



International Center for Agricultural Research in the Dry Areas
(ICARDA)

Report of a

Center Commissioned External Review of

Information Technology and Systems, Information

Services and

Knowledge Management in ICARDA

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21. The Panel recommends that critical committees are re-activated to engage more staff in guiding the directions chosen for different systems and services.66
22. The Panel recommends that ICARDA separate responsibilities for 'content' curation and management from responsibilities for technical hosting and software development and support..67
23. With regard to the wider CGIAR, the Panel recommends that ICARDA develop 'system' scenarios for major IT and IM activities to set out options with and without appropriate and reliable common services provided across the CGIAR.69

Preface

This report presents the findings and recommendations of a Center Commissioned External Review of Information Technology and Systems, Information Services and Knowledge Management in ICARDA (see TOR Annex 1).

The Review Panel, comprising Paul O’Nolan and Peter Ballantyne, visited the Center from 8-18 March, 2009. During this period they observed the various activities and initiatives of the Center and interviewed numerous ICARDA staff. Efforts were made to contact some ICARDA staff in regional and country offices as well as selected Center Board members (see Annex 2 for list of people met). Panel members were provided with a wealth of documentation before and during their visit.

On 17 March, the last day of the visit, Panel members made a presentation to staff of its preliminary findings.

In organizational terms, the Panel mainly focused on the activities of the CBSU and CODIS units. Since the issues under review occur across the Center, the Panel also looked across the organization. Within CODIS, communication activities were excluded as they will be the focus for a further review later in 2009.

We found the ICARDA staff we met to be open and cooperative, providing full answers to all our many queries.

In terms of process, we particularly commend the preparation work by CBSU and CODIS staff; the lunches each day with different people were an excellent use of the time, the wireless Internet access for use in the hotel worked perfectly. One learning point for future reviews would be to leave more space between the very many meetings that were scheduled.

The Panel members express their great appreciation to Zaid Abdul-Hadi and Samira Maksoud who facilitated every part of the mission. In terms of logistics, the Panel was perfectly taken care of by Visitor Services.

Executive Summary

"ICARDA will enhance its role as an 'open knowledge organization' and promote the use of modern computing and communication technologies so that research knowledge, results and experiences are freely accessible, shareable and searchable." This is the opening paragraph in the section on IT and communication in the ICARDA strategic plan 2007-2016. This is an ambitious statement. How would we rate progress?

This report presents the findings and recommendations of a 'Center Commissioned External Review of Information Technology (IT) and Systems, Information Services and Knowledge Management in ICARDA.' In organizational terms, the Panel mainly focused on the activities of the CBSU and CODIS units. Since the issues under review occur across the Center, the Panel also looked at these issues across the organization. Within CODIS, communication activities were excluded as they will be the focus for a further review later in 2009.

The Panel's key recommendations are listed on page 1 to 2 of the report. Elsewhere in the report, all recommendations are highlighted in italics.

ICARDA operates in a challenging IT environment – the US embargo on Syria essentially adds a layer of complexity as well as cost to every investment. It also leads to some web services and content being blocked. The Syria factor is also felt in other ways: Attracting staff is a challenge, many staff in ICARDA express their sense of professional isolation.

Beyond this 'Syria factor,' there are various 'system' factors that result from ICARDA's membership of the CGIAR. It benefits from and is encouraged to contribute to system-wide initiatives in all the areas covered by this review. To give a flavor, these include some shared IT and web services, a consortium of libraries, system-wide genetic resources databases, a CGIAR medium-term planning tool, and discounted access to GIS software and applications. The Center benefits from system investments; its options can also be bounded by its responsibilities to the system.

Under CGIAR reform proposals, there is a strong possibility that many of these system services will be brought together under some 'common services' that will be provided to all Centers. Such a scenario implies that ICARDA will be able to discontinue some of its efforts in this area. It will be able to re-assign staff, gain more reliable services, and have access to a suite of standard applications and tools suited to its various needs – from computer software, through accounting and project management systems, to IPR regimes and document management systems.

One of the most challenging issues for ICARDA is therefore to weigh up the likelihood that such common services and products will become available, and when, against the need to develop and provide instant solutions and services for the needs of today.

To what extent does it wait for, or drive, CGIAR-wide developments as being the most promising option for ICARDA? Which areas still require in-house development and management? How does it ensure that current investments are 'future-proofed' to not exclude ICARDA from any future benefits and synergies? A 'do-it-yourself' approach often seems necessary. Shared solutions with shared ownership and shared costs are likely to be more cost effective in the long run.

Some of the demands to be satisfied at ICARDA

- Wide Visibility
- Quality Science
- Learning and effectiveness
- Pathways to impact
- Project management
- Performance management
- Grant management and acquisition
- Corporate efficiency
- Transparency
- Day to day communication
- Data sharing
- E learning
- Collaboration with partners
- Accountability and reporting
- Information overload
- Communicate with colleagues
- ...?

These are exciting and challenging times. Research and science are being planned and conducted in new and innovative ways, with more diverse partners. New thinking on aid and development gives attention to issues of effectiveness, coherence, partnership and ownership. A new wave of innovation and business models is running through the information technology industry; the Internet is being transformed, making it easier than ever to create and share information and knowledge, and the roles of libraries and publishers are being questioned and re-designed. This is an opportune moment to review ICARDA's experiences and options.

We start with the element of this review that is closest to the daily experience of ICARDA staff – **information technology**.

In general, ICARDA's IT infrastructure is of a high quality. It is well managed and provides a reliable service with which staff members are broadly satisfied. Improving ICARDA's Internet connectivity, on both commercial and research and education networks, is the highest priority technology issue.

CBSU should be refocused on IT and redesignated as IT Services; biometrics services should be transferred to research, and CODIS should take on content related services currently within CBSU. There is an urgent need for CODIS to develop strategies to re-vitalize internal and external communication.

Significant improvements to ICARDA's internal operations are recommended, including the employment of a document management system and increased investments in IT training.

On **Connectivity**: ICARDA's current Internet bandwidth of only 2Mb is inadequate and an upgrade is urgently required. Connecting to the Syrian Higher Education Research Network (SHERN) and via SHERN to EUMEDCONNECT2 is recommended as a strategically opportunity for ICARDA. Investment in a fiber optic connection to and connection via the University of Aleppo is recommended.

On **Telecommunications**: With the deployment of a digital phone system it is time to transfer responsibility for telephony to IT Services (as it is proposed CBSU be redesignated), along with management oversight of all forms of telecom traffic. Employment of a 0.5 FTE telecom and video-conferencing support engineer is recommended as are some upgrades to PBX and the wiring of ICARDA's campus for wireless Ethernet (wi-fi) networking.

On **IT Services Management**: Benchmarking IT spending against other CGIAR Centers is recommended to ensure that ICARDA remains competitive. Currently ICARDA's computers and servers are probably among the oldest in the CGIAR with, very likely, correspondingly high support costs. A number of areas are identified where management of IT resources can be improved: printing and scanning, asset management and managed computers, including pool computers. Introduction of a Service Catalog¹ is recommended, also chargeback as a tool for managing computer requirements over and above those budgeted for permanent assignment to designated staff—to optimize their availability for reallocation.

On **IT Facilities**: Reconfiguration of ICARDA's main data center and the commissioning of a second center is recommended for disaster resilience. Introduction of server hosting facilities on commercial (ideally full cost recovery via chargeback) terms is recommended. The adoption of virtual server technology is endorsed. Adoption of tiered network storage offering different levels of resilience and backup are recommended as is chargeback for storage

¹ A Service Catalog is an ITIL (IT Infrastructure Library) concept. ITIL is a widely used compendium of IT industry best practices and policies for managing IT infrastructure, development and operations.

above default quota. A concerted effort to move all ICARDA digital assets to the network is recommended.

IT Training has declined markedly in recent years. Formal steps to make it a priority again are recommended as is the appointment of a full-time IT trainer. Reappointment of organizational unit IT coordinators for liaison with the IT Services unit and some first level user support is recommended.

On **CBSU**: Its portfolio is reviewed and recommendations for streamlining it are made: the transfer of biometrics to research, the integration of telecommunications, re-integration of MIS, and the transfer of content -related services to CODIS. A focus on “core services”, defined as those serving all users directly, or indirectly via corporate applications is recommended. Reporting to Corporate Services is also recommended. Priority attention to key skills redundancies is urgently recommended; also the development, *asap*, of a disaster recovery plan. Measures to flag risks arising from overdue pending appointments are suggested. The appointment of a document management applications specialist to implement and support SharePoint for ICARDA is recommended. Possible ways of organizing information functions are suggested for future discussion re CODIS.

CBSU work plans are reviewed. Some presentation suggestions for easier apprehension in future are made. The adoption of a departmental document system is advocated. Implementation of a Service Catalog is recommended to help make a clear separation between projects and continuing activities. The fact that CBSU's calendar is fully booked already is noted. Comment is made on an apparently technology-driven in-principle decision to upgrade ICARDA's mail system. User input to the prioritization of and understanding of the business case for investment decisions is recommended. Adoption of PRINCE2 or similar project management methodology is advocated for implementation of IT projects managed by CBSU.

The lack of specific objectives in the ICT part of the ICARDA strategy is discussed. A focusing of ICARDA's strategic objectives on specific, *tangible* outcomes, such as the creation of knowledge banks containing information for named crops and with targets in terms of participation of partners is considered preferable.

On **Management Information Systems**: Some software convergence difficulties experienced in the CGIAR are reviewed. The Panel endorses a decision by ICARDA management to finish revising corporate policies and procedures before considering changing systems. An alternative means of developing shared requirements and possibly finding solutions is suggested.

Recommendations are made on workflows and administrative information management (in particular of HR data) to reduce risks of inconsistent information and risks of potential security problems. Assignment of responsibility for identifying opportunities for process improvements and improved workflow is recommended. Implementation of single sign-on to network applications and is considered overdue.

On ‘**information services and systems**’, The Panel concludes:

- A physical and virtual ‘library’ services provides very good access to global information resources. This access is facilitated by the Center's collaboration with NARS, other CGIAR centers and ICARDA's strong engagement in international information exchange networks.
- Formal research outputs of ICARDA, mainly publications and reports, are being captured and organized in a central repository where they are both preserved and can be made more accessible to others. The Panel recommends that other important

intermediate outputs of research – images, presentations, grey literature, local reports from regional and country offices, *etc.*, are also comprehensively captured. This knowledge base should also put to good use and re-used in other ICARDA services.

- A similar repository has been established for scientists to deposit and describe their research data. This needs to become more widely known and more widely used.
- Several important scientific information systems have been created, particularly to support the genetic resources work of the Center. Many are associated with a single individual which makes them vulnerable. In some cases, software choices will need to be updated to meet future requirements. The Panel recommends that these systems and their sustainability be the focus of further assessment.
- ICARDA is one of the only centers that explicitly reinforces the capacities of its NARS partners in this area. This provides benefits to ICARDA's own information access systems. Further assessment of the training and consultancy work is needed to determine the impact of this support on the operation of NARS themselves.
- For some systems and services, the 'business case' in terms of users and usage needs to be more strongly documented and communicated. Metrics and use data need to be compiled into regular reports that are shared with staff.

On **knowledge sharing** and management, The Panel concludes:

- The Center should move on from knowledge management and its negative connotations. It should instead use the terms 'knowledge sharing' and communication.
- The emerging 'social' web offers particular opportunities for knowledge sharing and communication, internally and with partners. To be a participant rather than a bystander, ICARDA needs to bring itself and its staff up to speed.
- The Center should accelerate and revitalize activities designed to support 'knowledge sharing.' These can build on what is already happening across the organization. New skills, toolsets, and mindsets will be needed.
- A short-term step is to launch a knowledge sharing mapping exercise that involves people from different parts of the organization. This should result in a series of practical actions and visible benefits.
- These actions can focus on many different types of activities, with a focus on 'collecting' and 'connecting' as well as 'conversing.'
- It is vital that the incentives and organizational culture are sufficiently open and welcoming. Top level commitment and reinforcing in appraisal systems will be necessary.

On **internal communication**, the Panel discusses the use of email, the intranet, calendars, trip reports, instant messaging, document management, as well as internal bulletins. Specific recommendations include:

- That an effective Center-wide document management system be implemented as a high priority.
- That bottlenecks to Intranet (and other communication mechanisms) development at ICARDA be urgently tackled, through more open communication and knowledge sharing approaches; through adoption of more participatory technologies.

- In general, that ICARDA make openness a 'default' setting. Instead of asking whether content can be shared more widely, the default should be that it 'is shared unless there is a strong reason not to.'
- That internal communication is addressed as a high priority by the new Director of CODIS.

More generally on communication, the Panel observed a marked lack of consistent branding across different Center products. This should be a high priority task to address in a new Communication strategy.

The Panel also examined some Center-wide, **cross-cutting issues and opportunities**:

1. Get the Whole Information Systems Picture

There are many different systems and services in ICARDA that deal with information, data and perhaps knowledge. They are spread across units, they are in different forms, and they have different levels of visibility to outsiders. The Panel concludes that the development of a higher level vision or architecture is crucial to ensure that the synergies among different investments can be obtained.

- The Panel recommends that a succinct vision, set of principles and mapping of all information systems and services would lead to more clarity and coherence.
- For most of the systems, the Panel found that they have 'single' operators or champions. Just as data needs to be backed up, so ICARDA needs the knowledge and skills of the people running its systems to be backed up.
- If a part of the vision is that staff and visitors to ICARDA are able to engage with the wider ICARDA knowledge base, and not with each system one by one, then more attention must be paid to standards and the interfaces among systems.
- The Panel found very little re-use of information and knowledge across systems and services. The different repositories and systems should each be seen, and designed, as potential knowledge sources that populate several different services.

2. Better Manage Information Systems Development

Some observations are made about software development at ICARDA and the need for stronger management practice and quality control for ICARDA software products. Rigorous justification, the equivalent of a literature review before beginning a research project, and the use of a formal project management methodology such as PRINCE2 are recommended. Justification should include impact assessment. A shared software project management resource in the CGIAR is mooted as a possible means of risk mitigation.

3. Engage the 'Users'

Current strategies on information management and communication recognize the importance of 'user' engagement and ownership of the various processes and products. In general, the Panel found that ICARDA has a more centralized approach where a few people are authorized to edit and update each system and most staff members are passive consumers. It recommends that ICARDA:

- Identify and support information, IT and knowledge/communication champions across the organization in different units. These can provide front line support, track demands and needs, and act as links between users and providers.
- Empower users across the organization to create and share their information and knowledge.
- Reactivate some critical committees to engage more staff in the direction of different systems and services (IT, web communication, knowledge sharing, information and data management).

4. Re-focus the Roles

The Panel observed above that much more could be done to engage staff across the organization in information and knowledge tasks. It proposes that ICARDA also re-look at the division of roles and responsibilities among different units. It recommends:

- Recognizing that much information management, knowledge sharing, communication and IT work is actually done in units and programs, the Panel recommends that capacities across the organization need to be enhanced (new skills). In the various areas, these need to be facilitated and enabled by the 'central' groups with primary responsibilities in these areas.
- Separate responsibilities for 'content' curation and management from responsibilities for technical hosting and software development and support.
- Re-form the IT support services into a unit that focuses on "core services", defined as those serving all users directly, or indirectly via corporate applications. This group should be located in corporate services.
- Group people working on MIS applications within Corporate services where they are close to their 'customers.'
- Place Biometrics within research, close to its customers.
- Many web-based content systems and applications (such as the intranet, some web sites, data repository) are currently managed by CBSU. This causes bottlenecks and some lack of coordination and coherence. The Panel proposes that overall responsibility be transferred to appropriate units within CODIS. The CODIS groups will require additional capacities to support such responsibilities.
- Ensure that people assigned on these critical roles across Center boundaries operate as communities or teams that work towards shared goals.
- Following the subsidiarity model advocated above, the management of specialized scientific systems should remain in the units closest to them.

