 journals (1/3 in Farsi), and 10,000 scientific documents. Outside AREEO, each of the 11 institutes has its own library. Some are quite large (e.g., PPDR and SWRI) and three are within 500 meters of each other in Karaj (i.e., SPII, IAERI, and SBSI). None of the 29 provincial research centers has a significant technical library.

³⁶ In most libraries, at least 75% of the collection is in Farsi. Both scientists and librarians report that the coverage of Farsi materials relevant to agricultural research is generally excellent. In addition, all institute libraries subscribe to at least some foreign journals. The acquisitions budget for such journals and CD-ROMs for the entire NARS in 1997 is US\$350,000 and has remained at this level for 2-3 years. Allocations to the different institute libraries are made at AREEO HQ. The only libraries that have more than 100 paid journal subscriptions are at ASIDC and PPDR, whilst most of the others have 20-30.

The following chart shows how these seven are related.



3.2 Action Areas

3.2.1 INTRODUCTION

Libraries within AREEO have a mixed reputation among users. Many scientists regard them as having reasonable collections, at the same time as they view them as somewhat inaccessible and difficult to use.³⁷ This last point is perhaps best illustrated by the fact that most AREEO libraries are severely underutilized. University students are often more in evidence than research scientists.³⁸ Institute LIS staff report that many AREEO scientists have not actually visited their libraries within the past 12 months.³⁹

The team has identified four ways in which AREEO can encourage its scientists to make better use of LIS resources. The first is improved organization (section 3.2.2), the second is improved services (sections 3.2.3-3.2.8), the third is improved IT (section 5), and the fourth is upgraded human resources (section 6). The objective throughout is to advance the growth of a stronger service-orientation within AREEO LIS programs.

3.2.2 ORGANIZATION

The discussion of organizational options begins with several questions. Should there continue to be a documentation center at AREEO HQ in Tehran at all? If so, who will be its clients and what kinds of materials should it hold? Should there be three institute libraries in Karaj? What are the arguments in favor of and against some degree of consolidation? And what about the future of ASIDC? Should it continue to be located at AREEO HQ in some form, or should it move to a reorganized “national information center” in Karaj?

³⁷ Many scientists outside Tehran and Karaj appear resigned to the unavailability of good information resources. The common perception is that most AREEO libraries are inadequate from both staff and facilities points-of-view. The only opportunities to visit libraries come on visits to Tehran and Karaj, but in fact most scientists report not finding time to do so.

³⁸ This pattern is not the case at the libraries of PPDR and IAERI, both of which appeared to have adequate resources and high standards of service. The main users there are scientists.

³⁹ The key variables that seem to influence the degree of library use are - in order - (a) the professionalism and helpfulness of staff, (b) the information resources available, and (c) the location of the library, both within a campus and within a building.

The team has come up with tentative answers to these questions, and has translated them into three organizational scenarios for consideration by Ministry and AREEO management. The scenario that the team prefers includes the establishment of one major center as a focal point of national STI services, whilst at the same time significant STI resources are retained at the institute/center level. In other words, a balance between centralization and decentralization.

3.2.2.1 *Four Assumptions*

- AREEO need *not* have a major documentation center at its HQ in Tehran. Even though ASIDC currently has one of the two largest collections of agricultural materials in Iran,⁴⁰ it also has very few in-house users. The AREEO staff who visit or who make requests to ASIDC are mostly research managers from the HQ building itself rather than research scientists. The outsiders who visit number only about 30 per day and are mostly students from nearby Shayed Beheshti University.
- At the same time, AREEO officials *do* need a small in-house library in Tehran. Such a center might focus on publications of direct relevance to research policy and management. Examples might be AREEO reports, newsletters, publications from international research organizations, and basic reference materials.
- There are *no* strong arguments in favor of three separate institute libraries on the Karaj campus.⁴¹ The library space in the new SPII building is ample to accommodate holdings from IAERI and SBSI, particularly if movable shelf stacks can be purchased. The advantages of consolidation are obvious: elimination of duplicate book and journal holdings, as well as economies of scale in IT investments.
- If the three institute libraries in Karaj are to be consolidated, then there *is* a strong argument for relocating most of the existing ASIDC collection there. Combined holdings from ASIDC, SPII, IAERI, and SBSI could indeed form the nucleus of an internationally-recognized "Iranian National Information Center for Agricultural Research". INICAR⁴²

3.2.2.2 *Three Scenarios*

- #1. The current situation.
- #2. Consolidation of the three institute libraries in Karaj into an INICAR in the new SPII building. Development of a campus-wide LAN of which INICAR would be a part. Continuation of ASIDC in its present form in Tehran. Improved telecoms links between Karaj and Tehran so as to allow some on-line searching and document delivery. Reduction of duplication in holdings within Karaj, but little between Karaj and ASIDC.
- #3. Maintenance of a small core library in AREEO HQ. Consolidation of the three institute libraries and ASIDC in Karaj and development of a campus-wide LAN. Establishment of INICAR as a major national repository of agricultural research literature in Iran.⁴³ Improved telecom links between Karaj and Tehran so as to allow full on-line searching and document delivery. Major reduction in duplication of holdings.⁴⁴ Some staff disruption, as existing ASIDC staff are either assigned to Karaj or reassigned within Tehran.

⁴⁰ The other large collection is at the Tehran University Faculty of Agriculture library in Karaj.

⁴¹ An FAO mission considered this same issue in the early 1990s, and recommended that the three institute libraries be combined in the new building then under construction.

⁴² Because the AREEO mandate does not cover livestock, fish, forests, or farming systems, the information holdings of a new INICAR would necessarily be limited to crops. An even more ambitious and long-term proposal than the one presented here would be for INICAR to have two "Divisions", one in Karaj (AREEO) and one in Tehran (JSIS).

⁴³ The existence of such a facility in Karaj will undoubtedly increase potentials for cooperation with the Faculty of Agriculture Library.

⁴⁴ Money saved through this rationalization can be applied to offset a portion of costs associated with IT development.

	Consolidation WITHIN Karaj	An ASIDC Move TO Karaj
Scenario #1		
—The Status Quo	NO	NO
Scenario #2		
—The Halfway House	YES	NO
Scenario #3		
—INICAR	YES	YES

The team strongly believes that Scenario #3 will be in the best long-term interests of AREEO. Not only does this option have the advantages noted above, but it will also be an incentive to IM/IT innovation in the NARS as a whole. The existence of a “national information center” will provide the basis for concerted action on current awareness services, bibliographic searches, document delivery, publications, national bibliographic databases, publications, and acquisitions. Some of these services will necessarily be quite centralized, but most will be shared between INICAR and the institutes/centers.

#2 and #3 have three prerequisites, all noted above.

- ❑ An essential part of any library integration package *must* be the establishment of a LAN within the Karaj campus. Scientists at all three institutes should be able to search the new library catalog electronically and (eventually) to retrieve documents electronically.⁴⁵ An important and obvious by-product of this LAN will be campus-wide, desk-to-desk email.
- ❑ A necessary part of any relocation of all or part of ASIDC must be the establishment of good telecoms links between Tehran and Karaj.
- ❑ As any consolidation will involve staff reassignments, AREEO management will need to develop a plan that will minimize personal disruptions.

3.2.3 CURRENT AWARENESS SERVICES

The objective of CA services is to inform scientists of new bibliographic materials in their fields. A “current awareness” service or a “selected dissemination of information” service (SDI) may focus on any or all of the following types of information:

- Book and journal acquisitions (general).
- New titles (books and/or articles) in a particular discipline.
- New titles (books and/or articles) on a particular crop or commodity.
- New titles (books and/or articles) on agricultural research in a particular location.

At present, AREEO does not provide targeted CA/SDI services.⁴⁶ An AREEO scientist who wants to find any of the above information usually tries to visit his/her library first. But because library staff

⁴⁵ The catalog is computerized at all libraries where a PC is available. The software in use is usually “NOSA”, a commercially-available product in Farsi. The subject classification is from the Library of Congress. Farsi indexing terms are available. A legitimate goal for AREEO will be to have all libraries using the same cataloging software. The obvious benefit will be that catalogs can then be combined, and a “master catalog” can be made available for the entire country. A NOSA-based system is one possibility, but NOSA is copy-protected and costs approximately US\$1000 per copy. Another possibility is CDS-ISIS (free from UNESCO in English, and available in Farsi from IranDoc). The entire University of Tehran system uses NOSA.

⁴⁶ The *Agricultural Abstracts on Agronomy* and the *Agricultural Abstracts on Soil and Water* are exceptions. ASIDC puts out each of these publications twice yearly. Staff at ASIDC photocopy bibliographic details and abstracts from 8 international journals for the AAA and from 10 international journals for the AASW, assemble this material manually, and then photocopy and bind 200 copies. The final documents are sent to AREEO institutes, centers, and universities.

have usually not organized information on new titles by discipline, crop, or location, the only option for the scientist will be to go through available abstracts and journals one-by-one.

Alternatives do exist. The technology is now available in Iran for a library to send to each scientist each month (or quarter) a custom-made listing of new titles. Four relatively simple prerequisites must be met in order for such a service to be provided.

- ❑ The scientist must have filled up “a profile” with details of his/her particular interests.
- ❑ The library must have the technical and human resources to search international databases, either on the basis of the above profile or on the basis of a generic profile. If it does not have such resources, it must at least be able to scan the contents pages and abstracts of articles in all incoming journals, and then to match those scans with scientist profiles.⁴⁷
- ❑ The library must have made arrangements with international abstracts publishers to allow the dissemination of search results.
- ❑ The library must have efficient means of transmitting these results to the institute or scientist.

AREEO can meet such preconditions. At least one other organization in Iran is already doing so. The Jihad Sazandegi Scientific Information Services runs a CA/SDI service. JSIS maintains a large collection of primary and secondary resources (400 active subscriptions, including over 50 to CD-ROMs), searches them, and each month sends a floppy disk with the results of its matches to about 70 sites.

The inauguration of CA/SDI services is a logical task for a newly-constituted INICAR. Not only could INICAR ask each AREEO scientist to complete an individual profile, but each current research project could also become the subject of an activity profile. In the latter case, INICAR could then send a report of relevant new titles and abstracts to the project manager at 3-month or 6-month intervals.

3.2.4 TARGETED SEARCH SERVICES

Targeted bibliographic searches are a complement to CA/SDI. The objective of such searches is to provide scientists with citations and abstracts on specific problems in their current research fields or on specific issues for their future research. Whereas an individual scientist profile for CA/SDI services usually focuses on more general and longer-term interests, a targeted search deals with more precise and shorter-term questions.

The required technology *may* also be somewhat different. CA/SDI services that are designed to cover new hardcopy acquisitions need only a scanner (for the title and contents pages of journals).⁴⁸ But targeted searches also require CD-ROMs and/or access to the Internet (for article titles and abstracts from journals that may not be received in hardcopy). Several AREEO libraries now do targeted searches on request,⁴⁹ as do some libraries in the Ministry of Jihad-e-Sazandegi.⁵⁰

⁴⁷ An apparent violation of international copyright, but not one that most journals would choose to pursue.

⁴⁸ The minimum. CA/SDI services that also search international databases will need CD-ROM subscriptions and CD-ROM technology.

⁴⁹ ASIDC, PPDRI, and IAE are the most active. Included in current ASIDC CD-ROM subscriptions are AGRIS, AGRICOLA, PlantGeneCD, CropCD, Biological and Agricultural Index, and Deerwent Biotechnology Abstracts. IAERI subscribes to CropCD, HortCD, SoilCD, Water Resources Abstracts, and Food Science and Technology Abstracts, while PPDRI subscribes to PestCD. Library staff at the three locations receive requests for searches by fax, phone, in writing, or in person. Searches at ASIDC are currently based only on AGRIS and total about 6/day.

⁵⁰ JSIS estimates that it carries out about 200 searches per week with a 5-6 day turnaround time. In another part of the Ministry of Jihad-e-Sazandegi, IFRTTO has developed a decentralized search request service, based on CITRIX, which allows users to send requests by email, have their searches carried out on CD-ROM databases in Tehran, and have the search results returned by email.

If INICAR were to provide targeted search services on a national basis, it would need the following resources:

- Working email connections with all the institutes/centers.
- CD-ROM and/or Internet subscriptions to all the major bibliographic databases.
- Sufficient CD-ROM technology to be able to search multiple databases simultaneously.

Beyond this technology, AREEO would also want to build in some assurance that scientists would use the service. Current policy is that all new project proposals must contain evidence of a literature review. Evaluators are supposed to give considerable weight to the quality of the search on which this review is based, though in practice everyone recognizes that good searches are difficult. Scientists outside Tehran and Karaj have particular problems because of their lack of access to adequate libraries.⁵¹

All the above can be done, but there is one caveat. The fact that INICAR might be provided with CD-ROMs subscriptions and servers does not mean that all search services should be centralized there immediately. A transition period is inevitable. During that time, AREEO will need to ensure the viability of email connections, so that scientists can be sure that both search requests and returned results will get through. INICAR will need to get its new CD-ROM IT up-and-running and will need to develop procedures for managing search requests. Even once the national system is in place, there will still be strong arguments for selected institutes maintaining basic in-house search capabilities.⁵² Perhaps most important, such a system will not run itself. The most critical requirement is human resources. LIS professionals will have to be (re)trained to assist scientists in doing searches and then in analyzing results.

3.2.5 DOCUMENT DELIVERY SERVICES

Document delivery is the logical end-product of CA/SDI and targeted search services. After a scientist has found a title in a table of contents or seen an abstract, (s)he may very well wish to read the entire article. The problem at the present time is that most AREEO institutes have no set procedures for requesting "DocDel". They do not know whom to ask because there is no commonly-accepted, complete, and widely-available Union List of Serials.⁵³

The current "DocDel" process is therefore somewhat *ad hoc*. A "DocDel" request to ASIDC can be met via one of the following three levels:

1. At ASIDC itself. This option is the cheapest and potentially the quickest.

⁵¹ Even though most AREEO scientists have sufficient command of English to be able to read technical texts, they do not have the experience to do a good job at selecting keywords for searches and to identify sources. Most LIS professionals at sites that do not at present have CD-ROMs also have little experience in doing searches.

⁵² A good example might be PPDR. Staff in the library there report that they already carry out approximately 100 CD-ROM searches daily. Usually the results of these searches are downloaded to a floppy disk rather than printed. In such an intensive "search-oriented" environment, an institute should further develop the capacity to do its own searches and, in the case of PPDR particularly, retain the ability to do quick searches in the event of "emergencies" like new pest infestations.

⁵³ If there were such a Union List, a librarian could simply consult it, find out who in Iran subscribed to the desired journal, and request a reprint. The team saw a demonstration at the Faculty of Agriculture Library of a Union List of Non-Farsi Serials, implemented in a Farsi version of CDS-ISIS. This particular Union List has been developed by IranDoc. There appear to have been two related problems. First, it has not been well marketed, as evidenced by the fact that most AREEO librarians have never heard of it. And second, it is rumored to be expensive (though IranDoc claims that subscription prices are reasonable and negotiable).

2. Via another organization in Iran (e.g., the Faculty of Agriculture Library). This option involves little cost but takes more time.⁵⁴
3. Via a request to an organization outside Iran that has a special "DocDel" program (e.g., the British Library). This option is by far the most expensive and potentially the slowest.

The future of "DocDel" is one of the most exciting and potentially confusing in the entire field of scientific information. The prices of hardcopy international journals are going up in a period when the journal acquisition budgets of libraries are steady or going down. Publishers around the world are responding to declining subscriptions by beginning to offer their journals on the "World Wide Web". Internet-based readers who wish to access these journals must pay, not for entire volumes but only for what they see and/or what they download.

For an organization like AREEO, the issues for the next 3-5 years are clear.

- The prices of hardcopy journals will continue to rise.
- Libraries will therefore have to cut back on subscriptions, and will be looking for cost-efficient means of "DocDel".
- The identification of articles will increasingly depend on CD-ROM technology (which costs money).
- The access to articles will depend increasingly on Internet access (which also costs money).

The question will not be whether to continue hardcopy subscriptions. Instead, it will be how much to invest in IT, and how to distribute that investment.

3.2.6 NATIONAL BIBLIOGRAPHIC DATABASES

A critical component of CA/SDI services, targeted searches, and "DocDel" is the existence of "national bibliographic databases". There are at least four types, listed here in a suggested order of priority for action.

- A national database of agricultural research abstracts (English). The only such database now is a small one developed by ASIDC and based on AGRIS⁵⁵ structure and protocols. Subjects covered include crops, livestock, fish, and forests, though the only articles covered are those from Farsi journals that already have English abstracts. If ASIDC and/or INICAR wish to strengthen this database, action will need to be taken on the following issues:
 - Subjects. The issue is one of cooperation between different ministries. ASIDC should ideally limit itself to abstracts on crops, while Jahad-e-Sazandegi should contribute abstracts on livestock, fish, and forests.⁵⁶
 - Articles and journals. A legitimate goal could be to include abstracts of *all* articles in all relevant journals. The problem is that many scientists do not write English abstracts to go with their Farsi articles. Two actions to address this problem are possible: first, for AREEO to require an English abstract as a condition of article publication in any AREEO-supported journal, and/or second, for ASIDC to hire one-two staff with agricultural backgrounds to write abstracts.⁵⁷

⁵⁴ Reports from AREEO libraries outside Tehran are that "DocDel" can take up to 12 months. On the other hand, the Faculty of Agriculture Library in Karaj claims that the turnaround time for "DocDel" between university libraries is only two weeks. The team believes that AREEO could and should actively pursue inter-library cooperation. JSIS has indicated its willingness to work with AREEO both on inter-library loans and "DocDel", as has the Faculty of Agriculture Library.