The result would be a new IT Services Unit with a re-focused mission and role; a reinforced CODIS responsible for center-wide facilitation of information and communication systems content and its accessibility, knowledge sharing and communication (internal and external); biometrics services within research, and reinforced skills and capacities in all units to take more responsibility for their some information, communication and knowledge activities.

A key part of this change will be to provide training to the different individuals – in the ‘central’ units and also across the Center.

5. Think Center, Act System

In several places, the Panel highlights the CGIAR context of the services and systems.

In general, if the CGIAR would put in place appropriate and reliable common IT, information management and some related communication activities, the Panel believes these could greatly benefit ICARDA. There are many potential opportunities. They have significant implications for Center investment priorities. The key questions are whether the potential will be realized, when, and the extent that the results will indeed be appropriate and reliable.

The Panel recommends that ICARDA:

- Develop scenarios for major IT and IM activities that set out options with and without appropriate and reliable common services provided across the CGIAR.
- Ensure that any internal investments are future-proof in terms of inter-operability and compatibility with other CGIAR initiatives.
- Introduce a ‘system’ scan or check as part of the pre-design phase of all IT and IM development activities.
- Ensure that all IT and IM systems, software, products and services developed within the Center are shared and made available to others Centers.
- Make explicit to other Centers and the CGIAR as a whole that ICARDA actively seeks synergies and opportunities to share in the development and use of useful applications and services.

The Wider Context

This section identifies some key contextual issues that frame the review and which we expect will shape future demands put on IT, IS and KM systems and services at ICARDA.

- **Changing global technology environment.** That the IT world is about to be revolutionized has been a bit of a cliché for a long time, nevertheless the Panel feels that the next 10 years will be more dramatic than the last in terms of IT change (10 years ago ICARDA was not yet on the Internet). Key technologies and trends that will affect it include: the 'virtualization' of IT (driven in part by 'green' IT trends); the coming mobile Internet device explosion; the growth of 'Software as a Service' and 'Cloud computing'; and the growth of non-proprietary information technology and standards.
- **The Syrian environment.** For many years, ICARDA has faced uniquely difficult circumstances in the CGIAR in respect to its connectivity and its freedom to import and use technology. These have ameliorated somewhat over time and it should no longer be the case that it takes years (11 in the case of email, 4 in the case of the Internet) for new technology to reach every CGIAR Center, with ICARDA as the late adopter. The Panel notes that some of these restrictions may be lifted or reduced in the near future.
- **International Public Goods.** The overall CGIAR vision sees the Centers carrying out high quality IPG research whose benefits spillover across international boundaries. The implication is that ICARDA research outputs – technologies, software, datasets, and publications – therefore 'need to be able to travel.' They cannot do this on their own - attention needs to be given to their availability, accessibility and applicability. They may need to be in different formats and languages, they may need different licenses, they may need to be open access, several pathways can be followed. These notions are being worked on at CGIAR system level by the ICT-KM Program (see Annex 3).
- **CGIAR reform process.** The principles in various change proposals seem to have been accepted and are likely to be worked out in 2009 and 2010. One aspect is that various 'common services' in areas like IT, information and knowledge may emerge. In terms of this review, this provides some uncertainties, but also opportunities. In all practical terms, many ICARDA IT and information systems and services are already intimately tied up with CGIAR-wide initiatives. Often, improvements to the local situation are likely to be best achieved through system level actions. In the short term, the Panel recognizes that actions need to be taken at the Center level, with a close eye to system developments and emerging areas for synergies and efficiencies.
- **e-Science.** The UK Research Information Network² argues that "developments in information and communications technologies are transforming the nature and scale of research, enhancing both quality and productivity. They are facilitating new kinds of research, new organizational models, and collaboration across disciplinary, institutional and national boundaries. But they also demand new ways of thinking about how we manage data and information outputs." This means that IT systems and platforms need to support and enable increasingly information and data intensive collaboration that often requires collation, analysis, and sharing of large quantities of data. There is a trend emerging for scientists and their teams to themselves run IT systems, manage information, share knowledge, and communicate with peers and other audiences. 'Central' information facilities are not the only actors in this area. IT, information and knowledge management need to draw on organization-wide actions and capabilities.

² RIN. 2008. Stewardship of digital research data. London: Research Information Network.
www.rin.ac.uk/dataprinciples

- **Research to development continuum.** Doing high quality science and generating outputs is not sufficient to have development impacts. The Independent Review of the CGIAR argues³ that CGIAR centers should be encouraged to “make their research available and useful for development” – as well as to international science. The implication is that ICARDA outputs must, at the least, be widely and easily accessible for others to apply them. The CGIAR Science Council⁴ suggests that “it will be important that all actors in the R&D process – from research design through to those who will apply the outcomes in the field – should communicate with each other and should have equal access to knowledge.” This calls for inclusive, participatory approaches to knowledge sharing and communication.
- **Innovation systems.** In recent years, CGIAR Centers like ICARDA have given much attention to research that is based on more system perspectives in which development impacts are seen to result from the actions of many different actors, in networks and along value chains. The World Bank⁵ concludes that the “innovation systems concept is attractive not only because it offers a holistic explanation of how knowledge is produced, diffused, and used but also because it emphasizes the actors and processes.” Such approaches are important as they explicitly recognize that multiple actors, perspectives and knowledge sources are necessary. Knowledge thus needs to be sourced from a diverse set of actors. It is not sufficient for research institutes to access each others’ reports – they need to tap into other information flows, including from farmers. Information products and services also need to be accessed by more diverse ‘audiences’ who may not be familiar with traditional research communication. Collaborative, interactive forms of sharing and exchange are called for.
- **Social media.** In recent years, we have seen a fast-growing revolution in the way we use the Internet, especially the web. As part of this ‘web 2.0,’ the web is “shifting from being a medium in which information is transmitted and consumed, into being a platform, in which content is created, shared, remixed, repurposed, and passed along.”⁶ It is characterized by increasing amounts of ‘user-generated content’ and ‘user-remixed content’ – where different knowledge and information is created and brought together by individuals and groups in their own ways. Across the web, including in the CGIAR and its sponsors and among NARS partners, individuals, groups and organizations are using this new web to become active creators and producers of information. They are starting to communicate and share with different tools and applications; they begin to develop mindsets that value open sharing above ownership of information.
- **Accounting to sponsors and investors.** The CGIAR annual performance management review asks Centers to report on a range of indicators – including the outputs they have produced and any outcomes and impacts that may have resulted. Other funders, such as DFID, are looking at ways to collect and make accessible a complete record of all research outputs they finance⁷. Such demands are likely to increase as funders want to show their taxpayers how effectively their money has been spent. For ICARDA, internal systems to ‘capture’ information on outputs (as well as the outputs themselves) and to be able to produce streamlined reports are likely to be increasingly important.

³ CGIAR. 2008. Bringing together the best of science and the best of development: Independent Review of the CGIAR System. Washington DC: CGIAR.

⁴ Science Council. 2005. Science for agricultural development: Changing contexts, new opportunities. Rome: CGIAR. www.sciencecouncil.cgiar.org/fileadmin/user_upload/sciencecouncil/Reports/StAD_Entire_Doc.pdf

⁵ World Bank. 2007. Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Washington DC <http://siteresources.worldbank.org/INTARD/Resources/EnhancingAgInnovationeBook.pdf>

⁶ Downes, S. “E-Learning 2.0” <http://elearnmag.org/subpage.cfm?section=articles&article=29-1>

⁷ See www.research4development.info

Information Technology

IT in a CGIAR Context

Beyond the changing global technology environment and the particular constraints facing organizations working in Syria, ICARDA's use of IT needs to be considered in several contexts, notably the wider CGIAR

For over two decades the IT groups at CGIAR Centers have collaborated to implement shared services. A portfolio of services (notably email, virus and spam filtering, and web hosting) is currently outsourced and was managed for the CGIAR as a whole until recently under a single contract. The shared email directory in particular facilitated the work of and defined the community of the CGIAR.

CGIAR Shared IT Services today
convergence without governance

- **Active Directory hub services**
 - For 23 sites worldwide from Lima to Manila
- **Email (Microsoft Exchange)**
 - Hub services for 8,900 mailboxes, 25 servers
 - Spam and virus filtering, listservers
- **Web Services**
 - Web, FTP and SQL server hosting
 - Aqualogic (Plumtree) portal hosting for global Intranet
- **Microsoft Live Communications Server hosting**
 - instant messaging, voice, webcam
 - SIP telephony (coming)
- **Voice gateway services**
 - Integrated voice and data network hub
 - VOIP gateway
 - US phone and fax numbers
- **Internet dialup and helpdesk for travelers**

= single global IT infrastructure for 15 separate organizations



CGIAR shared services infrastructure in Silicon Valley (c.2006)

The CGIAR's implementation of one of the most globally extensive networks of its type, as if it were a single organization, is probably still unprecedented and remains a remarkable achievement. The key strategic drivers for collective action were:

- Achieving economies of scale and scope;
- Tapping technology resources and scarce competencies and those beyond the capacity of any single Center;
- Presenting a single CGIAR interface internally and externally;
- Leveraging the geographic coverage of the CGIAR.

Some people believe that, to some extent, CGIAR IT should be managed on a global basis by a CGIAR team with a budget and staff (at least one) in every Center.

It is worth noting that the CGIAR has worked at its best when it has really been a system, in particular, from a technology perspective, when it has connected CGIAR locations at a fixed cost or no cost to individual centers to the CGIAR's global network.

The *2nd Level Connectivity* project of the CGIAR ICTKM Program was responsible in recent years for getting some of ICARDA's non-HQ locations online, including Tashkent. The project was based on the idea of deploying standardized IT on a global basis and enabling any CGIAR traveler to operate in any location as if at home, as well as enabling support costs and services to be shared regionally among Centers.

The IT solidarity of the CGIAR Centers has recently experienced a blow with the recent withdrawal of a center from shared services. It means that the fixed proportion of the cost of existing shared services is redistributed, resulting in higher costs for others. It might not take much additional erosion for others to find the costs outweigh the benefits and there are signs of other centers following suit in various ways. It's too soon to say if it really matters. However, it comes at time when the CGIAR has agreed in principle to adopt common services, but what this will mean in practice isn't at all clear.

The Panel feels that the strategic drivers listed above are still relevant and believes that the CGIAR should regard IT as a system utility and those aspects of it which may be called "core services" – common to all Centers— should be operated and managed on a system-wide basis in a coherent and consistent way, with common:

- IT principles
- IT architecture
- IT infrastructure
- Business applications
- IT investment priorities

It could be a long time before this happens, if it does.

Meanwhile, there are very relevant developments occurring in (and around) the CGIAR today:

- In Africa, ILRI and ICRAF operate a single, jointly managed IT department.
- In Southeast Asia, the World Vegetable Center has outsourced IT operations to IRRI.
- The World Fish Center is about to do likewise and will do so *on a global basis, including Africa*
- The World Vegetable Center has moved its email "to the cloud" by adopting Google's Gmail;
- Currently 9 CGIAR Centers are discussing the adopting of a common financial information system (there will be meeting at IRRI on 3-4 May to review shortlisted options).
- CIP is currently leading an effort to develop a *One Corporate System* approach to develop harmonized Enterprise Resource Planning (ERP) system requirements.

A recurring theme in discussions about what can be done differently in simplifying IT infrastructures, driving down costs by giving up ownership of hardware and by sharing services, is the need to have sufficient bandwidth. Bandwidth is the great enabler—of access to remotely hosted systems, whether on the Internet at Google or in another Center. Without a significant increase in bandwidth ICARDA's options for the future will be constrained.

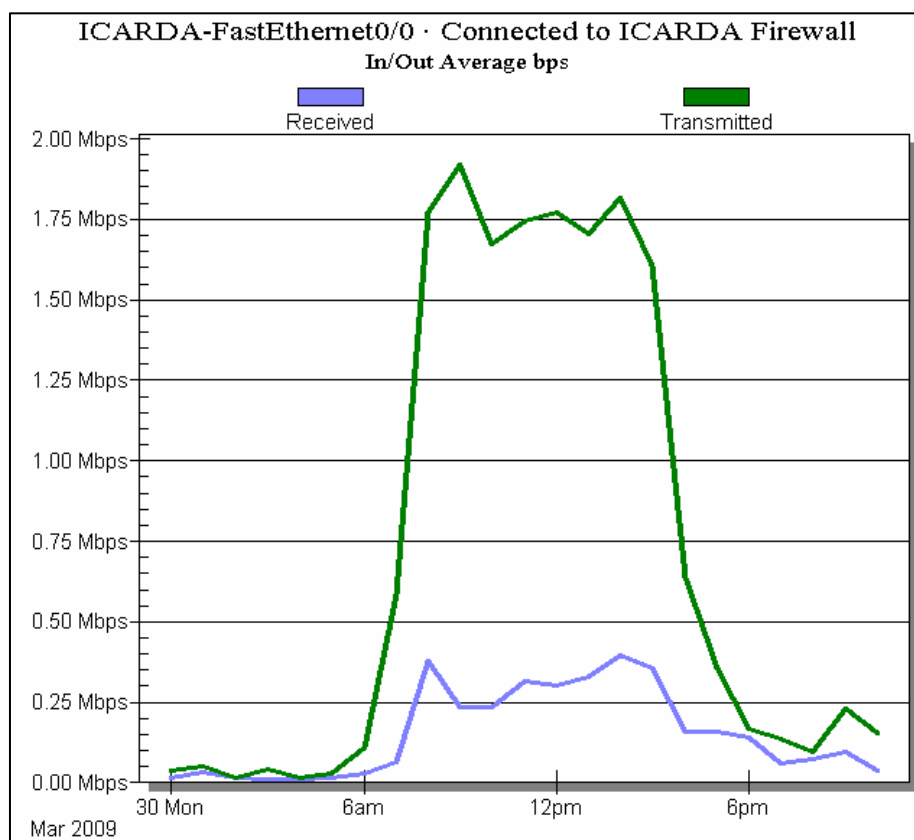
Connectivity and Bandwidth

Most CGIAR Centers have seen dramatic increases in their connectivity in recent years and the usual way this has been achieved is by maintaining or even increasing expenditure as the cost of connectivity has fallen.

The Panel was surprised to find that some ICARDA staff seemed to feel that \$3,500/month costs for the current E1 (2Mbps) circuit (plus \$500/month local loop) cost was expensive and that doubling this would be difficult.⁸

In 1994 ICARDA spent \$4,500/month on *telex alone*, out of a total of c.\$20,000/month on telecommunications⁹. In light of the opening point, for ICARDA to pay less now for something as essential as Internet connectivity than it paid for telex 15 years ago is surprising.

Currently ICARDA's main Internet link is fully saturated during the working day, every day.



Note: Total bandwidth used on a typical day = sum of received and transmitted.

The Panel acknowledges and commends ICARDA's resilient connectivity achieved by means of a backup satellite connection, however while this appears adequate to maintain minimum levels of email and very limited web traffic it is no way a substitute for ICARDA's main link.

The Panel found the 512k backup connection effectively unusable at times, although this was reportedly unusual, and noted that the primary link was saturated almost all of the time during working hours.

⁸ The Panel acknowledges that the relative availability and cost of connectivity in Syria place ICARDA at some disadvantage and that doubling commercial Internet bandwidth alone might not necessarily yield a dramatic improvement. ICARDA management did not indicate that ICARDA couldn't pay more.

⁹ Information received from ICARDA by a Panel member at the time.

The Panel commends the excellent cooperation of ICARDA staff in deferring non-essential Internet use to off-peak times but considers that ICARDA's need for additional bandwidth is now very, very urgent.

The Panel considers that the center's current bandwidth to be very inadequate.