⁵⁵ An international bibliographic database established and managed by the Food and Agriculture Organization of the United Nations.

⁵⁶ The AGRIS Input Coordinator from ASIDC has already trained a staff member from IFRTTO in the input of fisheries abstracts.

⁵⁷ FAO estimated in 1992 that Iran could be submitting 2000-2500 records per year to AGRIS, though by the end of 1995, the total input was only 600. During the past 14 months, however, inputs have risen to almost 2400 (i.e., more than quadruple the previous multi-year total). The team believes that AREEO and ASIDC should be congratulated for this effort! At the same time, this number could be increased still further if additional staff were available.

- Inclusion of “gray literature”. Much valuable research throughout the NARS is written up and never formally published. Papers, reports, and conference proceedings are plentiful, but the problem is finding them. ASIDC already has a “documents” section in its library, the contents of which it includes within its electronic catalog. Such material could well be integrated into a national abstracts database. Once again, a prerequisite is short abstracts or summaries in English.
- A Union List of International Serials (Non-Farsi). No such database exists at present. If there were one, a librarian could find out who in Iran subscribed to a journal containing an article that a particular scientist was requesting and request a “DocDel”. The potential for significant financial saving is obvious from such a UL, since pressure on libraries to subscribe to international journals would be decreased.
- A Union List of Serials (Non-Farsi). AREEO has previous work to build on, both from IranDoc⁵⁸ and JSIS. The team believes that AREEO could well take the lead in establishing a working group consisting of representatives from the Ministries of Agriculture, Jihad-e-Sazandegi, and Culture and Higher Education. The “terms of reference” for this group might include the following activities:
 - Further development of the Union List already started by IranDoc. Particular attention to be paid to the inclusion of all journals relevant to agricultural research and to keeping the UL up-to-date.
 - Analysis of the long-term suitability of CDS-ISIS as the software base for this Union List. A possible alternative might be the new version of PC-MINISIS (from IDRC, Canada).
 - Marketing of the UL to all institutes, centers, and universities involved in agricultural research.
- A Union List of Serials (Farsi). Similar to the above, the major difference being that there is little previous work to build on.

3.2.7 PUBLICATIONS

Current AREEO publications are all in hardcopy. However, in the next 3-5 years, at least some of them will also move to electronic form.. They fall into four categories.

Journals. Agricultural research in Iran has a long publishing tradition. The first journals appeared more than 50 years ago as products from various institutes. Many still exist and are still managed mainly by the institutes.⁵⁹ All are in Farsi, most with abstracts in English. The quality of the articles ranges from excellent to marginal (by international standards).⁶⁰

Books. AREEO has a small book publishing program. It has brought out twelve titles to date. Most manuscripts submitted for consideration are Farsi translations of foreign titles.⁶¹ An AREEO book is usually in soft cover with a print run of about 2000. The sale price is kept low to encourage widespread distribution. Authors and/or translators do not have to be from the NARS.

⁵⁸ Section 3.2.5.

⁵⁹ For example. *Iranian Journal of Plant Pathology*_(PPDRI), *Applied Entomology and Phytopathology* (PPDRI), *Seed and Plant*_(SPII), and *Soil and Water*_(SWRI).

⁶⁰ Editors come from the institutes, and Editorial Boards are composed of scientists from both AREEO and the universities.

⁶¹ An AREEO Publications Committee meets monthly to consider these manuscripts. Members come from AREEO and selected universities.

Bulletins. Each AREEO institute produces periodic bulletins with news and review articles (in Farsi), primarily aimed at extension services.

Annual Report and Annual Workplan. These two publications (in Farsi) originate in the AREEO Projects Coordination Bureau. The former includes short summaries of research projects completed, and the latter provides information on new projects.⁶²

The team has identified the following issues in the AREEO publishing program:

- AREEO scientists do not publish enough in international journals. The result is that neither they nor their work is well known outside the country at a time when scientific knowledge is becoming increasingly “globalized”. Scientists report that they would like to be able to prepare manuscripts for submission to journals outside Iran, but they doubt that they have the non-Farsi language skills to do so. In addition, they say that AREEO does not offer sufficient help with editing and article preparation.
- Articles in AREEO Farsi journals are not well known outside Iran. The only international visibility for this scientific work is through inclusion of bibliographic details in international abstracts databases.
- The main objective of the rather small AREEO book-publishing program seems to be the wide distribution in Iran of standard international titles. The products are solid and this objective is valid, but in a time of more and more specialized scientific knowledge, the main reporting medium for research has become journals rather than books.

What actions might AREEO want to consider to deal with these issues? Possibilities would seem to fall into five categories:

- New products. AREEO already has in the pipeline a new publication entitled Research Highlights. It will be issued annually, in English, and will be targeted for the agricultural research community outside Iran. Another possible new publication might be a “translation series”, in which outstanding articles of international interest from AREEO Farsi journals are made available in English.
- Electronic distribution. AREEO could be a pioneer in this field. The Research Highlights and “translation series” are obvious candidates. Two media are possible. The first and most desirable for the long-term is publication via a site on the “World Wide Web”. The second and more short-term solution is distribution in HTML format⁶³ via floppy disk. The preparation of material for even such relatively low-tech electronic publication will provide invaluable experience once access to the WWW becomes more widespread.
- Editing and translation support. A high priority. The team strongly believes that AREEO should establish a small unit either in Tehran or in Karaj, and should staff it with professionals fluent in spoken and written English. These individuals would have the following main functions:
 - Editorial assistance to scientists who are preparing manuscripts for submission to international journals.
 - Translation of Farsi articles that have already appeared in AREEO journals into English, either for inclusion in a new AREEO “translation series” or for submission to international journals.
 - Language assistance to IT professionals who are preparing materials for electronic distribution.
 - Organization of “scientific English” refresher courses for AREEO scientists.

⁶² Section 4.2.3.

⁶³ The format used on WWW pages.

- Expanded editorial boards. Many Iranian agricultural scientists live and work outside the country. Inclusion of some of them in the editorial boards of AREEO journals would bring the following benefits:
 - International perspectives on the quality and relevance of manuscripts submitted for publication.
 - Increased contact between AREEO scientists and scientists abroad.
 - Increased international visibility of AREEO publications.
- Improved communication among publications professionals. AREEO might well support a regular meeting of the editors and editorial boards of all its various publications. The objectives of such a meeting could be discuss new developments in the publications industry, and to make recommendations to AREEO management on ways in which the results of Iranian agricultural research might best be disseminated.

3.2.8 ACQUISITIONS

In a time of tight budgets and rising prices, AREEO is in a position to save considerable money if it can rationalize its book, journal, and CD-ROM acquisition policies. Rationalization does *not* mean the elimination of all duplication. As the team has noted in its discussion of “DocDel” above,⁶⁴ there are strong reasons for institutes/centers to have copies of some specialized journals and CD-ROMs always close at hand.

As AREEO moves toward a new acquisitions policy, however, it will need to think of two prerequisites.

- Information on the bibliographic resources that already exist. If ASIDC does not know what PPDRI has, or *vice versa*, it is difficult to know how much duplication there is. New and strengthened Union Lists will be one way of addressing this issue.⁶⁵
- Management structures and procedures for making decisions about acquisitions. One possibility is a new INICAR. Another (to be discussed below⁶⁶) is a new “Information Action Team” within AREEO.

⁶⁴ Section 3.2.5.

⁶⁵ Section 3.2.6.

⁶⁶ Section 7.2.1.

4 Management Information

4.1 The Rationale

As the apex organization in the NARS, AREEO is responsible for system-wide research management. Its mandate therefore includes the formulation of management policies and procedures, the acquisition and administration of resources, and the monitoring of program implementation. AREEO HQ in Tehran has separate offices for budgeting, accounting, project coordination, and m/e.

Just as good research requires good information, so does good management. Performance of the following basic management functions depends on hard facts and well-documented analysis:

- *Program Planning.* Data on research completed and research in progress. Rationales, objectives, locations, dates, resources, milestones, and outputs.
- *Program Monitoring/Evaluation.* Data to support basic cost/benefit analyses. Why have some projects been chosen for implementation rather than others? How much are these projects costing, and what impacts are expected?
- *Human Resource Management.* Data on qualifications and experience. What scientific fields need to be strengthened? What will the aggregate profile of scientists look like in 5, 10, or 15 years?.
- *Financial Management.* Data on projected and actual expenditures.

Good information is also good politics. Policymakers are most likely to be impressed when they can base their decisions on well-argued cases. A simple “wish list” of desired resources and/or reforms is usually not persuasive. The burden of proof is on the research manager.

The information that is required for good research management falls into four general categories.

- ☐ On Human Resources.
 - ☐ On Financial Resources.
 - ☐ On Physical Resources.
 - ☐ On Research Projects (including data on both content and the three types of resources).

The matrix on the following page provides a framework for a basic “Management Information System”. The four rows show the four *categories* noted above, and the two columns show the *uses* to which good data can ideally be put.

AREEO faces three challenges in designing and implementing an MIS that takes account of its current organizational realities.

- To develop further the databases that it already has.
- To establish procedures by which these databases can be shared (both within the AREEO HQ building, and between AREEO HQ and the institutes/centers).
- To acquire the information technology that will make such sharing possible.

SUBJECTS FOR INFO / USES FOR INFO	Planning/Programming	Monitoring/Evaluation
Research (Projects)	<i>Annual Workplans</i>	<i>Impact Assessment</i>
Human Resources (People)	<i>Recruitment Planning</i> <i>Career Planning</i>	<i>Performance Appraisal</i>
Financial Resources (Money)	<i>Budgeting</i>	<i>Accounting</i> <i>Auditing</i>
Physical Resources (Things)	<i>Procurement Planning</i>	<i>Inventory</i> <i>Stock Control</i>

4.2 Weak Linkages

The current MIS situation in AREEO can be analyzed under the three headings below.

4.2.1 STRUCTURE AND PROCESS

Management units at AREEO HQ have only a moderate degree of contact with each other. The team found little evidence of organization-wide *management* planning and *management* evaluation.⁶⁷ Synergies that might have been expected from a more cooperative work pattern are usually absent. Similarly, HQ units work largely independently of their counterparts in the institutes/centers.

In an ideal management environment, the annual research planning and implementation cycle might look something like the 5-stage scheme described briefly below. The importance of good IM/IT is obvious in such a cycle. Two features are particularly worth noting: first, the *sequence* of events, and second, the *interrelation* between them. Without good incoming and outgoing information at each stage, the cycle will break down. The result of such a breakdown will be that units will operate in relative isolation from each other.

- *Stage #1.* Scientists propose projects. Managers at the institutes/centers examine these proposals and develop integrated institute/center submissions for HQ.
- *Stage #2.* A planning unit at HQ evaluates these submissions in terms of both content and resource requirements. It sets priorities and passes the approved projects to a budgeting unit.
- *Stage #3.* The budgeting unit examines the proposals to see that they meet financial management standards and fund availability. It then sends the approved projects both to an accounting unit and to an m/e unit.
- *Stage #4.* The accounting unit monitors expenditure, and forwards periodic reports both to the m/e unit and to the institutes/centers.
- *Stage #5.* The m/e unit monitors substantive progress, evaluates output and impact, and makes judgements about the relationship between costs and benefits. It then sends its conclusions to the institutes/centers as an input to the next annual planning cycle.

At present, there is a threat to this type of cycle within AREEO. AREEO managers and scientists are very keen to move closer to the ideal, but they lack the standard *information content* and *information technology* to do so. See comments below on “project budgeting” and “software” as examples.

4.2.2 CONTENT

One symptom of this imperfect management integration is that most AREEO HQ units have set up their own separate “databases”. Managers and staff in the units appear to have made relatively independent decisions on at least the following IM issues:

⁶⁷ One person said: “We are good at trees, but not very good at forests”.

- Subjects about which data are to be collected.
- Specification of fields within their databases.
- Specifications of data options within each of these fields.
- Report formats.

The result is a high degree of incompatibility in content and software. Project data collected and managed by the Projects Coordination Bureau are mostly not usable by the Planning and Budget Department, much less by the Accounting Department. The solution must lie in the establishment of mechanisms for organization-wide IM/IT coordination.

Perhaps the best example of the effects of these incompatibilities is the lack of an AREEO “project budgeting system” (PBS). Team members asked many questions about project management. Was it possible for AREEO to answer the following types of questions? How much did the government spend last year on rice research? What percentage of research expenditure was used for citrus research in Shiraz Province? How many scientist years were spent on wheat research?⁶⁸ Answers to such questions would only be possible if research were organized into projects - and, most important, that data about these projects were managed in ways that allowed officers responsible for planning, implementation, and evaluation to use them.

Team members understand that AREEO management is eager to introduce a project management and information system. One challenge in this process will be to find the right balance between local flexibility and national requirements. Managers and scientists at the local level may prefer to do things “their way”, and are not therefore keen on national data standards and reporting requirements that give the impression of excessive “bureaucracy”. One incentive from Tehran may be new IT. An important use of new PCs and new networks could conceivably be a new PBS. The reform and expansion of AREEO IM/IT operations might therefore become a vehicle for more wide-ranging management reform.

4.2.3 USES

The most important question about data and databases is how they are used. Who consults the existing databases and for what purposes?

Database managers at AREEO HQ are mostly doing what they can to encourage widespread use. At least two of the databases come out annually in published form. A staff member in the Projects Coordination Bureau reported that both the Deputy Minister and the Deputy for Planning and Support commission make “daily searches” of the projects database, and that the Head of the Monitoring and Evaluation Bureau asks for specific reports from it before he goes on field trips.

But there are two problems. The databases are little known beyond AREEO HQ and the only format in which they are currently available is in printed pages. Staff at institutes/centers do not use them much, and any enterprising staff member who might want data reported in new ways to answer specific questions would have to approach AREEO HQ directly. A solution to both problems lies with electronic dissemination. AREEO could easily make selected fields from the projects, budget, personnel, and accounts databases available on floppy disk initially and over a network later.

The issue is one of encouragement in usage. From both a management and a science point-of-view, an entomologist working on rice pests at Rasht should be able to find out quickly and easily what other Iranian entomologists working on other crops are doing. AREEO has the information.

⁶⁸ The database on “current research” at IranDoc contains a field for “budget”, but officials there told team members that this field was empty for all or most AREEO projects.

4.3 The Process of Software Standardization

A prerequisite to effective exchange of management information is compatible PC software. The situation within AREEO on this issue can best be described as fragmented and “entrepreneurial”. Three of the major units in the HQ building have built their main databases on three different software platforms.⁶⁹ Outside Tehran, several of the institutes/centers have developed or are developing their own financial management software. Almost all these applications are undocumented. The people who run a particular program know how to use it, but, in some cases, the people who developed it have either left AREEO or were only part-time consultants anyway.

Why has there been such apparent decentralization and flexibility? Team members heard three reasons.

- AREEO did not seem to have a policy on software.
- Statisticians and accountants “liked to write programs”.
- Commercially-available software was expensive.

4.3.1 SPECIFICATIONS

The team believes that AREEO will need outside help in resolving this software issue. It currently has insufficient experience in-house, as evidenced particularly by the absence of any major databases on the major IT software platform of the 1990s (Windows).

The first step will be to commission an outside organization to assist AREEO managers to develop clear specifications for financial resources, human resources, physical resources, and project management databases. Good specifications will cover at least the following subjects:

- Different types of data to be included in each database.
- Precise data formats.
- Relationships between different data types and items.
- Report formats.
- Security and rights of database access.

This “specifications” exercise will be critical. Many organizations jump into software before they are clear about what they really want and need, with the result is that they too often lose both money and time (on software purchase and/or development). The common assumption that “we will work out the details after we see what the software can do” is almost always unjustified.

4.3.2 SELECTION

Only when AREEO management has good MIS software specifications in hand should it move to select actual packages. Though the team was not able to explore the national software market in detail, it did hear two divergent opinions about the future. One is that considerable software development is going on, mostly in the private sector. The other is that not enough software development is going on, mainly because most users are comfortable with off-the-shelf Arabic-language software supplemented by Farsi fonts. Whichever the case, there are obviously some local products that AREEO will want to consider. Several senior staff spoke approvingly of an accounting package from a private sector company often referred to as “the Microsoft of Iran”.

Good specifications provide the *only* basis for rigorous software evaluation. The first products for AREEO management to look at will probably be existing, commercially-available applications. If

⁶⁹ The Projects Coordination Bureau uses FoxPro (for DOS), the Planning and Budgeting Department uses Dataease (for DOS), and the Accounting Department uses Paradox (for DOS).

management then concludes that such packages are not appropriate, it will have to commission the development of custom-made software.

Three cautionary notes about software developed in-house.