The direct cost to ICARDA of lost staff productivity may approach or exceed the cost of, say, double the bandwidth. However, this is not the only issue. Other Centers have lost staff and candidates have declined to accept positions in locations with connectivity considered just too slow¹⁰. Then there's the impact on science and on scientific collaboration.

ICARDA's GIS users find the current connection hopelessly inadequate so that a transfer of even a 20Gb file can take three weeks if it's possible at all. Contrast: currently IRRI GIS scientists could transfer a 20Gb file *in less than an hour*.¹¹ Qualitative differences of this kind if they persist much longer would place ICARDA scientists at a significant disadvantage relative to CGIAR peers, even those in Africa in the near future.¹²

The Panel recommends that ICARDA commit itself to the greatest possible increase in its connectivity, not a marginal improvement, if necessary by seeking special funding for this.

A specific priority should be **re-establishing** connectivity to the *Syrian Higher Education and Research Network* (SHERN) and, by active participation in SHERN to regional **advanced research networks** such as EUMEDCONNECT2 (www.eumedconnect2.net) which interconnect national research and education networks (NRENs).

EUMEDCONNECT - An Overview



The EUMEDCONNECT project is a pioneering IP research network within the Mediterranean region, linking Mediterranean and North African countries to each other, and to the pan-European GÉANT2 network.

The infrastructure provides an international backbone dedicated to research and other non-commercial purposes. It is linking national research centres and institutions in the region with over 3,500 research and education establishments in Europe, and other regional research communities worldwide.

The Mediterranean partners in the EUMEDCONNECT project are Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia and Turkey. The European partners are France, Greece, Italy and Spain.

EUMEDCONNECT has created the first regional research and education network for the Mediterranean, and is contributing to the acceleration of development of the Internet in the region. The network is helping to foster cohesion with the region, and supporting collaborations both between users in the region and with those in Europe on issues of common interest.

EUMEDCONNECT has been particularly instrumental in supporting e-learning and e-science projects, for example:

- EUMEDGRID, the first grid computing project in the Mediterranean region, which began in January 2006 and makes extensive use of EUMEDCONNECT's infrastructure
- The EuMed Cancer - GeMed Network project, which aims to develop centres of excellence in genetics in Mediterranean countries through the provision of online courses and workshops.

EUMEDCONNECT is a key part of the European Commission's drive to promote Information Society objectives in the region. It was the principal infrastructure project supported by the EUMEDIS programme and provided connectivity for many of the EUMEDIS application projects. To find out more, please visit the EUMEDCONNECT web site, which you can reach via the link in the black panel at the top-right of this page.

Advanced Research Network Connectivity

Today what is sometimes known as the commodity Internet is unsuitable for video-conferencing and other time-sensitive and high-volume traffic. Research and higher

¹⁰ And have also done so because of restrictions on use of VoIP technology such as Skype. When nobody had access to such technology it was less of an issue; today the comparative accessibility and cost matters.

¹¹ Currently they experience sustained (> 24 hours) throughput levels of 50Mbps over a 155Mbps link to the Asia Pacific Advanced research Network (APAN).

¹² While ICARDA currently enjoys lower latency on its Internet link 2009 will see a large increase in African connectivity with the commissioning of the SEACOM and other fiber optic cable networks; ILRI and ICRAF will be able to purchase bandwidth at c.\$500 per Mb / month. There will also be new fiber links to Lagos in 2009 presenting significant opportunities for bandwidth upgrades to IITA.

education organizations worldwide have been moving for many years to national research and education networks (NRENs) and connecting these to regional networks such as Internet2, ALICE, GEANT and APAN (in North and South America, Europe and Asia respectively). Currently IRRI, CIMMYT and CIP are directly connected to NRENs, and ICARDA was, briefly.

In 2006 ICARDA received funds from the Advanced Research Networks (ARN) project¹³ of the CGIAR ICTKM Program to establish this link and equipment was purchased and installed and a link to SHERN via the University of Aleppo established. The link was operational for some months but the local loop to the university is no longer working.

This is a classic last mile problem and it is imperative that it be resolved – again. This is a tractable problem with a potentially large payoff, of two kinds:

1. More (additional) bandwidth for scientific applications and data exchange involving **research network connectivity** from end to end
2. More bandwidth for commodity **Internet traffic** (Google, Yahoo etc.) by shifting research network traffic off commodity Internet links.

Subsequent to its visit to ICARDA, the Panel was in touch with Dante¹⁴, a European not-for-profit organization that builds and operates pan-European research networks, linking national research and education networks, and which is responsible for EUMEDCONNECT2, to inquire about future plans for EUMEDCONNECT2 in relation to European-Syrian connectivity.

The Panel received the following advice from EUMEDCONNECT2 project manager, David West:

- The Syrian link to EUMEDCONNECT2 is due to increase from 8Mb to 34Mb in April 2009.
- Dante had just corresponded with the Higher Institute for Applied Science and Technology (HIAST) in Damascus about ICARDA's status and possible re-connection.¹⁵

Quote (David West to Panel):

"We regard ICARDA as a strategically very important organization and are keen to see how their activities can be assisted by SHERN and EUMEDCONNECT2. The whole point of setting up a regional research and education network in the Mediterranean region is to help the scientific and academic communities to collaborate effectively and to allow them to carry out innovative international programs and research. **ICARDA is exactly the type of organization that should benefit from the EUMEDCONNECT2 infrastructure, and DANTE is committed to supporting ICARDA's case for connection to SHERN and EUMEDCONNECT2.** Our representative at HIAST is Dr. Maher Suleiman. We will continue to encourage him to secure ICARDA's (re-) connection to SHERN." (Emphasis added)

In short, an association of European research networks was anxious to ensure that ICARDA was connected, was already very aware of and 100% supportive of ICARDA's mission.

The Panel understands (from Dante) that ICARDA's connection problems with the University of Aleppo may have had something to do with the fact that ICARDA is not formally a member

¹³ http://ictkm.cgiar.org/investment_plan/2004/projects_summary/ARN.htm

¹⁴ <http://www.dante.net>

¹⁵ HIAST is the termination point for EUMEDCONNECT2 in Syria and a part of SHERN.

of SHERN. Dante understood from Dr. Suleiman that this was under review following representations received that day (6 April, 2009) by ICARDA¹⁶.

The Panel trusts that the Director General will be successful in having ICARDA granted membership of SHERN on an exceptional basis, if necessary. Given the possibility of

- ICARDA scientists giving presentations by video-conference to audiences in SHERN-connected organizations in Syria;
- Audiences in SHERN-connected institutes tuning into events and presentations at ICARDA;
- Collaboration and information exchange via SHERN between ICARDA scientists and national partners in Syria;

and

- the fact that ICARDA is a research and education organization that trains scientists (even if it is not a degree granting organization)

the case for ICARDA membership should already be strong. It may be enhanced still further given ICARDA's plans to use digital media and communications technologies for e-learning activities. Support from Dante, and if needed from the EU, is certainly a possibility but is hopefully not necessary.

How to Reconnect

There are typically two problems associated with connecting to advanced research networks:

- Last mile infrastructure
- Not enough or too much demand for bandwidth¹⁷

ICARDA has already overcome the last mile (or first mile) problem. Technically it just needs a circuit to be reactivated, then for its capacity to be increased as much as possible.

The Panel has seen a CGIAR Center request NREN connectivity unsuccessfully because it didn't bring anything to the table. The CGIAR Centers already connected to NRENs contribute valuable dollars over and above local-loop costs which help pay for international circuit costs. The Panel is not aware that ICARDA made a specific contribution to SHERN in this way and recommends that it do so.

As a non-member and non-contributor to SHERN, and possibly as an organization perceived to be well resourced, it's possible that ICARDA could have faced, or may face in future, some adverse sentiment about competition for international bandwidth with the rest of the national research and education network.

Regardless of the precise circumstances now, *the Panel recommends that ICARDA should make a financial contribution that makes a real difference to SHERN*, not simply seek equal access to SHERN resources. If ICARDA is perceived as helping to expand the international circuit capacity then occasionally high demand at Tel Hadya will be less of a problem.

ICARDA's contribution to SHERN could be made, for accounting purposes, in the form of an agreed router co-location charge.

¹⁶ This was not the first communication with ICARDA; however, resolution now seems a possibility.

¹⁷ Insufficient traffic makes upstream links hard to justify, too much makes those already connected reluctant to add to the problem by connecting additional users.

An important contribution that ICARDA could make, of a non-financial nature, would be to agree to a mutual backup (failover) arrangement for Internet traffic, for at least some of SHERN and some traffic (e.g., email).¹⁸ *The Panel recommends that ICARDA explore a mutual Internet backup arrangement via the University of Aleppo or SHERN.* If this proved viable it would be possible for ICARDA to dispense with the satellite link and contribute the full cost to SHERN instead.

Assuming it is permitted to connect to SHERN, ICARDA is *eventually* going to require a fiber link to SHERN. The Panel has been advised that only 4km of fiber, approximately, is needed for ICARDA to have a fiber link to the University of Aleppo.

Fiber optic cable is normally warranted for 25 years and could be depreciated over that timescale. The cost of ICARDA connecting via a few kilometers of fiber to SHERN is low by international standards (*i.e.*, the per kilometer cost of the work). It is estimated that the amortized cost to ICARDA of infrastructure needed could be as little as \$3,000/year – it is certainly of this order.

For information, the situation at ICARDA and IIRI may be contrasted as follows

	ICARDA	IIRI ¹⁹
Main Internet link	2 Mbps	16 Mbps
Cost /month	\$3,500 + \$500 local-loop	\$3,500
Backup Internet link	512k	2 Mbps
Cost /month	€900	\$1,500
Advanced Research Network link	? down (was 2 Mb)	155 Mbps
Cost/month	\$500	\$2,000 ²⁰
National ARN link	8 Mb, will be 34 Mb by May 2009	155 Mbps

The cost of the commercial Internet circuits is not something ICARDA can influence greatly, except by buying in the capital and having connectivity there. However, how IIRI achieved the 155 Mbps link is relevant.

A “fiber-gap” (but of 20km not 4km) was closed by laying fiber to provide an end-to-end fiber link from the institute to the Asia Pacific Advanced Network termination (APAN) point in Manila (70+km distance). This was done by a carrier as result of a tender for a 5 year contract for connectivity to the APAN connection point (at no up-front cost to IIRI).

The Panel recommends that ICARDA make a similar arrangement if possible.

Given a co-located router in the capital and fiber all the way there, it’s possible to:

- Obtain commercial Internet connection at lowest national prices (note IIRI pays \$218/Mb/month in Manila v \$750/Mb/month on campus for a backup link).
- Match the incoming international circuit and, in principle, use the entire circuit if there is no other traffic – note 155Mbps appears twice in the table above.

The Panel recommends that ICARDA’s link to SHERN should be commensurate with SHERN’s bandwidth to EUMEDCONNECT2 (due to be 34Mb) in so far as this is possible technically, financially and with regard to other demands on the link.

¹⁸ IIRI has an automatic failover in place for Internet traffic with the Advanced Science and Technology Institute (ASTI) in Manila. The automatic (BGP) routing is managed by ASTI for IIRI. The arrangement works well. A similar arrangement is in place between ILRI and ICRAF in Nairobi.

¹⁹ IIRI’s level of connectivity represents the state-of-the-art in the CGIAR.

²⁰ Includes contribution to PREGINET, Philippine counterpart of SHERN, in router co-location fees.

However: The link between the University of Aleppo and SHERN in Damascus is currently a bottleneck – a 2Mbps circuit as overloaded as ICARDA's Internet link.

The Panel recommends that ICARDA: Either do whatever it takes in partnership with the university to resolve this by contributing to a shared higher speed link to Damascus, if the university is agreeable; or, commission its own link and move its router currently at the University to HIAST in Damascus.

Either way, the same link out of the country will be shared and will see the same traffic to and from Aleppo. However, an independent ICARDA link to HIAST would help keep SHERN-SHERN traffic from affecting ICARDA's international traffic, and vice versa.

A recommended long-term aim should be to have redundant links to SHERN as well as to the Internet if possible. One way to achieve this would be to have ICARDA links in place to *both* HIAST and the University of Aleppo and to have link failover in place. Failover of some Internet traffic (e.g., email) could also be considered.

A link only to Damascus would have the slightly anomalous consequence of ICARDA traffic to and from the University of Aleppo routed via Damascus.

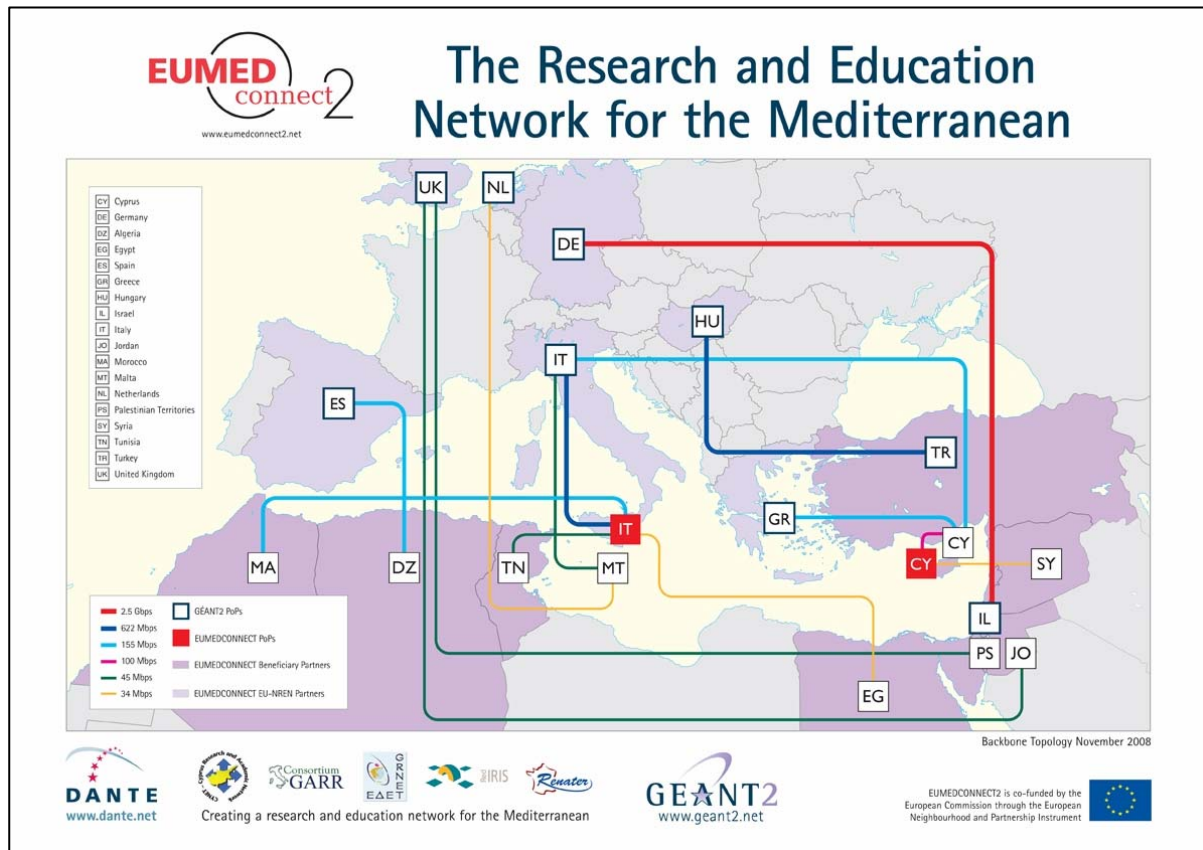


Figure 1. With a connection to SHERN ICARDA scientists can exchange data and communicate via EUMEDCONNECT2 and the international research and education networks to which it is connected.