- Start-up problems. A package specially written for a specific task in a specific organization almost always has initial bugs. The effort, patience, and even money that AREEO might have to put in to get it up-and-running properly might therefore turn out to be substantial. The alternative is an off-the-shelf package, which in some cases may make up for its lack of flexibility by being mostly bug-free.
- The job market. The market for IT professionals is certain to grow dramatically in Iran. The team believes that AREEO will therefore be running a considerable risk if it chooses to continue its current preference for software developed in-house. A young person with programming expertise will probably stay in a public sector organization like AREEO only briefly before moving to a higher-paid job in the private sector. And if (s)he leaves the organization before start-up bugs have been fully eradicated, and/or before having produced full documentation, and/or without having trained support personnel, AREEO will have problems.
- Cost. A common perception among AREEO managers is that most commercially-available software is too expensive. In fact, the experience of most organizations outside Iran is just the opposite. If AREEO develops its own software, it has little possibility of savings on future procurement, upgrades, training, or support. On the other hand, if it opts for commercially-available packages, the negotiation of site licenses and quantity discounts can bring overall costs down considerably.

Conclusion. The team believes that the general principle regarding software selection for management information should be: “if you can buy it, don’t develop it”.

4.3.3 USE

The main reason for going through systematic processes of software specifications and selection is so that people will use whatever products AREEO decides on.

Numerous staff at institutes/centers told the team that there was not enough consultation during the development of the current DOS-based software packages. The general complaint is that these databases have fields and formats that are inappropriate to the operations of the institutes/centers. The response has been to use the databases selectively (for reporting to HQ), but otherwise to disregard them and often to develop alternative software in-house.

In order to encourage the maximum acceptability of software, the following three-stage process would seem advisable:

- Participation of managers and scientists from both HQ and institutes/centers in the specifications and selection processes.
- Widespread dissemination of whatever new software is selected to institutes/centers, along with whatever new hardware is necessary to run it.
- Mandatory adoption of the new software according to a fixed schedule. Without such a schedule, the natural preferences of staff for existing applications may be difficult to overcome.

5 Network Development

A major constraint on the improvement of information management within AREEO is technology. AREEO will need to make deliberate and planned investments in PCs, CD-ROM servers, LANs, email, and Internet connectivity if it is to address many of the issues raised in the preceding pages.

A starting point for discussion of IT alternatives is a brief description of the current situation.

- Within AREEO HQ. The HQ building in Tehran is equipped with a relatively high number of PCs, several of which are connected in three small LANs.⁷⁰ Most word processing is done under Windows, though staff use DOS-based software for many other functions. The only email connection is in ASIDC and is not reliable.
- Within AREEO libraries. Most institute libraries have at least one PC. If there is more than one (as in ASIDC), there may be an intra-library LAN. Only the largest libraries have CD-ROM drives and in no cases are these drives connected to a LAN.
- Between AREEO HQ and Research Institutes/Centers. The only current connections are via telephone and fax.
- The Internet. A few institutes/centers have modems, but scientists seldom use them. There are two problems. First, connections must go through several intermediaries (any one of which may be “down” at any given time).⁷¹ And second, the slow speed of connections means that the only practical use to be made of the Internet is email.⁷²

5.1 Within AREEO Headquarters

Most organizations with PCs and networks, public or private, anywhere in the world, can place themselves at one of the following five stages of IT management.

- Introduction. A few PCs, mainly used for word processing.
- Proliferation. More PCs and a few small LANs.
- Confusion.
- Rationalization. Some centralization. Adoption of standards.
- Managed Change. Clear IM/IT policies and processes.

5.1.1 CURRENT SITUATION

The team believes that, at present, AREEO HQ is in Stage #3. Some symptoms of this stage are the following:

⁷⁰ In ASIDC, the Planning and Budget Department, and the Accounting Department.

⁷¹ Two examples. AREEO HQ must first dial-up to the Ministry of Agriculture (in downtown Tehran), which must in turn dial-up to the IPM. The Rice Research Institute outside Rasht must first dial-up to Gilan University (in town), which must in turn connect via VSAT to the TCI/DCI hub (in Tehran), which must then connect to the IPM.

⁷² Within Tehran, the most common modem speed is 14,400 bps, though tests at 28,800 bps are underway. Between the Rice Research Institute and Gilan University the current maximum speed is 9,600 bps. If AREEO and the institutes/centers want to use the Internet mainly for email, then speeds even below 9,600 are possible. But if WWW access (with the ability to view graphics) is the goal - as the team strongly believes it should be - then anything less than 28,800 is only marginally practical.

Policy	☐ No IM/IT policy framework. ☐ No hardware and software standards. ☐ Insufficient contact with external sources of support.
Management	☐ No clear decision-making authority over IM/IT. ☐ No clear rules regarding PC use. ☐ No regular support services. ☐ No regular acquisitions procedures. ☐ No regular maintenance procedures.
Resources	☐ Few trained users. ☐ Variable annual expenditure.
Hardware	☐ Few standard PC configurations. ☐ Widespread virus infestations. ☐ No regular backup procedures.
Software	☐ Mostly unlicensed copies. ☐ No regular upgrades. ☐ Few manuals.

AREEO can deal with each of these issues separately. But a much more desirable approach will be to manage them in the context of a new set of structures and procedures specifically designed for IM/IT. Just as the AREEO “budgeting unit” decides how the annual budget is to be put together, so a “computer services unit” can decide how data, software, and hardware are to be managed. In the 1990s, the argument that an organization like AREEO should have a unit responsible for IM/IT must be just as compelling as one that it must have units responsible for financial management.

The general Terms of Reference for such a new unit are presented in detail below.⁷³

5.1.2 THE DEVELOPMENT SEQUENCE

An underlying objective for AREEO management can be to turn the usual IM/IT development paradigm on its head. In most organizations, the sequence of events presented on the following page is the practice. Hardware acquisition comes first. Growth then becomes unplanned and *ad hoc*. PC and network “specialists” are left on their own because management feels that it does not understand the technical issues involved. There are usually many problems. Hardware standards are difficult to bring about without a policy on software standards, and software standards are difficult to enforce without a policy on data compatibility.

In sharp contrast to this model, the team strongly believes that AREEO management will want to consider *starting at the bottom*. The first steps in this (more challenging) sequence will be articulation of an IM/IT policy congruent with AREEO goals, the development of necessary human resources, and the establishment of clear management structures and processes.

⁷³ Section 5.1.4.



The most obvious result of starting at the bottom will be cost savings. If appropriate policies and commitments can be put in place, successive steps can then be taken more-or-less automatically.

5.1.3 A NETWORK FOR AREEO HQ

A high priority for AREEO will be to establish a LAN within the HQ building in Tehran. Such a network will bring at least four benefits.

- Improved information sharing within AREEO HQ.⁷⁴
- Coordinated management of software.
- Efficient use of hardware peripherals (e.g., printers, CD-ROMs, scanners, tape backup units).
- Integrated access to communications facilities (e.g., email, Intranet, Internet).

Ethernet options. The current worldwide standard for LANs is “10Base-T Ethernet” (operating at 10Mbps, or 10 million bits per second). A new and rapidly-developing standard is “Fast Ethernet” (operating at 100Mbps).⁷⁵ AREEO can choose either of these options or an intermediate one.

- ❑ *Ethernet*. 10Mbps. The least expensive option overall. Most equipment will need to be replaced in 2-3 years.
- ❑ *Fast Ethernet*. 100Mbps. The most expensive option, but probably good for up to 10 years. Likely to be underutilized at the beginning because of low demand from individual PC users. Lifetime can perhaps be stretched by upgrading selected parts of the network to higher speeds later.
- ❑ *Switched Ethernet*. 10/100Mbps. Intermediate in price between the above two options.⁷⁶ The usual setup is to run 10Mbps connections from each PC to a small number of distribution points that are connected to a 100Mbps backbone.

⁷⁴ Section 4.3.

⁷⁵ An even greater future development is “Gigabit Ethernet” (operating at 1000Mbps). This technology will be most useful when high bandwidth is required, such as when linking Fast Ethernet LANs in campus-wide networks.

⁷⁶ Hubs in this option are more expensive than hubs for a (simple) Ethernet, but network cards are more expensive.

The team believes that AREEO should go for “*Switched Ethernet*”, which it believes has two major advantages.

- Cost. Inexpensive and standard 10Mbps network interface cards (NICs) can be used to connect individual PCs to the network.
- Segmentation. When switches are used instead of repeaters, the overall AREEO network will become naturally “segmented” into several different sub-networks. Traffic within each of these sub-networks can then be kept separate. The benefits are a higher system-wide network speed, as well as the ability to allocate sub-networks to individual bureaus and offices as needed.⁷⁷

What are the hardware implications of this choice?

- ❑ For each PC, a 10Base-T NIC.
- ❑ For each server, a 100Base-T NIC.
- ❑ Category 5 cabling from each PC to a distribution point on each floor.⁷⁸ This cabling must be certified and tested for operation at 100Mbps on a Fast Ethernet network. Cable runs should not exceed 100 meters.
- ❑ Ethernet switches with 10Mbps ports and Fast Ethernet uplinks.⁷⁹

How much will all this cost? Total expenditure depends on the number of servers and PCs. As an approximation, however, the team estimates that AREEO will need to spend between US\$150 and US\$275 per PC for NICs, switches, and cabling. This figure does not take into account the purchase of new PCs and/or the upgrading of existing ones.

In order to draw up detailed plans and cost estimates, the first step for AREEO will be to commission a detailed network design study from an outside (national) consultant.

5.1.4 A COMPUTER SERVICES UNIT

A new Computer Services Unit (CSU) will have overall responsibility for AREEO IM/IT operations at three levels: within the HQ building in Tehran, between the HQ and research institutes/centers, and between the NARS and the Internet. The CSU will be the focal point for implementation of all AREEO policies on IM/IT.

The Terms of Reference for the this new unit will include at least the following items.

- Encouragement of an information-sharing culture within the NARS.
- Organization of training for NARS staff.
- Implementation of NARS-wide guidelines on IT acquisition and maintenance.
- Promulgation of rules regarding IT use.
- Development of NARS-wide data compatibility standards.
- Enforcement of software and hardware standards.

⁷⁷ Switches are single boxes that can be installed in minutes. If the AREEO network is “segmented”, each sub-network can operate at its own speed and the sub-network containing the servers can operate at its own high speed.

⁷⁸ Unshielded twisted pair (UTP). Distribution points on each floor can ideally be linked to a high-speed optical fiber backbone connecting floors. A more economical option will be to link the distribution points to a high-speed switch using the same UTP cable. In most locations, the largest cost in installing a network is in the labor costs of running cable.

⁷⁹ For economy reasons, standard Ethernet repeaters can be put in initially and replaced with switches later.

Three prerequisites for effective functioning will be that the unit has strong support from AREEO management, a regular budget, and an energetic staff. This issue of CSU personnel will be critical. Formal academic qualifications will be less important than individual commitment and enthusiasm.⁸⁰ The need will be for people with large appetites for information and the ability to get things done. The IM/IT business moves so rapidly and obsolescence sets in so quickly that the challenge of keeping up-to-date is a significant one.

At the beginning, the CSU will require at least the following four persons:

- **Head of Unit.** A member of the overall AREEO management team. Responsible for performance of the following functions:
 - ❑ Participation in continuing development of AREEO IM/IT policies and plans.
 - ❑ Implementation of the CSU mandate.
 - ❑ Budgeting and control of expenditure within the CSU.
 - ❑ Supervision of CSU staff.
 - ❑ Liaison with IM/IT-related organizations, both within Iran and outside.
- **Network Manager.**
 - ❑ Installation of PCs.
 - ❑ Installation of software.
 - ❑ Management of the LAN infrastructure.
 - ❑ Troubleshooting (PCs, software, network).
 - ❑ Asset management.
- **Systems Manager.**
 - ❑ Management of the LAN operating system, network, and communications software.
 - ❑ Server applications management.
 - ❑ Network security.
 - ❑ Disaster planning (including backup management).
- **Applications Specialist.**
 - ❑ Management of procurement and maintenance contracts.
 - ❑ Provision of “helpdesk” services.
 - ❑ Coordination of training programs for staff in IM/IT.

Other positions may be added later if needed.⁸¹ AREEO will not need to have all IM/IT skills represented in the CSU on a full-time basis.

5.2 Between AREEO Headquarters, Institutes/Centers, and The Internet

5.2.1 RATIONALE

Why should AREEO be interested in moving beyond a LAN in its own HQ building to a WAN⁸² covering the entire NARS? There are three general reasons.

- *Community.* To develop further a sense of shared purpose within the NARS. The experience of most organizations that have connected dispersed field sites over WANs is that new

⁸⁰ A background in the social sciences (including statistics) will be no more or less appropriate than a background in the natural or physical sciences. Many of the leading figures in the worldwide information business have no background in either, and in fact have no university education at all.

⁸¹ Database Administrator, Systems Analyst, Programmer, Communications Specialist, etc.

⁸² Wide Area Network.

technologies encourage new contacts. Staff who can email each other and exchange information easily can build an organization.

- *Access.* To improve both the quantity and quality of information resources available to NARS staff.
- *Dissemination.* To provide quick and efficient means by which NARS staff can make their results and decisions available both nationally and, where appropriate, internationally.

More specifically, an AREEO “Intranet” will provide a platform for data exchange,⁸³ for information applications,⁸⁴ and (potentially) for telephone traffic.⁸⁵ Within 2-3 years, at least the following value-added services are likely to be available over the AREEO WAN facilities.

- World Wide Web access.
- Email.
- Scanning of email attachments for viruses at point of entry to the network.
- Conversion of email attachments between document formats.
- Conversion and forwarding of email to fax (and eventually voicemail).
- Access to subscription-based services (e.g., online databases, electronic journals, new services).⁸⁶
- In the case of IVDN capability, transfer of phone calls and faxes to-and-from national and international public telephone networks.

5.2.2 THE NEED FOR A NETWORK OPERATIONS CENTER

Any network, a LAN or a WAN, requires some form of central organization. This organization is usually a physical office, though it may be simply a collection of more virtual groups responsible for setting standards.⁸⁷ The team believes that there are several possible locations for a Network Operations Center (NOC) for the AREEO WAN. These options are presented below (sections 5.2.3 and 5.2.4). But first, what functions will an NOC perform?

- Negotiation of licenses for software and other commercial property.⁸⁸
- Provision of general consulting and/or “helpdesk” services to members of the network.
- Support for specific network applications.⁸⁹
- Network monitoring and trouble-shooting.
- Management of an email hub with directory services.
- Provision of facilities for central data storage.
- Housing of application servers to enable use of shared databases.
- Establishment and maintenance of listservers.⁹⁰
- Provision of a collective “front door” to the Internet,⁹¹ including security services.⁹²

⁸³ Via the World Wide Web, email, FTP, Telnet, Gopher, etc.

⁸⁴ Examples include access to AREEO databases on project management, access to Iranian and international scientific databases, and electronic publishing.

⁸⁵ Networks based on Internet technologies are increasingly carrying voice as well as data traffic. These so-called “Integrated Voice and Data Networks” (IVDNs) can be either private networks (that carry traffic only of members) or virtual private networks (that use 3rd party network facilities). Even though an AREEO WAN will probably not carry voice initially, the prospects are strong that AREEO will want to use it for voice in the future. Decisions now should ideally take account of this possibility. When buildings are wired or rewired, the same and shared connections should be used for person-to-person communications (e.g., phone, fax) and for data communications (e.g., email, LAN).

⁸⁶ Sections 3.2.3 through 3.2.6.

⁸⁷ As in the case of the Internet.

⁸⁸ For example, electronic journals and online databases.

⁸⁹ Particularly for shared applications like email and shared databases.

⁹⁰ Listservers (mailing lists) are basically email discussion groups. They can be open, closed, moderated, or unmoderated. The NOC can customize them for each user group.

⁹¹ A WWW site.

⁹² A firewall.

- Web hosting.⁹³
- Provision of general IM services.⁹⁴

5.2.3 THE JIGSAW PUZZLE

Who should set up and maintain the NOC? The starting point for discussion of this question must be the following assumption:

AREEO should **not** get into the networking business itself.

Network management is costly and complex. If AREEO were to decide to set up its own network, it would have to be prepared to make significant financial outlays at the beginning. Not only would it have to buy hardware and software, but it would also have to negotiate contracts for leased lines and support services. After this initial investment, it would have to continue to spend in order to keep its IT up-to-date. And, most important, it would have to be sure that it had the people in-house to install the IT and to keep it running.

The team strongly believes that networking is *not* part of the AREEO core business. AREEO can serve itself better if it “outsources” the provision of WAN services to Iranian organizations with mandates and expertise to provide them. The ISNAR members of the team do not know of any NARS, anywhere in the world, that attempts to run its own WAN.

Who are the candidates? In the following matrix, the major organizations (or types of organizations) with which AREEO might consider partnerships are listed across the top. In the far left column are subjects in which these organizations have experience and/or resources. The checks in the cells are admittedly subjective. The team is not suggesting a scoring system, but is rather using the matrix as a means of illustrating which organizations might control different pieces of the puzzle.

⁹³ Provision of the hardware, software, and technical expertise to set up web pages. The NOC can maintain a public web site for each member of the network, and can provide mechanisms for members to manage and maintain materials online.

⁹⁴ For example, software to monitor traffic, facilities for database publishing, and a search engine to index documents available on the network.

	TCI	MOA	IPM	IROST	Univs	Private Sector ⁹⁶
Mandate	X			95		
Service Orientation						X
Internatl IP Connectivity	X		X	X	97	
National IP Connectivity	X	X		X		X
Expertise in Networking	98		X	X	X	X
Human Resources	X	99				X
Financial Resources	X	X				

The obvious and inevitable conclusion from the matrix is that there is *no single organization* to whom AREEO can “outsource” its WAN.