Telecommunications

With the installation of a new digital phone system responsibility for telecommunications has moved partially to the IT department. Currently responsibility for mobile telephony lies elsewhere.

The Panel recommends that overall management responsibility for telecommunications be passed to CBSU and that CBSU be re-designated as IT Services.

It is important that ICARDA have a consistent oversight of its telecommunications from both technical and budgetary points of view. It should be routine for the IT department to monitor trends and costs across:

- Email
- Fax (including e-fax)
- Mobile voice
- Mobile data
- SMS text
- Commodity Internet
- Advanced Research Network (when restored; see Connectivity)
- Remote Internet access services used by travellers

on a monthly basis and to be constantly able to make recommendations to management how best to take advantage of changes in technology and cost and to respond to questions about possible changes.

The Panel was concerned to learn that ICARDA had signed an undertaking not to use a Voice over Internet Protocol (VoIP) PBX for VoIP calls off campus but understands that this was necessary for government approval.

Other CGIAR Centers have been deploying digital phones to country offices for some years. It has the effect of providing an internal extension, making it possible to call someone, at no marginal cost, *exactly* as if they were in the office. It is even useful within the same country (ICARDA could deploy such phones to the Damascus office and guesthouse, and if needed, to the ICARDA school).

For ICARDA to be denied the right to use this technology is not in the best interests of the institute and its mission and *the Panel recommends that ICARDA should make every possible effort to negotiate an exemption from restrictions which the Panel was assured are temporary*. The Panel considers this quite urgent²¹.

VoIP traffic is now starting to dominate international telecommunications. After only 5 years Skype is now the largest provider of cross-border voice communications in the world.²² *The Panel recommends that ICARDA should seek to have a Skype gateway on its PBX as soon as this is legally possible for improved communications with traveling staff and with NARS scientists.*

Ten years ago the government gave ICARDA permission to operate an integrated voice and data connection (IVDN) to connect to other CGIAR Centers. Inter-center voice traffic was approved.

²¹ The Panel accepts that ICARDA may have little influence. However past representations re video-conferencing have been successful.

²² http://www.telegeography.com/cu/article.php?article_id=27800

The logical conclusion today, given the restrictions currently placed on ICARDA, with its exemption for inter-Center communications, is that a NARS scientist in the CWANA region could and should call ICARDA via a call to another CGIAR Center with a VoIP gateway.

While this is intended to illustrate the anomalous effect of current restrictions, in fact the Panel considers the idea of CGIAR-wide virtual PBX long overdue. Being able to dial any CGIAR extension anywhere in the world from any other CGIAR extension would be a more than merely symbolic demonstration that the CGIAR system is indeed a system. ICARDA may wish to advocate for this at the CGIAR system level.

The Panel notes that ICARDA has already obtained permission from the government to use video-conferencing technology, which, it is noted, uses VoIP technology.

The Panel recommends that ICARDA upgrade its video-conferencing to use Access Grid connectivity (via EUMEDCONNECT2) to enable ICARDA scientists to participate in international meetings by video-conference.

The Panel recommends that ICARDA should consider implementing unified communications if it is possible to do so with the MITEL PBX. Integrating voice mail, SMS messaging with email can pay significant dividends in senior staff time. If possible at least 2 cellular trunks should be added to the PBX for incoming and outgoing calls and SMS messages²³.

Although it now has a state-of-the-art digital phone system, ICARDA still uses many analog phones and the phone system is reportedly more complex and expensive to maintain as result. The panel suggests that a price incentive could be offered to budget holders to encourage them to migrate to digital phones.

A proposed monthly IT chargeback cost (or “seat”) cost should include a pricing incentive to replace old analog phones with new digital phones.

Cellular / Mobile voice and data + Wireless

The Panel notes that ICARDA drivers and management have official ICARDA phones and cellular data modems. The Panel expects that there will be a large increase in demand for mobile Internet devices and in the costs associated with these recommends that CBSU be formally tasked with finding creative solutions to manage this. Currently CBSU does not have the capacity to do much beyond keeping the phone system running, but some additional investment of time, which must come from slack time for creative exploration of different possibilities, should enable such things as unified messaging (email with integrated voice mail, fax and SMS), use of Outlook Calendar to schedule conference phone calls and, later, webcam video conferences.

The Panel recommends that ICARDA commit a proportion of its total communications expenses to development activities, not only for the productivity benefits for ICARDA staff, but to be better placed to identify and exploit opportunities to apply new technology for the benefit of NARS.

The Panel believes that ICARDA could usefully have at least half of one IT engineer’s time devoted to this and to supporting video-conferencing.

²³ One for incoming calls and one for outgoing; the latter will reduce the cost of calls to mobiles by putting the PBX on the cellular network for outgoing calls.

The Panel recommends that ICARDA should identify and partner with technology partners who may be able to provide suitable interns, participate in collaborative externally-funded projects and assist ICARDA from time to time in other ways.²⁴

Mobile devices paid for by ICARDA will increasingly be an area where appropriate ways of balancing official and personal use, costs, institutional security and personal privacy expectations etc. become important.

The Panel recommends that ICARDA invite the CGIAR Internal Audit Unit to provide guidance based on the collective experiences of the Centers. Some interesting lessons have been learned already in other Centers.

The Panel suggests that ICARDA drivers be equipped with hands-free facilities for making and receiving phone calls when driving as soon as possible.

The Panel received conflicting advice from senior ICARDA staff about the legality of the use of wireless network access points on campus, something that was mentioned as desirable repeatedly in interviews with scientists. Such equipment is very inexpensive and some is already deployed at ICARDA, and has been for some time. Given the apparent uncertainty, the low cost and the precedent established, the Panel considers that ICARDA has two choices to make: to remove or disable the existing equipment or to proceed to full deployment.

Via the web it is possible to discover that such access is already available in hotels and hostels, in coffee shops, in Damascus airport, across the campus of the Arabic Teaching Institute for non-Arabic Speakers in Damascus and in many other places. Some ICARDA staff also use wi-fi at home.

The Panel recommends that ICARDA provide its scientists with on-campus wireless access with full coverage as soon as possible.

²⁴ In the Philippines IRRI has such a partnership with the Advanced Science and Technology Institute (ASTI) at the University of the Philippines, Diliman, which has proven of significant mutual benefit. HIAST may be a suitable partner in Syria.

IT Services Management

IT Spending

IT expenditure is reported to be less than 3% of ICARDA's total budget. This compares to 5-6% for CSIRO in Australia (R.Bertram, pers. comm.), 10% for the financial services industry and 2% for the healthcare industry (Business Week, 2 March 2009) which is considered still fairly backward in its use of IT. Weill and Ross (2004)²⁵ report that IT consumed, on average, 8.4% of the budget of 74 not-for-profit organizations they studied.

Caution is needed in interpreting such figures. First, there is no universal standard for attributing costs as IT expenses²⁶. Second, there are significant differences between organizations²⁷.

IT and purchasing staff estimate that the effects of the US embargo on Syria add, reportedly, approximately 15% to IT purchase costs, as well as significant inconvenience. If the additional investment of staff time is taken into consideration the overall cost premium ICARDA faces when compared with organizations outside Syria is likely to be 25% or more, meaning that ICARDA's effective spend on IT is close to 2% of total budget.

It is impossible to say precisely how much ICARDA should spend on IT but its spending should be broadly comparable with that of other CGIAR Centers, and adjusted for local market constraints. To ensure that ICARDA remains competitive and to help the system have common policy:

The Panel recommends that ICARDA exchange information on IT expenditures with other centers for benchmarking purposes.

The Panel believes that benchmarking expenditure routinely may help facilitate convergence and in achieving better value for money across the system, given that most of the Centers have very similar requirements. *"If we don't have a common policy then we don't have a system"* - ICARDA DG, Dr. Solh.

Notwithstanding a total spend that appears comparatively low, the Panel noted some examples of waste:

- An extraordinary number and variety of printers, with only 29 out of 275 networked;
- Some automatic document scanners that appear lightly used;
- An apparently excessive number of typewriters²⁸;
- Approximately 50 cases of individuals using more than one computer, typically both a laptop and a desktop;
- A server room that is and has been for many years mostly a large empty space all of which is air-conditioned, at a presumably significant cost;

²⁵ IT Governance. Harvard Business Press. Boston, MA. Pp.267.

²⁶ An external assessment of IRRI's Total Cost of Ownership (TCO) of IT in 2004 estimated IRRI's annual TCO for IT as \$6.6m. This, for an organization with about twice as many computers as ICARDA (c.1,000), included the costs of downtime of all kinds, inefficiencies arising from inadequate staff training etc., but did not include telecommunications, software development or information management. IT expenditure measured in terms of purchase costs was, of course, a fraction of this.

²⁷ IRRI's costs were estimated to be slightly (3%) above agricultural industry norms for S.E. Asia but this comparison must be treated with some caution as the nature of a CGIAR Center's operations is very different from that of commercial organizations where operation cycles, e.g., inventory, production, sales and distribution can typically be consolidated in fewer servers: "The number and type of users may differ markedly. A commercial agricultural entity will have more the data entry and structured task workers, and very few knowledge workers, therefore will have a lower server to user ratio." –G. Reardon, CGIAR Internal Audit consultant.

²⁸ The number could perhaps be reduced to about 1 per organizational unit following the elimination of paper forms – the number and diversity of are red flags for processes that could be made more efficient.

- A training facility that is apparently underutilized.

Printing and Scanning

In other CGIAR centers, data on pages printed by standalone laser printers show total cost per page to be very expensive²⁹. In many cases, the printers were very lightly used. The pattern at ICARDA appears likely to be similar or worse.

Other CGIAR centers have adopted networked printers and multi-function printer/copiers. These have a lower cost of operation and ALL printing costs can be captured and charged back to projects and cost centers. Gartner Group, an IT industry consulting and research firm, refers to printing as *the last bastion of unaudited IT costs*.

At a cost of taking a few steps to a nearby printer the following can be achieved:

- Fewer, higher specification printers sufficient to meet most needs
- A reduction in the expenditure on consumables

At ILRI, paper consumption dropped by 50% when network printing was introduced (I. Moore, IT Head, pers.comm). Automatic chargeback of printing costs encouraged more careful use and fraudulent use was markedly reduced if not eliminated³⁰. IIRI was able to replace 56 copiers with 27 multifunction copier/printers with features not previously available such as double-sided printing, collating and binding and color laser printing. It was also able to replace a traditional print shop with an on-campus copy center.

In many CGIAR Centers, reportedly including ICARDA, it is routine for color inkjet printers to be discarded with significant stocks of ink supplies that could no longer be used due to printer design changes.

Benefits of switching to network printing/copying at IIRI included the ability to print on demand to any device on the network including, where desired, color laser printers and the ability to scan documents directly to email and to network storage, including personal network storage of colleagues (avoiding the need to send attachments via the email system). Note: a common argument for standalone printers is the need to print confidential documents. Nowadays it is normal for network printing devices to be capable of holding output until a security code is entered, eliminating most of the risk.

The Panel recommends that ICARDA review its office printing operations.

The following recommendations are suggested:

- ICARDA should transition to using networked multi-function copier/printer devices as soon as possible, phasing out copiers and most standalone printers and scanners.
- To begin with, no further standalone devices should be procured except in very exceptional circumstances.
- Older devices should be disposed of, perhaps with some sales to staff or via negotiated buy-back by a supplier.
- Access by staff to network color laser printing and scanning facilities should be contingent upon giving up standalone printers (for disposal or redeployment).

²⁹ Gathering this data can be time-consuming; in many cases a visit to the device is required. Sampling the data is likely to be worthwhile to raise awareness.

³⁰ In ILRI's case, at least initially, a requirement to enter a budget code when printing caused some difficulties and contributed to the reduction but this was not an issue in other centers.

- Chargeback for networked printing and copying costs should be carefully managed so that there are no incentives for undesirable behavior.³¹

Some of these recommendations concerning printers may appear trivial. However optimizing printing is worthwhile both financially and culturally, in the statement it makes to staff, visitors, auditors and others about how resources are used.

The Panel noted an apparent lack of systematic paper recycling at ICARDA and recommends that this be reviewed if confirmed.

However, there are pitfalls if the transition to a “balanced deployment” is not carefully managed. A balanced deployment is one that takes into consideration the value of staff time spent walking to and from network devices and waiting for output. It’s important that senior staff set a good example in efficient use of printing resources.

Until such time as ICARDA deploys multi-function copier/printer devices the Panel suggests that ICARDA should consider making shared scanning facilities available adjacent to existing photocopiers if the assigned “owners” of existing lightly used devices are agreeable and if there is demand.

The Panel recommends that requests to purchase additional scanners should be reviewed very carefully to see if the needs can be met from existing resources.

IT Asset Management

After the printer surplus, ICARDA’s apparently large number of typewriters was a surprise to the Panel. Today, use of typewriters to address occasional envelopes is unremarkable, but the apparently widespread presence of these devices at ICARDA appears slightly anachronistic – at least worth questioning.

Typewriters can be a sign of continued use of paper forms that should have been computerized or simply eliminated, and indirectly of slow and inefficient processes, or of failure to retire and dispose of assets no longer in use – an issue that was confirmed to the Panel (impact undetermined).

The Panel recommends that ICARDA review its use of typewriters and paper forms and rationalize these where possible, and that staff should be equipped with dedicated Dymo (or similar) label printers where appropriate.

The Panel understands that a review of fixed asset management, including disposals is planned and it was briefed on of some of the legal complexities involved. Accordingly, the Panel makes only the following recommendations which it feels can be implemented without further delay:

- ICARDA assets should be labelled with non-removable bar-coded tags (this is overdue)
- Staff time spent on IT asset disposal should be tracked and factored into IT chargeback costs (and any purchase or lease decisions should the opportunity arise).

³¹ At IRRI, staff with personal laser printers objected to being asked to use network printers because the page costs exceeded their cost of consumables – they disregarded the purchase cost of their printers. The solution adopted was to distribute the fixed cost of network devices across all computers and to charge users only for variable costs related to consumption. (Of course, one could also charge back depreciation on standalone printers but this is not recommended).

Use of financial system fixed asset modules to track IT assets has often proven difficult or impossible. IT assets are small and mobile and, where it is technically possible to do so, are best tracked using automated IT asset management systems capable of inventorying networked assets automatically.

In principle, there is no reason why automated IT asset management couldn't be outsourced remotely *provided ICARDA has adequate connectivity* – which it currently does not. Given decisions to outsource IT services to IRRI by the World Vegetable Center and the World Fish Center, and the Panel's belief that Center-level remote IT asset management is a logical consequence, the Panel suggests that ICARDA review in due course, perhaps with the CGIAR's Internal Audit Unit, the experiences of other Centers in respect of:

- inventory and asset management automation and integration
- automated management of remotely located assets

for any relevant lessons that may be applicable to ICARDA and for possible opportunities.

The panel notes that ICARDA doesn't actively manage the desktop and laptop computers belonging to ICARDA but which are not directly connected to ICARDA's network, that is, deploy software updates, security patches, inventory software etc. The IT asset data for headquarters and non-quarters locations used by CBSU are not integrated³². A 'them' and 'us' distinction is apparent.

A step in becoming a Center-without-walls *internally* is to remove the barriers to communications and access to information for non-headquarters staff. Part of this must involve making no differentiation in IT asset management between near and far, safely integrating remote computers to the network.

As soon as ICARDA's connectivity permits, *the Panel recommends that CBSU begin to manage remotely located systems as if they were on the network* and to give remotely located users as identical an experience as possible (albeit slower) as their colleagues directly connected to the ICARDA network. The Damascus office will be a good place to start, followed by others in order of the quality of their connectivity.

Managed Computers and Chargeback

The Panel recommends that ICARDA adopt a policy of one computer per person and that some needs be met using a pool and some new management practices, with chargeback.