5.3 AREEO options

5.3.1 BUILDING A COALITION

The team therefore believes that the best approach will be for AREEO to act as a catalyst. Its role will be to take the lead role in building a coalition to establish a WAN that will be a model for the Iranian public sector. No other organization is currently in a position to put together the puzzle pieces.¹⁰⁰ If AREEO wants to go ahead with development of a WAN at all, it will have to put the puzzle together itself.

This idea of AREEO as a “model” is one that team members discussed in meetings in numerous organizations. It is based on the following assumptions, all of which were repeatedly confirmed:

- That most Iranian public organizations have little experience with networking of any kind. They are therefore unfamiliar with the costs, benefits, technologies, and resource requirements of networks.
- That most such organizations have little idea of what other organizations are doing (or not doing) with networks.
- That there is a need for a small number of organizations to make serious commitments to network development in order to show others what can (and cannot) be done.

⁹⁵ The mandate of IROST is to encourage research on science and technology. It currently runs a network with approximately 560 subscribers throughout the country, including about 100 government organizations and universities. National access is via dial-up, and international access is via a leased line to the United Kingdom.

⁹⁶ Private sector organizations do not, at present, have formal government permission to operate full Internet services. If and when this situation changes, there will undoubtedly be a large national market for such services and private sector “Internet Service Providers” (ISPs) will organize the necessary financial resources.

⁹⁷ Several universities have international IP connectivity, but only via the facilities of other organizations. For example, as noted above, Gilan University is connected to the Internet, but only through the TCI/DCI hub (in Tehran) and then through the IPM VSAT to Europe.

⁹⁸ Very few people with whom team members spoke know much about TCI/DCI. The common perception is that because the PT&T has a formal monopoly over telecoms, it has not made a concerted effort to inform the public of its plans. The assumption is that TCI/DCI *must* have expertise in networking. It has the mandate and it runs its own hubs. It has its own network (IRANPAC). Also it has assisted several large government organizations to set up their own networks (including the National Iranian Oil Company, Iran Air, the Iranian Central Bank, the Budget and Planning Organization of Iran, and the Ministry of Energy).

⁹⁹ The MOA HQ building has one of the best computer facilities in the Iranian public sector. It has a good LAN and experienced people.

¹⁰⁰ In theory, AREEO could simply put a WAN development proposal out for tender. The team sees two major problems with such an approach. First, there are no obvious organizations or even groups of organizations that are in a position to meet the conditions that AREEO would lay down. Second, and much more important, AREEO does not currently have the expertise in-house to evaluate the bids that might be presented or to manage relations with contractors.

AREEO can attempt to build one (or more) of three different types of coalition. The choice depends on the primary client base of the network that AREEO wants. This decision is a political rather than a technical one.

- ❑ *A government network.* Prominent members to be ministries (including their constituent departments and agencies). Major organizers to include TCI/DCI and MOA.
- ❑ *An education and research network.*¹⁰¹ Prominent members to be universities and research organizations. Major organizers to include TCI/DCI, the Ministry of Culture and Higher Education, IPM,¹⁰² IROST, and universities.
- ❑ *A private/public sector network.*¹⁰³ Major organizers to include TCI/DCI, universities, perhaps IPM, perhaps IROST, and private/semi-private organizations like SinaSoft, Neda, IRNET,¹⁰⁴ and Apadana.¹⁰⁵

5.3.2 GETTING STARTED ALONE

The alternative to “building a coalition” is for AREEO to start small on its own. The choice between this option and the previous one is not “either-or”. The two options are not incompatible. At the same time that AREEO is actively looking for partners, it can begin with some of the “next steps” as described below (section 8).

¹⁰¹ The archetype was the National Science Foundation Network in the United States. NSFNET no longer exists, but the model has been copied in several other countries. In India, ICAR (the Indian Council of Agricultural Research) uses ERNET (the Education and Research Network) as one of its main service providers. In Iran, the nucleus of such a network might well be IPM and the universities that already connect to it, as well as all parts of the Ministry of Culture and Higher Education.

¹⁰² IPM has emerged as the *de facto* national NOC for the Internet in Iran, but it lacks a clear government mandate to perform this function. Its job is research and it does not have sufficient resources to provide services other than basic connectivity. Its attitude toward potential clients (e.g., AREEO) tends to be that “we provide the Internet connectivity, and we do not care how you get connected to us”. TCI/DCI, on the other hand, has both the mandate and the resources. The problem is that it lacks service experience. The High Council of Informatics has noted that “DCI sees all others as competition and sees no interest in improving quality and availability of network access, rather restricting competition in this area, allowing only itself and related organizations to function...” (Quoted by Payman Arabshahi, *The Internet in Iran: A Survey*, <http://www.iranian.com/WebGuide/InternetIran/InternetIran.html>). The team believes that demands for Internet connectivity will soon move beyond the capacities of IPM, and that TCI/DCI must therefore move to assume a more prominent role.

¹⁰³ There is an accelerating worldwide trend toward privatization and competition in the telecom business. The deregulation of the telecom market in most European Union countries at the beginning of 1998 is a symptom, as it led to the withdrawal of public funding for NSFNET. In international agricultural research, CGNET (which provides IVDN services to the CGIAR, FAO, and CABI, among others) is a private sector company.

¹⁰⁴ Information and Communication Network of Iran.

¹⁰⁵ Team members were impressed by the reservoir of hardware, software, and networking talent in the private sector. The release of these resources will depend on emerging government policies regarding the provision of Internet services.

6 Human Resources

The most important AREEO resource in the implementation of new IM/IT programs is *people*. Most STI, MIS, and network development initiatives that fail do so not because technology doesn't work, but because of inadequate human resources. Either an organization simply does not have enough people, or there is too much staff turnover, or the people who are there are not well trained.

“Information Management” is a new concept to many AREEO managers and scientists. Much new “Information Technology” is intimidating. A major goal must be to create an environment in which information is regarded as important, and in which IM/IT skills are seen as part of the tool-kit of each member of staff.

What are the first steps? The HRD¹⁰⁶ component of a successful strategy will deal with each of the cells in the following table. In the rows are four distinct target groups for training, and in the columns are two distinct objectives. All cells are important, but the number that the team has placed in each represents a first-attempt at priority-setting. A #1 is the highest priority and a #4 the lowest.

	Awareness	Skills
AREEO Managers	1	4
Scientists	4	3
Library/Documentation Specialists	2	1
IT Specialists	3	2

6.1 Training for Managers

The objective of such training will be to let senior managers see what IT can do both for them and for their organizations. Subjects covered will include current awareness and targeted search services, electronic publishing, shared database access, and management information systems. Each “course” will last 3-4 days and will have no more than 8-10 participants. Each participant will have his/her own network-connected PC.

Who can and will organize such training? In the short-term, at least until the AREEO HQ LAN is up-and-running, the most practical option will be to contract out such events. The contractor will then be responsible for hardware and software (including Internet connections), as well as for the provision of trainers.¹⁰⁷ AREEO personnel will focus on the development of follow-up programs, and international organizations may play a supporting role if requested.

6.2 Training for Scientists

This training will be related directly to the conduct of research. The objective will be to enable scientists to make better use of standard software. Applications covered are likely to include word processing and spreadsheets (for report writing and project management), databases (for organization of research data), and statistics packages (for data analysis). Because AREEO will organize and

¹⁰⁶ Human Resources Development.

¹⁰⁷ Several types of organization might be suitable as contractors. One is a leading public sector IM/IT organization (e.g., TCI/DCI). Another is a university (e.g., Gilan). And another is a private sector company (e.g., SinaSoft). If AREEO decides to move forward with the “coalition building” strategy outlined above, then TCI/DCI might be an option worth exploring.

manage such courses itself, it will need to wait until its “computer services unit” is established, staffed, and fully functional.¹⁰⁸

6.3 Training for LIS Professionals

Current staffing levels in most AREEO libraries are adequate for the performance of traditional functions. Even though few LIS staff have professional library qualifications, several have attended short courses organized by ASIDC. Subjects covered have included the use of the Internet, FTP, and Networking. In addition, some staff have attended international meetings on library science.

The team has identified the following subjects as priority areas for the training of LIS staff.

- Compilation and indexing of in-house bibliographic databases.
- Information retrieval from CD-ROM databases (using SPIRS).¹⁰⁹
- Development of CA/SDI services.
- Use of email for CA/SDI and “DocDel” services.

Skills in these subjects will be essential if LIS staff are to adapt to a new and more IT-oriented environment. As routine functions in libraries become more automated, AREEO will continually call on LIS staff to redefine their jobs. The demand will be for “more service”, and the primary focus in all training offered will be on the use of new IT to improve the “service orientation” of LIS staff.