In other CGIAR Centers it has long been the norm for individual scientists to have *one computer*, usually a laptop. Exceptions are those with intensive data processing requirements such as GIS scientists, software developers, crop modelers etc. whose main computer is ordinarily a scientific workstation (usually a very high specification PC).

Some ICARDA staff members have laptops used only for travel. In one case a scientist reported having two computers, "a notebook and a laptop." The justification offered was so that data would not be lost if the computer was stolen—as it ordinarily resided on the computer left behind.

A better approach is to work online with network storage, otherwise to backup data on a daily basis and, as needed, to borrow a pool computer for travel, preferably from the organizational unit³³.

³² Integrated records are maintained in Oracle Fixed Assets.

³³ An institute pool of laptops is not recommended.

ICARDA's accumulation of old computers is considered by the Panel to be a false economy and an IT industry worst practice. The results typically include a proliferation of configurations with higher resulting support costs as result of hardware failures (with longer downtimes), security problems, and extra administration costs when applying software updates³⁴. Unnecessary complexity impinges negatively on the automation of IT administration, resulting in higher costs and inferior security. Chargeback is an excellent way to contain the cost as it automatically creates incentives for standardization that reduces costs.

The Panel recommends that ICARDA formally adopt IT Service Management best practice and restrict PC configurations to 3 per annum (desktop, workstation and laptop) and to limit the number of configurations managed by establishing a maximum life/minimum specification for all computers that will be supported on the internal (managed) part of the ICARDA network.

Managed systems: those subscribed to services, updated automatically by ICARDA, over which ICARDA has full admin and software installation rights, and which incur chargeback costs for network administration, software licenses etc.

Unmanaged systems: (old computers not compliant with current specifications and computers of visitors and any other computers over which ICARDA does not have full administrative rights) should be strictly confined to a separate network zone and have NO ACCESS to ICARDA network resources.

In principle, this separation is already made at ICARDA, which has already experienced downtime of its financial system as the result of a software virus. We strongly endorse this approach.

The Panel heard but did not attempt to verify feedback that currently new computers are preferentially allocated on the basis of seniority not need. The Panel believes that an effective chargeback system should give incentives to effective resource allocation³⁵ by organizational unit heads and notes that the basis for computer allocation should be functional – i.e., a requirement to run particular software.

Pool Computers

The Panel recommends the use of chargeback to manage the availability of computers not permanently assigned to individual users.

For effective management of the total number of managed systems the following practice is recommended: charging back for network logon rights when machines that are not permanently assigned to individual staff are allocated to users and otherwise attributing monthly chargeback costs to an institutional IT budget.

The Implication: Such machines should be treated as “pool computers” managed by CBSU and *not* the de facto property of the organizational unit where they are located. This has the result that machines that are not in active use are effectively declared to be available if required. Machines can be left *in situ* most of the time. Some administrative support is required for this to work – a Helpdesk with appropriate admin privileges etc. The change should be phased in carefully and adapted as needed – re minimum assignment periods etc.

³⁴ A long tail of old computers also has adverse effects on training, software compatibility, fungibility of support staff and on a variety of staff perceptions pertinent to morale, particularly for those at the end of the IT “food chain.”

³⁵ Including properly accounted reallocation costs (e.g., in the case of cascade replacements) which are often disregarded

Computer Deployment and Management Policy

The Panel commends ICARDA's practice of aggregating requirements and purchasing systems in batches of identical systems – an IT industry best practice.

The Panel recommends the adoption of a baseline computer allocation or roster approach under which all units of ICARDA receive an official resource entitlement.

This would have the following IT asset management practices:

- ICARDA should establish the baseline entitlement and require management approval for changes to it; it may be considered analogous to a payroll or vehicle fleet, with basic entitlements established for every organizational unit. It is an effective way to manage often invisible costs associated with expanding numbers of computers and to ensure 1:1 replacements.
- New computers should replace old ones in a very limited time (no more than a week)
- All computers should be considered ICARDA property, managed by CBSU and rented to organizational units via
 - o Fully funded chargeback for approved (within baseline) systems (*i.e.*, with no administration for organizational units beyond annual/periodic baseline approval).
 - o Variable chargeback for *ad hoc* requirements met from pool resources.

Server Rooms / Data Centers

ICARDA's server room currently constitutes a potential single point of failure for the organization's IT. Despite the decommissioning of VAX mini-computer equipment years ago the space formerly occupied has not been reclaimed, with the result that ICARDA has been air-conditioning a very large space in an often rather hot climate for a long time.

The Panel recommends that ICARDA reconfigure its data centers.

The reconfiguration would include:

- Reconfiguring the existing server room to reclaim vacant space and reduce its air-conditioning bill;
- Use the former Bioversity premises and server room on campus to establish a backup server room, taking advantage of existing raised flooring etc.

ICARDA is already well equipped with redundant IT – routers, firewalls, domain controllers, PBX and UPS systems, however these are concentrated in a single location.

ICARDA should aim to be able to survive the loss of a data center without serious interruption to operationally critical functions. The additional cost will be modest compared with the costs in staff time and other costs of losing a data center.

The Panel recommends that ICARDA plan for a 2nd fully functional data center.

For complete resilience, the Panel suggests that a fully independent additional Internet link should be connected to the 2nd data center and that traffic on this should be load balanced with automatic failover. Storage to support critical systems should be mirrored between data

centers.³⁶ This provides insurance against data loss and, given the availability of ready to go servers and connectivity, the ability to resume normal operations quickly.

Servers

The Panel was informed that ICARDA management had been advised in the past that an excessive number of servers are in use at ICARDA.

The Panel considers the criticism less than fully informed, yet it contains an element of truth. ICARDA's network uses a "domain controller" server to authenticate network logons. It is standard practice to have two of these so that network logons may continue in the event of a server outage. Having three such servers is considered a best practice (one of which, at least, should be in different location). ICARDA uses three servers. Eliminating the redundancy that CBSU has provided in ICARDA systems for reasons of high reliability or system testing (for software development) is not recommended.

Using servers dedicated to specific applications is a standard practice for important applications to avoid the complexities of interaction effects and avoidable downtime when systems are shared and experience problems. The solution to this, which CBSU is well aware of, is to use virtual server technology. This is not yet in mainstream use in the CGIAR, though it is expected to be within the next year or two, and it does require higher specification servers to host a number of virtual servers. The Panel endorses CBSU's expressed plan to deploy this technology in due course.

In the meantime, however, it was noted that ICARDA is keeping servers two years and more beyond their intended life (3 years) – *i.e.*, the lifespan for which they were designed³⁷—and that some servers hosted in the server room for research programs may be little more than storage systems.

The Panel recommends that research units are charged realistic server hosting fees at or near commercial rates.

The reasons are as follows:

1. The present arrangement whereby research unit equipment is housed and managed by CBSU separates acquisition and subsequent operating costs. It cannot be emphasised enough that acquisition is the SMALLEST part of the cost of operating a system. If space, power, UPS, administration, backup *etc.* are accounted for over the life of a system these costs will predominate.
2. Currently ICARDA is paying all of the operating costs and it is likely that none are ever charged back to a project, directly, and passed on to a donor.
3. Effective use of chargeback here will help with full cost recovery, and contribute to a reduction in ICARDA's overheads. It will also promote effective use of systems and their timely replacement.

During the Panel visit to ICARDA, a new Storage Area Network (SAN) system was installed with 10Tb capacity was installed. This should permit the elimination of any servers currently primarily used for storage.

³⁶ This practice is increasingly routine in the CGIAR. ILRI and ICRAF currently mirror each other's mission critical network storage on paired 42Tb NetApp storage systems. IRRI mirrors tier 1 and 2 storage (see text) between two on-campus data centers and has an agreement to mirror data with CIMMYT over advanced research network links. Replication of SQL Server databases to remote locations is practices at CIP and other centers.

³⁷ When this is exceeded components begin to fail, beginning typically with hard disks. Replacing parts no longer in production can mean maintaining costly inventory. CBSU has experience frequent disk failures on old servers, has managed the problem well and is commended for the evident standardization of systems which permits spare parts to serve for many systems.

The Panel recommends establishing and charging back data center costs via a Service Catalog.

The contents of this, together with associated service level agreements, should be negotiated annually between CBSU and users.

Storage

The Panel recommends that ICARDA establish criteria for implementing tiered data storage once a second data center has been commissioned, with a view to minimizing the impact of critical system or data center outage.

The following data classification could be considered:

1. Mission critical information: email, shared documents, finance, HR *etc.*
2. Externally accessible web sites, less critical databases *etc.*
3. Scientific and other data not needed *continuously*

mapped to the following storage tiers:

1. Mirrored storage (live copy) – for servers only
2. Mirrored storage (daily disk-to-disk copy for quick recovery) – for servers or PCs
3. Non-mirrored storage (backed up to tape) – for PCs.

Some scientists interviewed by the Panel acknowledged making infrequent backups and keeping obsolete data online. Nevertheless, some good progress is being made: The Panel acknowledges the important and laudable developments in documenting and storing research data and publications in online repositories.

The Panel recommends that ICARDA review and improve its day-today data and file management practices.

The Panel recommends that:

- The ICARDA network should be the default location for ALL but the most confidential data to be stored and that data should be synchronized with PCs periodically when needed, not the other way around.
- CBSU uses tools to identify duplicate files on network storage and to reclaim space.
- Network storage costs should be charged back to users

The Panel considers it desirable that network storage costs are bundled with the costs of providing a computer on a desk and that these costs should be all-in (including assigned storage quota, backup and management).

There is a risk of data loss if charges are set at a level that discourages use of network storage and this must be managed carefully with clear policies and an appropriate menu of services and costs.

Given an option to save money by transferring infrequently used and old files to commodity storage that is backed up weekly, or to backup media, many staff will do so³⁸. Without

³⁸ The process can be automated using hierarchical storage management tools but these are still considered too costly.

choices and incentives reflecting actual costs storage systems will invariably operate at full capacity all the time, regardless of the actual costs.

The Panel recommends involving ICARDA scientists, via an IT users committee, in the development of data management policies including chargeback.

Their engagement and understanding of the costs and benefits of backup etc. should help make it culturally unacceptable to risk losing information by keeping it off the network. The Panel considers this an area of vulnerability though it noted some scientists taking many precautions, including keeping data on old and even privately-owned laptops kept in the office as a form of backup – measures likely to be of questionable use in case of a fire.

The Panel recommends that ICARDA make a concerted campaign, supported by official policy, to get ALL of ICARDA's digital information off PCs and onto network storage, so that only copies of data are found on PCs.

Securing ICARDA's digital information should be considered only the first step. Formal research data management practices should follow. The Panel commends ICARDA's Research Data Repository initiative and recommends further initiatives be taken appropriate to managing data associated with work in progress, managing the sharing, oversight, and gathering of metadata about those information assets at research program and organizational unit levels.

The ICTKM Program of the CGIAR has facilitated some exchanges of practice information in this area.

The Panel recommends that ICARDA set a target date for the adoption a consistent set of practices for the management of all digital research information and that progress be reported regularly.

IT Training

The Panel believes that IT training of staff should be a top priority for ICARDA, one that merits continuous attention.

IT training has declined in recent years from a reported 25 courses per year to about 3, with 15 participants each. The need for more IT training was mentioned repeatedly in interviews with staff. It seems that the needs training box is ticked on the performance reviews annually but action doesn't follow.

The Panel recommends that formal attention be paid by ICARDA's HR department to IT skills development of ICARDA staff, and that this should be managed at a Center level.

Given the absence of an essential skills curriculum, complaints about non-attendance and partial attendance at courses when offered, and some notable examples of poor practice in using IT (see Internal Communications) the Panel believes there is very substantial scope for productivity and efficiency improvements in the use of IT by ICARDA staff. There is also strong demand for training, notably among contract staff³⁹.

The Panel recommends that ICARDA review the eligibility for IT training of all users of ICARDA's network and look favorably on requests for training from non-permanent staff where possible and appropriate.

³⁹ Note: The Panel assumed contract staff to mean staff without permanent contracts of employment.

The Gartner Group estimates that untrained users need 2 – 6 times the level of support of adequately trained users. Typical IT best practice recommendations include:

- Maintain a database of users and IT skills (typically done using a HR application)
- Align IT training to business needs and IT strategy
- Have a corporate IT training policy
- Assign responsibility for training to a central body (e.g. HR)
- Enforce some mandatory training
- Train all users and IT staff when new products are rolled out⁴⁰

Gartner Group studies suggest a possible 16% improvement of the overall TCO costs per user if IT training best practice both for IT staff and end users is fully implemented.

The Panel recommends that ICARDA develop an essential skills curriculum and an IT training policy; employ or obtain access to a full-time IT trainer, and institutionalize end-user training to ensure it always happens.

The Center should also:

- Track and understand user skills and those of CBSU staff
- Integrate training with HR performance management processes
 - Staff and supervisors should review IT skills needs at least annually and plan training accordingly
 - The aggregated training needs should then be acted upon
- Encourage support staff to obtain Microsoft Office Certified Professional and other similar qualifications and reward them for success (first by reimbursing examination fees upon passing and as appropriate by other means).
- Offer a variety of training mechanisms (quick one hour courses, half-day, 1 day, 1 day per week courses etc.; access to a training lab / reading room; induction/orientation course)
- Use Helpdesk records to identify institutional training needs⁴¹

The Panel recommends that an IT training needs assessment be conducted for all new staff (and other network users) as well as an IT orientation, preferably at the time of their entry to the Center.

In addition, *the Panel recommends that a former practice of having an Organizational Unit IT Coordinator be revived.* OU IT Coordinators should serve as a liaison with CBSU on IT issues as needed, such as coordination of computer replacements, and should receive additional IT training so that they may help colleagues directly with minor support requests.

⁴⁰ The Panel noted complaints that Office 2007 had been deployed without staff training. The Panel is aware that this was done “experimentally” but considers that this deployment could have been handled better. The Office 2007 conversion tool which enables printing and reading should have been deployed to all ICARDA PCs, including those of outreach staff, before the first Office 2007 deployment, and Office 2007 should have been configured in compatibility mode until such time as all ICARDA staff members have Office 2007 installed.

⁴¹ It is important that this be done in a way that does not in any way discourage individual use of the Helpdesk, therefore reporting data by organizational unit or as a whole is recommended.

CBSU

Strategic Objectives

CBSU has three constituencies with somewhat distinct roles with each:

- Science (projects)
- ICARDA (the organization)
- NARS partners

Science projects, scientists and their support requirements come and go, but ICARDA and its systems continue and assert a higher claim to CBSU time and attention, normally (confirmed by good humored and commendably tolerant comments by scientists about unequal position sharing with CBSU).

It is mainly in the area of biometrics that CBSU really has any possibility of independent contribution to and accountability for specific strategic research objectives.

Inspection of the ICARDA strategic plan reveals no specific objectives at all for Information Technology and Communication. Instead it contains some very general statements of an aspirational nature, focused on new technologies and partnerships. Little basis is evident for later assessing objectively whether desired outcomes were achieved or not.

What are the success criteria for evaluating ICARDA's biocomputing initiative, e.g.? Is 240 requests from 13 countries in 5 years enough?

Refocusing ICARDA's strategic objectives on specifics such as the creation of knowledge banks containing specific kinds of information for named crops and with targets in terms of participation of partners would be more enlightening.

These objectives should then, logically, generate requirements that it is CBSU's objective to meet and which it should be resourced to address.

The Panel concluded that the breadth of CBSU's mandate and the thinness of its resources shortchange it and ICARDA of an important commodity: focused management attention on core services – those provided to the largest number of people. Certainly some of the issues identified in this document will not be new to CBSU but the time to sit back and think, to explore new opportunities, to be creative etc. is hard to see in what we have seen of ICARDA.

The panel noted for example that although Helpdesk records are kept they are not analysed systematically, reportedly *because there simply isn't time*.

Only by keeping a complete record of *all* service requests and by analyzing them regularly, preferably weekly, will it be possible to see where disproportionate effort is being expended and to make some policy adjustments in response, and to really know what time is really available for projects of importance to the organization.

The Panel recommends that ICARDA's IT Helpdesk number be answered at all times during working hours, that all service requests be logged and that reports be prepared regularly.

In this way, it can:

- Schedule additional training
- Communicate with staff on issues of concern
- Ensure that certain information is available to staff outside working hours
- Manage expectations (e.g., we no longer have any spares for ...)
- Advise an organization unit head where there may be opportunities to meet shared requirements
- Strengthen security
- Suggest more efficient workflows
- Improve asset management (when things are reassigned and the organization hasn't been advised the Helpdesk is usually the first to discover)
- Schedule a visit to a country office⁴²

Logging permits useful comparisons to be made across organizational units and in many other ways. With a good helpdesk software solution⁴³ in place reports can be generated automatically giving the service history of every asset, the productivity of support staff, the length of time it took to resolve problems *etc.* and automatic escalation procedures can be put in place too.

The Panel considers Helpdesk logs and service outage records are essential in any negotiations about service levels and requisite levels of investment and recommend that ICARDA address these.

Scope of the Unit

The Panel notes that CBSU's responsibilities and work plans address:

- Core IT services: (Technology management + admin support)
 - o Implementation and operation of IT services and support functions for all users (network infrastructure, Internet links, phone system, servers, routers, firewalls, PCs, email, Intranet, IT skills training, helpdesk, hardware maintenance services, core application installation and support, e.g., Microsoft Office, *etc.*)
 - o Corporate applications (supporting all users / entire institute / admin and management functions): MIS, Oracle applications, various administrative database applications (guesthouse, trainees, consultants *etc.*)
 - o Management of IT assets (including all applications software, software installation *etc.*)
- Information services (Content management and delivery)
 - o Publishing
 - ICARDA web site (technical oversight)⁴⁴
 - Intranet
 - Some project web sites
 - o Curation and management of scientific data
 - Content management⁴⁵ (research data repository *etc.*)
 - Software development to support some scientific applications

⁴² Outreach staff would like at least an annual visit.

⁴³ Some good open source options now exist.

⁴⁴ Responsibility for content lies with CODIS; and for technology and CGIAR shared IT services with CBSU.

⁴⁵ CBSU assists the scientists with this.

- Biometric services
 - o Scientific advisory and statistical support services
 - o Development of biometric software
 - o Capacity development in biometrics

Information systems, software development and databases are common to all themes.

The Panel recommends that CBSU be restructured, to separate and run IT Services as an internal business, with services provided on a utility basis with chargeback.

The following are recommended:

- A focus on common or “core” services (as indicated above)
- The addition of responsibility for telecommunications
- The transfer of content related services to CODIS (The Panel considers CBSU responsibility for web and Intranet content publishing may have been appropriate 10 years ago).
- The transfer of biometrics services to research
- Software development in the unit to focus mainly on integrating and streamlining ICARDA’s business operations
- The integration of MIS (with a corporate services remit)
- The re-designation of CBSU as IT Services
- The strengthening of the unit by the addition of
 - o A full-time IT trainer dedicated to running courses in standard ICARDA applications
 - o A full-time person dedicated, for one year initially, to the task of getting a document management application establish for the institute (SharePoint is recommended as a complement to Microsoft Office), the lack of which is considered a critical deficiency for the institute.
 - o A half-time telecommunications/video-conferencing engineer
- That the unit report to Corporate Services

Specific recommendations are not proposed for reorganization of content services. Instead, *the Panel recommends that incoming head of CODIS convene a workshop to review possible reorganization options with staff* with the aim of submitting recommendations to ICARDA management that have the support of staff.

Planning CBSU Work

The Panel is convinced that the work plans of the unit do not really do justice to the unit in several respects. The plans resemble an aggregated set of activities designed to add up to the requisite number of weeks per year per person. Some of the activities are essentially job descriptions.

The Panel would have preferred to see a single annual report and plan document with the following, or similar, headings:

- Past performance review (compared with objectives, performance targets)
- Work in progress (status of multi-year projects)
- Failures
- Lessons learned
- Objectives (current year)
- Resources required
- Priorities

It was only at the end of the visit to ICARDA that past reports to the board and auditor's report were available, against which plans could be reviewed. If the Panel had any concerns that important documents were overlooked (it had more a feeling of having too many) it wouldn't have been possible to scan a document index or document management system, since neither exists.

The Panel recommends that a document management system be put in place as soon as possible. The Panel also recommends that ICARDA develop corporate policies regarding document retention, disclosure and auditing.

The work plans mix very different things, from activities that should form part of an IT Service Management framework to project activities designed to achieve very different strategic objectives, from staff development to collaboration with NARS.

The Panel recommends that ICARDA adopt the concept of an IT Service Catalog. It is essentially a menu which provides:

- An unambiguous description of services (including, costs, support information and details of escalation procedures).
- A basis for negotiation on Service Delivery (the processes required for planning and delivery of IT services and improvement in the longer term)
- A checklist for IT Service Continuity and performance reviews

It does not include IT infrastructure management, application management or security management, all of which also represent activities that must be performed on a continuing basis, unlike projects.

So the first observation is that it's quite difficult to distinguish between activities and projects and to identify resources available for projects. Further, it appears that CBSU is already fully booked, with little if any time available for such things as evaluating new technology or taking on any unplanned projects.

It wasn't possible to see from documents provided to the Panel:

- How projects are selected and prioritized or the business case made for them in first place
- What additional projects could be completed if additional resources were available

It is not unusual for a service department to have more projects than it can successfully complete with available resources. Some of the deficiencies are certainly due to the fact that CBSU is overstretched, both in terms of management attention (the Panel notes that the head has been "temporarily" doing two jobs for well over a year) and staff resources across a complex portfolio that doesn't currently include IT responsibilities that we feel belong in it (telecommunications).

The main concern of the Panel with CBSU's work plans was the lack of business case information for technology investments.

As an example, the work plan indicates ICARDA plans to migrate its mail system, which is currently a CGIAR agreed standard (now minus one center) to a later version, at an undeclared cost estimated by the Panel at tens of thousands of dollars. The Panel understands from other Centers that no collective decision has been made to make such an upgrade. Accordingly, ICARDA's proposed pre-emptive upgrade runs some risk of being at

least a partly wasted investment in the event of other centers not following suit—and there are precedents for failures to implement even consensus decisions regarding CGIAR IT⁴⁶.

Granted, replacing old servers is a good practice and this is where most of the planned expenditure would go.

However, the Panel feels that this should be less apparently technology driven and less subject to the vagaries of capital budgets and should instead follow from routine IT capacity planning and chargeback, with requirements and service level agreements negotiated periodically with customers (without quotation marks). A regulated business monopoly, in which CBSU (with other Centers where appropriate) meets the minimum requirements for the institute, and in which the customers decide on the rest, is considered a good approach.

The Panel recommends the adoption of a PRINCE2 type project portfolio approach to managing IT projects, to be implemented after CBSU has been reorganized.

This will provide a higher level of accountability for resource management and a better basis for prioritizing investments. It is recommended for projects managed by CBSU.

Managing Risk

The Panel notes that although CBSU had prepared an IT risk assessment in 2005, and updated it in 2008, it had not previously prepared a competencies matrix which the Panel feels should be used in assessing the possible consequences of staff turnover.

The Panel believes that CBSU has inadequate levels of redundancy and notes with concern the apparently very limited time budgeted for training of CBSU staff and the fact that planned staff development doesn't appear directed at the clear personnel risks. The simultaneous loss of only two key staff in CBSU could have seriously adverse consequences.

The Panel recommends that ICARDA develop a disaster recovery plan as a matter of urgency.

This is an activity that requires investment of staff time that simply doesn't appear to be spare at the moment. It doesn't appear on the list of objectives for the year.

The Panel notes with concern the reportedly long delays in filling positions and the risks that ICARDA runs in CBSU, at least, as result. It recommends that board reports should include both duration that vacant positions have been unfilled and a brief risk assessment if appropriate (even, a criticality score)⁴⁷. The Panel recommends that the board (or DG?) should indicate for each position with a risk flag how often it (or DG?) should be updated on the recruitment. In the absence of a mechanism like this, or an agreed alternative, the Panel is concerned that avoidable risks may be run inadvertently. This should be done as soon as possible, before the development of a full disaster recovery plan.

⁴⁶ CGIAR IT staff agreed at a meeting of IT heads at ICARDA in 2005 to implement a Microsoft-based instant messaging system across the CGIAR. Several centers invested tens of thousands of dollars and shared infrastructure was installed at the CGIAR's outsourced network operations center in the US. Subsequently other centers failed to commit the resources needed, despite the availability of concessionary license terms, and what was agreed to be a core service was abandoned. The main reason for the failure was budgetary.

⁴⁷ Past experience of the Panel suggests that organization units overrate the impact on the organization of risks they identify. Management judgment is required.

Information Systems and Services

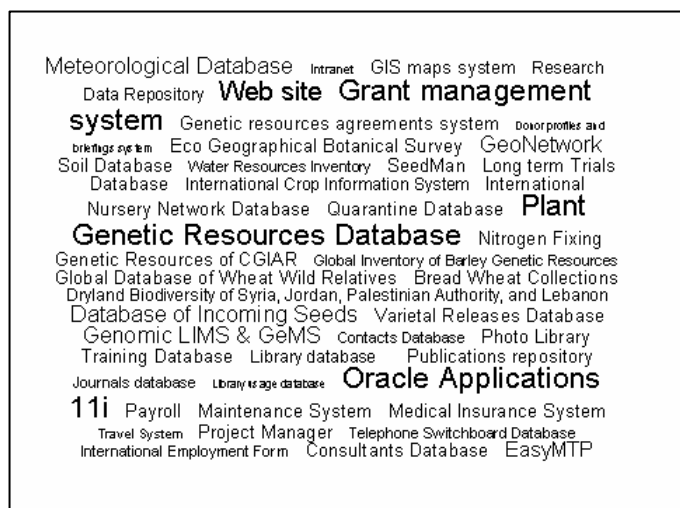
Beyond the provision of IT as a service, to support its operations, the Center has put in place systems and services intended to:

- Enable effective operation of internal ICARDA business processes – program and project planning, monitoring, evaluation; reporting; fund raising and grant management; human resources and personnel management; accounting and financial management; procurement; internal communication; *etc.*;
- Facilitate the conduct of science and research.
- Capture, communicate and make ICARDA's own knowledge 'outputs' widely accessible, along the research cycle, also ensuring they are permanently available;
- Gain access to the world's knowledge that is produced and published in the countries where ICARDA works, by sister research centers, and by international science;
- Reinforce capacities of ICARDA partners to effectively capture and communicate their own knowledge; maximizing the potential for them to also take up and apply knowledge from ICARDA.

These systems and services are spread across the entire organization, with some particular clusters in CODIS, CBSU, BIGM, GISU, and GRS.

They are hosted on ICARDA technology platforms, they were often developed by ICARDA staff and are maintained and curated by them; they are often linked to wider international and global initiatives. They comprise data, metadata, text, models, images, maps, documents, and more.

The picture on the right lists the main 'named' systems we encountered in our discussions. There are certainly more to be discovered.



We will discuss some of them in more detail when we discuss the activities of CBSU and CODIS. For many systems, we will not comment on their content as this is beyond our mandate. We will look at the ways in which they are developed and maintained, how their content is made permanently available and accessible, and their prospects.

One of the initial challenges encountered by the panel was to obtain a complete overview of the various systems and databases in use across the Center.

The Panel recommends that the inventory of systems and services compiled by CBSU be maintained and extended and made visible to staff and management.

Such a holistic overview is essential to understand potential synergies and overlaps.

Management Information Systems

ICARDA's Oracle system is a large and expensive dinosaur that costs a great deal to maintain.

This is the candid opinion of the IT staff of several other CGIAR Centers. Translation: they probably wouldn't recommend Oracle today.

The Panel believes that the criticism is merited but feels no need to recommend that ICARDA downside to something lighter on the bottom line, it is so clearly on the cards.

The large sums spent by ICARDA and other Centers trying keep their finances and project information straight when their transaction volumes are, by the standards of a corner supermarket, very small indeed, represents a considerable opportunity cost in foregone research funds. (ICARDA, as the smallest Oracle "shop" in the CGIAR is acknowledged by the Director for Finance to have the highest transaction costs in the CGIAR).

If ever there was a case for convergence and a common approach in the CGIAR, finance and project information systems present it. The requirements of the centers are effectively nearly identical and becoming more so.

A valiant effort was made by CIAT, by the ICTKM Program and many Centers, including ICARDA, to achieve some convergence in the shared adoption of what is now called the *CGIAR Project Manager*. ICARDA now considers this a failed project and is again facing a pressing need in this area.

The Panel (which fully supported the initiative in principle) regrets the alleged failure of this project and recommends that all possible lessons be learned for the future.

Currently, a group of CGIAR Centers are attempting to define a shared set of requirements for an Enterprise Resource Planning (ERP) system. ICARDA hasn't been able to participate in the process to date and, by default, is unlikely to replace the Oracle system until it is fully depreciated in 2010.

Going for Gold!

Being open, peering, sharing and acting globally are the principles of what has been dubbed *wikinomics* (*Wikinomics* by Don Tapscott and Anthony Williams (2006). Atlantic Books).

A classic example was Goldcorp, a mining company that opted for an open source exploration strategy, shared its proprietary data online, and ultimately found both gold as well as "state-of-the-art technologies and exploration methodologies" (p.268).

Its fortunes were transformed. It quickly accumulated more gold than the Bank of Canada, acquired its nearest competitor, and saw its costs fall 600% in 4 years. Two features stand out in this story: External collaboration and the sharing of proprietary information in a way previously considered unthinkable.

Could the Centers save some of their precious gold by being more open, and by peering and sharing globally in its business processes? A group of CGIAR Centers is currently exchanging information and collaboratively developing their requirements for enterprise resource planning software (financials, project management etc.) ICARDA is outside this group but could benefit from joining. Applying some principles of *wikinomics* might help ICARDA and its sister centers get their numbers right!

The Panel reviewed the history of the implementation of the travel module referred to elsewhere, the user interface, and as much of the relevant business logic as could be

gleaned from it. (ICARDA spends \$3m/yr on travel, so some expenditure on automating the process of planning, budgeting and approval is entirely rational and to be expected).

What was not expected was that a simple one page form could be a front for an apparently disproportionate level of complexity. Adding Center-specific rules about *per diems*, times of day when proportions of meal allowances became entitlements and the like, looked very much like a mistake. *Don't customize the system, customize your business process* has been a mantra in the world of ERP systems for a long time, meaning unless you have to, unless the cost are justified. The business case for this looked questionable.

ICARDA is revising its rules now and considers that until it has done so there is no mileage in thinking about a new system. The Panel concurs.

The Panel heard complaints about the cost of responding to some external reporting requirements, the business impact of compliance with which is certainly not understood.

The Panel wonders if donors would be willing to offset the business impact of their queries, wholly or in part. In countries which have a freedom of information act there is usually a provision permitting a request to be declined on grounds of disproportionate cost relative to the value of the response, but a negotiated business impact limit might be more worth discussing, failing which, actual costs could be reported with responses.

The latest pragmatic simplification of the chart of accounts by the current Director for Finance is commended by the Panel and was very favorably commented upon by ICARDA scientists. They were unhappy with previous changes and their effect, most notably including a requirement to specify the associated medium term plan output every time anything was purchased, however trivial.

The Panel regrets that the CGIAR hasn't managed to agree on a single standard ERP system and chart of accounts to date but is hopeful that it may happen in the not too distant future, one way or another.