What will be the effect of these changes on personnel policies? The profiles and status of LIS staff worldwide are clearly changing. IM/IT training generates new skills; new skills imply new qualifications, and new qualifications imply new career and remuneration issues. In many organizations in Europe and North America, the head of LIS is now one of the most senior (and highest paid) members of the professional staff.

How will training for LIS staff be organized? ASIDC must take the lead, though in close cooperation with STI and IT professionals both from inside and outside AREEO. There are likely to be three venues, training at each of which will focus on different skills.

- At the institutes/centers. The focus here will be on service delivery. Participants will be both LIS staff and selected members of the user community (e.g., scientists).
- At AREEO HQ. The focus will be on technical skills, and most participants will be LIS staff.
- Outside Iran. The focus will be new LIS technologies. Participants will be expected to “train” colleagues once they return to Iran.

6.4 Training for IT Professionals

Good IT management depends on the existence of a good IT plan, but the team did not find a single institute/center that had one. A high priority for AREEO will therefore be the production of such baseline documents. Each institute/center will need to have someone clearly in charge of IT operations and AREEO will then train that person in IT planning.

Again, however, because AREEO will organize and manage such courses itself, it will need to wait until its “computer services unit” is established, staffed, and fully functional. Subjects to be covered will deal with IM operations on three levels.

- The individual PC.

¹⁰⁸ One of the functions of the “Applications Specialist” in the CSU is likely to be the “coordination of training programs for staff in IM/IT”. Section 5.1.3.

¹⁰⁹ Silver Platter Information Retrieval System.

- The LAN within the institute/center.
- The WAN connecting the institute/center to the outside world.

Training for staff of the AREEO CSU will be mostly on-the-job, supplemented by short courses outside AREEO.

7 Management

Information is a big field. It covers several different types of content (scientific, managerial, resources) and several different types of technologies (PCs, CD-ROMs, LANs, and WANs). Also, it is changing fast.

How can AREEO best manage its emerging involvement in “the information revolution”?

The team has identified the following IM functions that AREEO must ensure are performed on a *system-wide* basis:

- Continuing advice to management on responses to new developments in IT.
- Continuing formulation of new plans and programs for IM/IT.
- Development of integrated plans and procedures for:
 - the financing of IM/IT growth;
 - the staffing of IM/IT activities;
 - the management of IM/IT equipment and facilities.¹¹⁰

The team believes that some degree of centralization is necessary if these functions are to be well performed. Without clear authority and control over resources, the kinds of flexible decision-making necessary for good IM will not be possible.

One way in which AREEO might organize this authority is through a NARS-wide “Information Action Team”. Such a team could bring together senior professionals from ASIDC, the new CSU, management units from AREEO HQ, and staff from the institutes/centers.

A new IAT would perform the functions listed above - and, *most important*, would be responsible for the administration of a budget specifically marked for IM/IT.

At the beginning, members of the team might include the following:

- Deputy for Planning and Support, AREEO
- Head, Scientific Information and Documentation Office, AREEO
- Head, Computer Services Unit, AREEO
- Head, Planning and Budget Department, AREEO
- One head of an institute library
- Two senior scientists.

¹¹⁰ This heading includes hardware, software, books/journals, and CD-ROMs. The goal of coordinated acquisition and maintenance procedures will be to save money through reduction of duplication (in the case of STI materials) and through bulk purchases (in the case of IT equipment). Library Acquisitions Committees will continue to exist at the institute level, but the IAT will provide a system-wide overview.

8 Next Steps

The team has identified ten actions that AREEO can take to begin implementation of this strategy. They are listed here in the order in which the team believes that they should be taken (rather than in order of importance).

1. An Information Action Team (IAT). Section 7. To be set up immediately. One of its first tasks will be to advise AREEO management on the establishment of the CSU.
2. A Computer Services Unit (CSU). Section 5.1.3. A prerequisite for all further IM/IT action.
3. Coalition-Building. Section 5.3.1. Can begin as soon as the IAT and CSU are in place.
4. An AREEO HQ LAN. Section 5.1.2. The first job of the new CSU. Funding to come from the IAT-administered budget.
5. Standards. Sections 4.3 and 5.1.2. Necessary before institutes/centers can begin large-scale hardware and software acquisition. To be decided by the IAT on the advice of the CSU.
6. LIS training (for STI professionals and scientists). Emphasis on service delivery. Specific subjects to be decided by the IAT.
7. A WWW Site. An important means of “educating” policy-makers about AREEO plans and programs. NARS-wide connectivity is not a prerequisite because the main audience lies outside AREEO.
8. Development of a campus-wide LAN in Karaj, including integration of the three libraries. Section 3.2.2.
9. Tehran-Karaj Connectivity. Section 3.2.2.
10. Shared Applications. Sections 3.2.6, 4.2.3, and 5.2.1.

9 Budget

This draft budget covers the years 1998-1999. The emphasis is on activities necessary to get a vigorous program of IM/IT development started.¹¹¹ All figures are in US Dollars. The budget does not include the following items.

- AREEO Personnel Costs.
- Training Costs.
- CD-ROM Subscription Fees.¹¹²
- Telephone Charges.
- Internet Subscription Fees.

The team expects considerable change in the national IT environment by the end of 1998. Both new connection possibilities within the country¹¹³ and new options for connecting to the Internet are likely.¹¹⁴ The team has not therefore included in this budget the IT required for connecting institutes/centers outside Tehran and Karaj to an AREEO WAN. It believes that the first priorities are to get the AREEO HQ and Karaj LANs established, and then to get other sites connected in 1999-2000.

Description	Number	UnitCost	Total	YearTotal
Year 1998–AREEO HQ				
New PCs	20	2,000	40,000	
New PC Peripherals	20	750	15,000	
Standard Software	80	250	20,000	
Year 1998–AREEO HQ LAN				
Wiring and Installation	80	100	8,000	
Network Cards and Switches	80	250	20,000	
Network Server (incl Software)	1	8,000	8,000	
Year 1998–Consultants Fees				
LAN Planning and Installation	50	100	5,000	
Database Standards	30	100	3,000	
Year 1998–TOTAL				119,000
Year 1999–AREEO HQ				
New PCs	20	2,000	40,000	
New Peripherals	10	750	7,500	
Software Upgrades	80	50	4,000	
Database Purchases	30	250	7,500	

¹¹¹ Section 8.

¹¹² Hard currency.

¹¹³ For example, increased availability of leased lines at lower prices.

¹¹⁴ For example, improved access to existing networks.

Description	Number	UnitCost	Total	YearTotal
Year 1999–AREEO HQ LAN				
Maintenance			5,000	
Additional Servers	2	7,000	14,000	
Year 1999–Karaj LAN				
New PCs	20	2,000	40,000	
New Peripherals	20	750	15,000	
Standard Software	60	250	15,000	
Wiring and Installation	60	300	18,000	
Network Cards and Switches	60	250	15,000	
Network Server (incl Software)	1	8,000	8,000	
Year 1999–Consultants Fees				
AREEO HQ–LAN Operations	30	100	3,000	
Karaj–LAN Design, Installation	70	100	7,000	
Database Adaptation	20	100	2,000	
Year 1999–TOTAL				201,000

10 Acronyms

AREEO	Agricultural Research, Education, and Extension Organization
ASIDC	Agricultural Scientific Information and Documentation Center
CA/SDI	Current Awareness / Selected Dissemination of Information
CAB	CAB International
CGIAR	Consultative Group on International Agricultural Research
CSU	Computer Services Unit
DCI	Data Communication of Iran
DocDel	Document Delivery
ERNET	Education and Research Network
HRD	Human Resources Development
IAERI	Agricultural Engineering Research Institute
IAT	Information Action Team
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
IDRC	International Development Research Center
IFRTO	Iran Fisheries Research and Training Organization
IM/IT	Information Management / Information Technology
INICAR	Iran National Information Center for Agricultural Research
IPM	Institute of Physics and Mathematics
IranDoc	Iran Information and Documentation Center
IRNA	Islamic Republic News Agency
IROST	Iranian Research Organization for Science and Technology
ISNAR	International Service for National Agricultural Research
IVDN	Integrated Voice and Data Network
JSIS	Jahad Sazandegi Scientific Information Services
LAN	Local Area Network
LIS	Library and Information Services
MIS	Management Information System
MOA	Ministry of Agriculture
NARS	National Agricultural Research System
NEDA	Neda Rayaneh Institute
NOC	Network Operations Center
PBS	Project Budgeting System
PPDR	Plant Pests and Diseases Research Institute
PT&T	Ministry of Post, Telegraph, and Telephone
SBSI	Sugar Beet Seed Institute
SPII	Seed and Plant Improvement Research Institute
SWRI	Soil and Water Research Institute
TCI	Telecommunication Company of Iran
UL	Union List
VSAT	Very Small Aperture Terminal
WAN	Wide Area Network
WWW	World Wide Web

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