The preference of the MIS staff for a home in both CBSU and a Corporate Services rather than strictly Finance is acknowledged, as it is a service to the whole of ICARDA.

The work done to present a simpler user interface to ICARDA users is commended.

With all due respect to the collaboration on new ERP requirements currently in progress, the Panel wonders if ICARDA might suggest a more open process (See "Going for Gold" p.42).

IT-Enabled Business Processes

The Panel recommends that CBSU inventory the number of paper forms in use, prioritize automation based on frequency of use and report regularly on progress.

The Panel noted and endorses the recommendation of external auditors that a paper form with signature be required for audit purposes for the creation of network accounts. ICARDA management did not accept the recommendation at the time.

On the assumption that consistent practices in the CGIAR are desirable: *The Panel recommends that ICARDA seek guidance from the CGIAR Internal Audit Unit on the question of where to draw the line in respect of automated workflow and dispensing with signatures.*

In the view of the Panel, for security and cost management reasons, network accounts should be considered effectively as cash – with account authorizations and closures receipted accordingly. (There are a variety of subscription-based variable costs associated with network accounts, mailboxes and associated licenses and services).

There is no reason that ICARDA cannot do both – open an account in response to an official email request, with a grace period for a signed form for archival purposes. All requests for accounts should be transmitted and validated as official by HR, without exception.

The Panel notes that the HR module of the Oracle ERP system is not used for all HR data management purposes and that HR records are also managed using a spreadsheet. There is not a single, definitive information source, synchronized with the network's Active Directory. This presents coordination and IT security risks.

The Panel recommends that relevant HR data (name, job title etc. and, most importantly, a contract or network privileges expiration date) be synchronized automatically with the network domain.

The Panel noted that CBSU staff were aware of administrative problems arising from, among other things, inconsistent data sources, but had not felt empowered to effect change.

The Panel recommends that ICARDA designate a member of the MIS team to look for and propose solutions to administrative information management, process and workflow problems as part of their assigned terms of reference.

However, improving business processes, capturing good ideas and putting them into effect is something that should concern all ICARDA staff. The Panel noted that some of the staff who attended presentations given to it reported that they hadn't previously known much of the information presented, *i.e.*, what other colleagues were doing.

The Panel believes that the best prescription will be one that is internally developed and owned by the ICARDA community; however some facilitation and focus on specific issues would probably help

ICARDA Dashboard and Single Sign-on

The Oracle system employed at ICARDA is considered by several ICARDA staff who spoke to the Panel to have a sufficiently complex user interface that is not usable by non-specialized staff. The Panel has reviewed this and is inclined to agree⁴⁸.

CBSU has developed an alternative web-based interface for a travel application which is vastly simpler and easier to use.

However, this is only one application. *The Panel recommends that ICARDA develop an administrative "dashboard" integrated into the institute's Intranet which centralizes, integrates and provides a web interface to and workflow for all back-end administrative systems.*

Currently ICARDA staff members have to remember too many usernames and passwords.

The Panel recommends that CBSU take steps to implement single-sign on to as many applications as possible (obviating the need for multiple logons).

⁴⁸ There can be no objective truth here. If staff members are unhappy one of the things that is likely to happen is delegation of passwords and some administrative tasks to junior staff. This is a violation of security policies that forbid password sharing and incentives for it should be avoided.

Information Services

This part of information management services at ICARDA is carried out by the CODIS Library and Information Services Unit (LIS) and aims to:

- Support the Centers' scientists by ensuring that they receive up-to-date supply of relevant information;
- Collect, organize, store and disseminate ICARDA research results (GPG) globally;
- Participate in relevant national, regional and international information and research networks to improve the exchange of information and ensure better sharing of resources as well as wider dissemination of ICARDA's generated information and knowledge;
- Foster the flow of information and communication within the global community of scientists working on each of ICARDA mandated crops and other related fields;
- Assist the NARS on agricultural information systems through collaboration and training in scientific information management and relevant ICT tools.

What does this comprise? The main activities are:

Provision of 'Library' Services

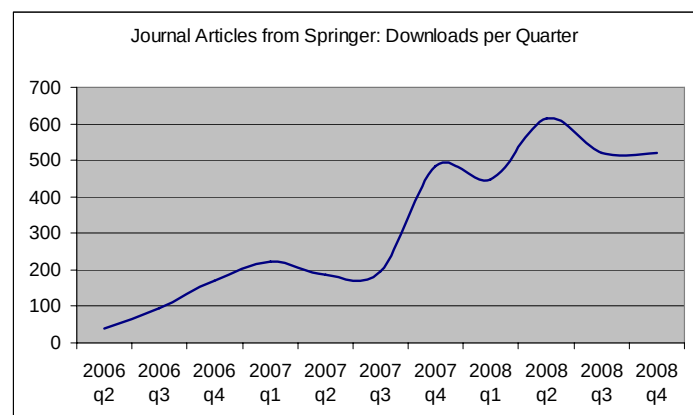
These services provide access to external knowledge. ICARDA staff has access to a physical library (mainly used by students and trainees), they can request documents from other libraries, they can search and obtain digital versions of journal articles – both from the local version of the TEEAL collection and online from subscriptions paid by the Center. A new library management system 'NewGenLib' has been installed and is currently only available to staff.

In 2008, library staff responded to 200 internal requests for literature searches and provided photocopies of about 2500 of documents (in print or electronic forms) to ICARDA researchers, trainees and graduate students. The library staff also responded to 175 external requests (via mail and email) for literature searches as well as provided photocopies of about 1250 to NARS users coming mainly from the CWANA region with the majority from Iraq and Syria. The relationship with the NARS works both ways: In 2008, ICARDA received about 300 documents from NARS collaborators who have access to AGORA.

The Library provides staff with direct online access to 155 electronic journals as well as access to another 140 journal titles (covering the period 1993-2007) through TEEAL. Through library contacts with some NARS, ICARDA staff can indirectly access the entire AGORA journal collection (about 1,500 titles) - documents can be obtained in full text via interlibrary loans.

Data from one of the subscription services (Springer) show that the electronic journals are gaining increasing use by staff. Almost 3500 articles were downloaded between 2006 and 2008.

The 5 most popular titles – with 60% of all downloads – are: TAG Theoretical and Applied Genetics, Euphytica, Molecular Breeding, Genetic Resources and Crop Evolution, and European Journal of Plant Pathology.



These services are delivered in cooperation with libraries at other CGIAR centers: A consortium negotiates shared journal subscriptions for the system; the libraries provide free document delivery services to each other; the library collections can be search in one click through the CGIAR Virtual Library. In 2008, ICARDA provided 90 documents to other Centers and received 145 documents from in return. Through the virtual library, some 500 searches of the ICARDA catalogue are carried out each week.

The Library and CBSU also acquired and implemented an EZ-Proxy system for ICARDA out posted staff members to allow them to access the subscribed online journals and other library resources.

Provision of 'Repository' Services

The ICARDA Repository (publications database), launched in 2004, captures, stores, indexes, preserves, and redistributes the intellectual output of ICARDA research in digital formats. In 2008, 420 new records were added to the publications database, bringing the overall total to 6,362.

It is available on both the Intranet and the website, it is searchable through the CGIAR Virtual Library, and it is available on a DVD for local use. It contains ICARDA documents (annual reports, programs reports, research reports, training materials, book and conference proceedings, articles, abstract and poster presentations published in journals, book chapters or conference proceedings, agreements, etc). Where, available, the repository links to the full text of the document. An ongoing effort is digitizing older ICARDA reports to include them in the repository. As the table below shows, ICARDA is making good progress to ensure that the full text of its outputs is in the repository, and is also available to external visitors.

The database is also used to capture information on the publications outputs for the CGIAR performance management reports on ICARDA.

ICARDA Repository				
year	Added	full text	% full text	total
				4724
2004	353	108	31%	5077
2005	355	124	35%	5432
2006	269	161	60%	5701
2007	241	205	85%	5942
2008	420			6362

This repository currently uses 'Inmagic' software. The plan is to move to the 'NewGenLib' system that allows greater possibilities to export and harvest the metadata in open systems. This should make it easier, for example, to share ICARDA outputs in the AGRIS database (the most recent contribution is from 2004).

Online Access to Publications

An important role of the repository is as the publications catalog on the ICARDA web site. This provides the main entry point to research outputs on the web site. One of the indicators of the usefulness of the database is the frequency of its use to provide access to ICARDA research. These numbers were difficult to obtain as web site usage data was not widely shared within ICARDA.

Web site usage data for January and February 2009 shows the publications page receiving some 988 views.

As can be seen, most views are to the home page, where recent publications are not advertised. None of the other pages particularly highlight recent publications and there are no direct links from the repository (the new web site architecture may address this).

Top website pages, Jan-Feb 2009	
Page	Views
Home	18758
Jobs	8095
RSS feed	5283
About ICARDA	3564
News releases (in Arabic)	3489
Arabic home page	2515
Training	2196
News releases	2175
Desertification news story from home page	1112
Research	1104
Publications	988

The large use of the RSS feeds shows there is significant potential to advertise publications through this channel.

The statistics also show which 50 publications were most downloaded each month. These may or may not have been found via the publications page – they can also be found through a direct search on Google. The combined list for January and February is shown below. The most-downloaded document seems to be a special case from February 2009, and suggests someone (in Ethiopia) who probably had some problems with the download.

Top website downloads, Jan-Feb 2009	
url	hits
publications/price_list/book3/food barley.pdf	25075
/publications/lab_manual/pdf/	4521
/arabic/publications/soil_lab_manual/	2172
/aprp/pdf/slz2.pdf	573
/publications/annualreport/icarda_ar2007.pdf	566
/announcement/2008/9th-iddc/abstractbookoralpresentation9thicdd-complete13nov.pdf	452
nars/ethiopia.pdf	439
/aprp/aprp-ae/taez/pdf/irr&fer.pdf	427
/announcement/2008/1stinternationalsymposiumonmedicinalplants.pdf	426
/nars/tunisia.pdf	426
/aprp/aprp-ae/taez/pdf/argh in.pdf	392
/aprp/pdf/ar_00-01_annex.pdf	370
/announcement/2008/9th-iddc/abstractbookposterpresentation9thicddcomplete11nov.pdf	361
/pdfs/research_pages/laboratories.pdf	348
/afghanistan/pdf/fhcras.pdf	345
/aprp/pdf/ar_00-01_pa.pdf	334
/aprp/pdf/new pdfs/reevgcc_final.pdf	316
/pdfs/intl_cooperation/ngosandcivilsocieties.pdf	265
/mtp_07-09/icarda_mtp_2007-09.pdf	264
/pdfs/hrdu/manual_of_training_procedures.pdf	253
/ralfweb/pdfs/saffronmanualforafghanistan.pdf	253
/pdfs/hrdu/grtpolicy.pdf	244
/publications/8th-icdd-abstractsbook/8th_icdd_abstracts-of-papers-presented.pdf	243
/inrm/inrm4_site/irri03.pdf	239
/cac/calendar_events_2009.pdf	191
/publications/price_list/book3/food barley.pdf	174
/nars/ethiopia.pdf	159
/publication_policy.pdf	143
/aprp/pdf/new pdfs/ann03-04/oman.pdf	138
/publications/povertyandlivelihood.pdf	138
/announcement/2008/9th-iddc/iddcprogram.pdf	137
/publications/annualreport/97/annual97.pdf	137
/seed_unit/pdf/focus/focus-ethiopia.pdf	128
/arabic/publications/annual_report/2003/ar-ar2003.pdf	127
/jobs/nationalemployment-application.doc	127
/aprp/pdf/phase.pdf	126
/news/seed info/seedinfo_36/seedinfo_36.pdf	126
/publications/horticultureresearchaticarda.pdf	125
/publications/proposal_for_expanding_the_crop_mandate.pdf	123
/cac/files/press_release1.pdf	119
/aprp/aprp-ae/pawsabu/pdf/anx.pdf	116
/aprp/pdf/new pdfs/ann01-02/kuwait.pdf	116
/ralfweb/progressreports/round2_fullprojectreports.pdf	116
/aprp/pdf/new pdfs/ann03-04/annex.pdf	111
/pam/publications/supervisionmission03.pdf	106

Development of Knowledge Bases and Portals

An emerging area⁴⁹ involves working with Units and Programs in ICARDA to develop knowledge bases, on legumes for instance, and portals, for the Nile Valley Regional Program for example. Combining knowledge 'collecting' and 'connecting' roles, the idea is to bring together different knowledge and expertise to create spaces to store and make available the relevant information and to create a platform that can link the related stakeholders working on ICARDA mandated crops. So far, these efforts are at initial stages due to limitation in resources. Once linked with the new repository system and other applications, such approaches seem to offer much potential to ICARDA programs.

Information and Knowledge Collaboration

There has been a long history of collaboration with NARS and other partners on information management. This has taken the form of training (88 trainees from the region in the past 5 years), joint projects (such as library twinning with Sudan and Egypt, support for Aleppo University, potential new project in Libya), and support for regional information exchange networks such as AARINENA. There has also been strong engagement with global networks and initiatives beyond the CGIAR – with GFAR, FAO, and IAALD for example. Together, these serve to reinforce ICARDA's profile in the regions where it works and to keep it abreast of current developments worldwide.

Observations on these services:

The cooperative/collaborative approaches followed are a model for others to learn from. ICARDA is playing an important reinforcing role with NARS; it also directly benefits from these efforts. At the international and CGIAR level, it has also been a 'team' player, contributing to various system-wide and international efforts. It also derives benefits from them. This commitment to collaboration should be continued. A balance is needed to ensure that time spent on NARS activities/consultancies does not compromise other important activities within the Center.

We commend excellent progress on the repository of publications. It is important to ensure that the repository is complete, up to date (some recent information seems to be missing), that the older materials are digitized and included, and that necessary permissions to make articles publicly accessible are obtained from publishers. The system provides a solid basis that guarantees the continued availability of the outputs.

We were not able to examine the digital workflow for publication creation, dissemination and capture in the repository. The efforts needed to collate the necessary information for the CGIAR performance reporting system suggest that it could be streamlined, especially to collect all the externally published outputs of staff.

Once the repository migrates to the new system, maximum public accessibility needs to be achieved. With appropriate standards, there is much potential to re-use this content on other ICARDA platforms (the web site for instance, through RSS feeds), to contribute to emerging knowledge projects, and to ensure it is widely visible on the mainstream web as well as through 3rd party services (AGRIS, NERAKIN, Google *etc.*) Such an open repository is a core building block and content provider for many other products and services of the Center.

Current low promotion and re-use of the publications repository means that many of its potential benefits in terms of wide accessibility are not realized.

⁴⁹ Though they build on a concept of specialized information access centers pioneered by ICARDA 20 years ago!

Cost savings have already been realized from the journal subscriptions and document delivery. Usage data suggests there may be some small scope to reduce some journal titles. For example, ten titles account for 75% of all downloads from the Springer database.

The Panel recommends that emerging work on knowledge bases and portals should be encouraged as vehicles to re-use and promote existing information, to better target specific audiences or communities, and as ways to encourage greater participation in knowledge sharing among staff and partners.

The Panel recommends that emerging 'social' media applications are used to reinforce and extend such knowledge organization and access efforts.

Existing expertise in 'organizing' knowledge and information that is currently in CODIS-LIS should be made available and used in other 'knowledge' activities elsewhere in the Center. We observe other information systems – such as the one for research data – that could usefully use taxonomies from the Library.

These types of services are usually hard to sell, and to demonstrate use and impact, especially when, as at ICARDA, useful indicators and data of usage seem to remain unanalyzed or not widely shared.

The Panel recommends that useful indicators and metrics on information and knowledge services, the web site, and related activities are regularly compiled, shared and reported so staff and management are aware of usage and benefits from investments in this area.

The Panel is concerned about the current limited capacity in the LIS Unit. Besides the unit head, it comprises two local staff and a daily. Given the need to address and support emerging knowledge organization, access and dissemination tasks across the Center, these seem to be insufficient.

As part of any reorganization and strengthening of CODIS, the Panel recommends that additional professional staff inputs are mobilized to support emerging knowledge organization, access and dissemination tasks across the Center.

Finally, since rather classic 'library' activities have expanded to focus more on 'knowledge' – its capture, organization and sharing:

The Panel recommends that the 'Library and Information Services' be renamed, perhaps into the 'Knowledge and Information' Services or Center.

Observations on Scientific Data Management

Scientific data generated during research is becoming more and more important. This is often lost when staff members leave an organization and it is often not documented sufficiently for others to easily understand and re-use. Datasets and databases and services based on these are increasingly critical outputs of the science process.

Our interviews showed recognition in the Center of the importance of scientific and experimental data. Steps are being taken to document and make backups of datasets and to include them in a repository. This should be extended to include all datasets.

The Panel was shown several larger scientific information databases and systems related to the Center's genetic resources work. These are frequently part of CGIAR-wide and global collaborative initiatives and represent part of the Center's contribution to making its scientific materials accessible as international public goods.

The Panel was unable to examine the content and architecture of each system at ICARDA in detail. We have some questions and concerns however about their management and continued sustainability:

- Some of the systems are very dependent on a single individual;
- The software used, in some cases, need to be updated;
- The 'business case' for some systems needs to be clarified;
- The content of the various systems is not easily accessible Center-wide and globally;
- Discussions on Integration among systems often seems to be ex-post rather than the much more desirable ex-ante;
- Some systems are hosted inside the Center, which puts pressure on bandwidth.

The Panel recommends that a separate assessment be made to determine the strengths and weaknesses of the scientific systems in use at ICARDA and how they can be sustained. This should explicitly consider system-wide implications, commitments, and opportunities.

Regarding overall data management, the Panel suggests that ICARDA draw up standards and guidelines for its own use. As inspiration, the UK Research Information Network⁵⁰ 'data stewardship principles' recommend that:

1. Digital research data should be created and collected in accordance with applicable international standards, and the processes for selecting those to be made available to others should include proper quality assurance.
2. Digital research data should be easy to find, and access should be provided in an environment which maximizes ease of use; provides credit for and protects the rights of those who have gathered or created data; and protects the rights of those who have legitimate interests in how data are made accessible and used.
3. The models and mechanisms for managing and providing access to digital research data must be both efficient and cost-effective in the use of public and other funds.
4. Digital research data of long term value arising from current and future research should be preserved and remain accessible for current and future generations.

Adopting and ensuring such principles apply in ICARDA would help ensure that these systems and the data they contain are managed and maintained to international standards and continue to meet ICARDA's needs and obligations.

⁵⁰ RIN. 2008. Stewardship of digital research data. London: Research Information Network.
www.rin.ac.uk/dataprinciples

Conclusions on Information Systems and Services

A physical and virtual 'library' services provides very good access to global information resources. Staff can search a range of databases, they can obtain journal articles, a document delivery service provides access to items not available at ICARDA. Statistics show these services are being used. This access is facilitated by the Center's collaboration with NARS and strong engagement in international information exchange networks.

The Panel recommends that these core 'library' activities continue at the same level and intensity; involvement in the networking and collaborative efforts should receive continued support.

Formal research outputs of ICARDA, mainly publications and reports, are being captured and organized. The repository seems to be complete, and appropriate steps are being taken to improve the preservation and accessibility of these outputs. One of the next challenges is to ensure that this knowledge base put to good use and re-used in other ICARDA services. Emerging work on knowledge portals offers examples of such an added value approach; the new Center web site needs to systematically make this already-organized knowledge more visible. Collection is a first step towards exploitation and re-use.

The Panel recommends that the intermediate outputs of research – images, presentations, grey literature, local reports from regional and country offices, etc., are also comprehensively captured in the ICARDA repository.

The Panel recommends that value-adding services like portals are developed to extend the use of content in the various repositories; and that this content is structured and organized to facilitate wide re-use of the content across other ICARDA platforms.

A similar repository has been established for scientists to deposit and describe their research data. This needs to become more widely used. In terms of accessibility, it could benefit from a closer association with the other repositories. The system has been shared with other CGIAR centers as a potential 'system good' that others can adapt and use.

The Panel recommends that data repositories are brought into line with the publications repository so the metadata and content can be made fully accessible.

Several important scientific information systems have been created, particularly to support the genetic resources work of the Center. These are closely associated with global and CGIAR-wide initiatives and are thus strongly influenced by external drivers, standards and resources. Many are associated with a single individual which makes them vulnerable. In some cases, software choices will need to be updated to meet future requirements.

ICARDA is one of the only centers that explicitly reinforces the capacities of its NARS partners in this area. We were not able to directly assess these efforts with NARS stakeholders. The closer connections and cooperation that such work reinforces certainly seems to provide benefits to ICARDA's own information access systems.

The Panel recommends that further assessment of information management training and consultancy work is carried out to determine the impact of capacity development on the operation of NARS themselves.

For some systems and services, the 'business case' in terms of users and usage needs to be more strongly documented and communicated. It is essential that a range of metrics on different services and their use is monitored and acted upon if needed. Existing data, on web site usage for example, needs to be made public. Usage data on other services needs to be compiled into regular reports, again accessible to the staff.

Knowledge Sharing

In 2006, the External Program and Management Review of ICARDA recommended the discontinuation of a stand-alone 'mega-program': "The MP6 activities on knowledge management should be integrated within the other research programs and MP6 should not be a separate research program." It argued that "dissemination of research is best if placed directly under the research programs for efficiency and management considerations."

The Review Panel recognized that "effective dissemination of research results is essential to achieve impact" however it argued that "original research in this area is not of sufficient priority" to be a major focus on future ICARDA effort. They argued for a lower-key more pragmatic approach. The need for knowledge of ICARDA and its partners to flow and be accessible was reiterated over and over in our interviews with staff.

In 2007 therefore, residual 'knowledge management' activities and the services of a KM specialist were transferred to CODIS with a brief to carry KM work forward. By all accounts this has been quite difficult and our interviews revealed a widespread skepticism regarding the notion of knowledge management.

This is no bad thing as the general notion of 'knowledge management' – with its emphasis on knowledge banks and warehouses – is in decline⁵¹. Instead, there is a much stronger focus on strategies and tools to document, capture, organize, and share knowledge – particularly the learning and experience embedded in people and social networks. There is not to say that collecting and organizing knowledge is not important: Such systematization is complementary to more personalized approaches.

The Panel's conversations with staff, while avoiding KM terminology, revealed a strong interest in communicating and sharing their knowledge as well as that of their colleagues and partners. We also discovered many examples of knowledge that is already being documented and shared and a great interest in more and better communication and visibility of research results. This sometimes also takes us into the realms of knowledge organization and communication – the boundaries are sometimes blurred. We also found many instances where workflows and systems could be improved to enhance knowledge flows.

The Panel recommends that ICARDA avoid further use of the term 'knowledge management.' It should instead use the terms 'knowledge sharing' and communication.

"The spread of the web invites us to look at the future from a different vantage point, to see that what we share is at least as important as what we own; what we hold in common is as important as what we keep for ourselves; what we choose to give away may matter more than what we charge for. In the economy of things you are identified by what you own: your land, house, car. In the economy of ideas that the web is creating, you are what you share ... The biggest change the web will have on us is to allow us to share with one another in new ways and particularly to share ideas."

Leadbetter, C. 2008. We-think: mass innovation, not mass production. www.wethinkthebook.net

⁵¹ The term "knowledge management" is acknowledged by some of its earliest proponents to be increasingly out of favor, even "dying." The number of Google searches on the term and the number of conferences on the subject have fallen very dramatically. (See <http://blip.tv/file/1048981/> for more). Terms such as "knowledge related management practice" and "knowledge sharing" seem clearer and are likely to prove more durable.

Approaches to Knowledge Sharing

Some years ago, two main approaches⁵² to managing knowledge were identified:

- 'Codification', in which knowledge is described and warehoused ready for re-use, with a main focus on technologies.
- 'Personalization', in which knowledge in people is shared and communicated, with a main focus on processes.

These are often referred to in short as 'collecting' and 'connecting' approaches. They are very relevant to the ICARDA situation and can provide a framework to move forward in this area.

Both are usually necessary. However, the emphasis of a particular service may vary from being totally about collecting (an archive for instance) to one that is totally about connecting (Skype for instance), with all variations in between.

Depending on demands and ambitions, the trick is to position the service most appropriately: In the middle, to the right or to the left. The outputs, activities and skills needed to carry them out will vary accordingly.

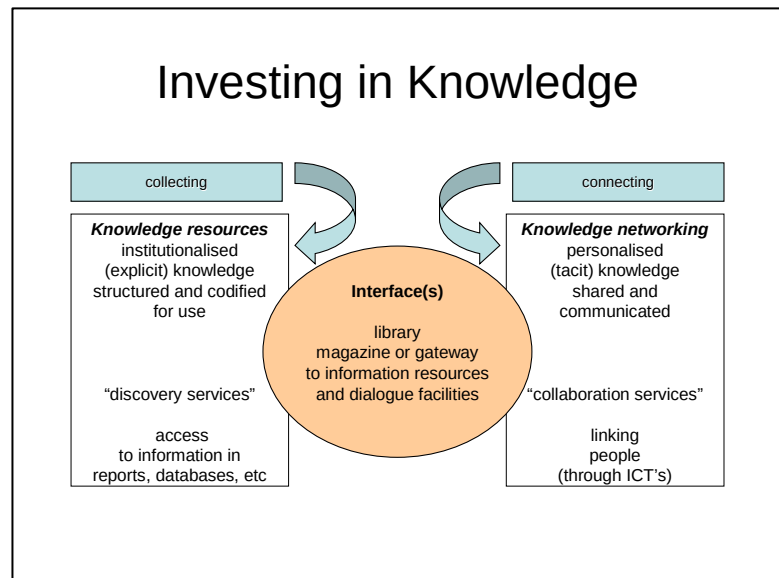
This positioning is something that ICARDA urgently needs to determine. It could be done through a process of knowledge mapping with different staff and partners that would lead to a framework and set of actions linked to desired outcomes.

Through some of the information management work in the Center, there are already several initiatives in place to capture and organize knowledge in the form of outputs. These could be looked at from a 'sharing' perspective to assess to what extent the knowledge in these collections is used, is likely to be used, and how this can be enhanced.

Some types of knowledge remain hidden and hard to access. How important is this and can it be documented and captured somehow. A mapping exercise can shed light on where different knowledge is, what forms it is in, and how it could best be mobilized.

Beyond these 'collecting' efforts, it is important to also pay attention to more 'connecting' efforts that encourage and facilitate processes by which people share, learn and collaborate.

It is important to emphasize that good knowledge sharing is participatory and inclusive and typically involves many different people in an organization. It is done 'by' people not 'to' people. It is thus extremely dependent on organizational culture, on the incentives and rewards to share or hoard knowledge, on the examples set by key individuals, and the levels of trust among staff and their partners.

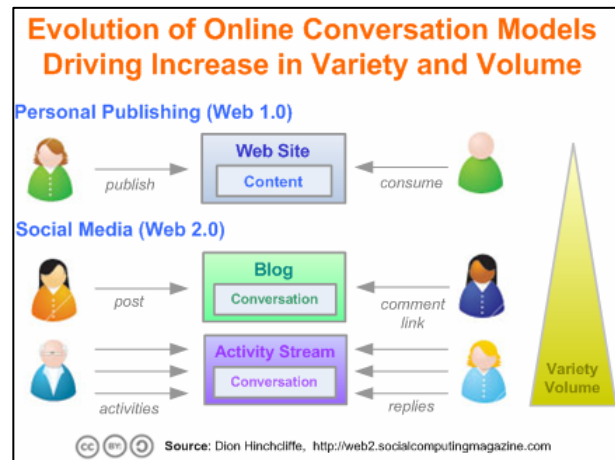


⁵² Hansen, M.T. *et al.* 1999. What's your strategy for managing knowledge? Harvard Business Review, March-April: 106-118.

The Social Web

Current practice and thinking in this area is strongly associated with the emergence of 'social' web-based applications to capture, share, publish and exchange information and knowledge.

The new 'revolution' is called 'web 2.0'⁵³. It is characterized by increasing amounts of 'user-generated content' and 'user-remixed content' – where different knowledge and information are created and brought together by individuals and teams in their own personal dashboard. Across the web, individuals, groups and organizations are using this new web to become active creators and producers of information. Inherent in most of the tools are features offering interaction, feedback and discussion – 'if you like this story, other readers recommend this one'; 'if you care about this issue, join this social networking space', and so on⁵⁴.



The potential anarchy as everyone publishes and interacts is matched by a suite of new tools that allow people to track, aggregate and channel different streams of knowledge. Each individual can be a publisher; each individual can also create his or her own personal – or group – news channel, library or atlas, specifying what it should contain, how it should be accessed, and by whom.

Key characteristics of the tools include: They follow a 'service model' - most are designed to be used across the Internet and they tend to be free or very low cost. They are designed to encourage 'user' participation. People can leave comments, cross-link content, add tags, and re-use and re-publish content. Attracting visitors to a web site is web 1.0; optimizing content so it will interact with different people, wherever they are on the web, is web 2.0.

The Panel observed very little involvement of ICARDA staff in any of these activities, certainly nothing strategic or systematic. While it is not necessary for ICARDA to join the 'hype', these social applications and tools complement and enable an open collaborative mindset that should be cultivated in the organization.

Current KS Activities at ICARDA

What is currently being done by ICARDA in this area? As was mentioned earlier, much informal KS is occurring across the Center and in its programs. It was not possible to delve into all of these.

Some elements of knowledge capture have been described in earlier sections on information management systems and services. These should mainly be seen as part of the 'collecting' tradition, essential building blocks for more effective communication and institutional sharing.

⁵³ Initially described at: www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html; a compact definition is at: http://radar.oreilly.com/archives/2005/10/web_20_compact_definition.html

⁵⁴ See <http://web2share.pbwiki.com> or www.kstoolkit.org for further information and examples.

The 'KM specialist' identifies three current objectives:

- Extend research delivery; Enhance collaboration; and Improve institutional learning.

Reflecting demands of scientific staff, these have a strong communication emphasis and examples of this work include: Working on knowledge products such as the Center's newsletters, impact briefs, posters and flyers, knowledge banks, and the web site; assessing expert systems as a research dissemination tool, promoting ICARDA with German media; and connecting with the wider knowledge sharing community (for insights and learning). In addition a communication platform for a SEPR initiative on social assessment and gender analysis is also supported as part of the portfolio, and 'exit' interviews have begun with departing employees for knowledge capturing purposes and put in place mechanisms to capture outreach to farmers and communities through field days and training.

In short, this position has been caught up in the KM 'fallout'.

Some other KS activities at ICARDA include:

- An 'International Farmers' Conference' in 2008 where ICARDA staff and farmers from several countries shared their experiences of farming and plant breeding through storytelling (<http://www.icarda.org/farmersconference/>). The story was picked up by other sources - www.research4development.info/caseStudies.asp?ArticleID=50391;
- A signal by senior research managers that scientists can spend a proportion of their time on their own reading and research;
- Contracting senior scientists to work with ICARDA to ensure past research is documented and submitted to peer reviewed journals;
- Convening south-south meetings on research issues where knowledge is shared;
- More than 90% of ICARDA articles are co-authored with NARS scientists;
- Through the 'benchmark' project, employ a strategy to 'scale-up and scale-out research' results that builds on community involvement and validation, links with partners, networking mechanisms, databases, knowledge products, communication and dissemination, and policy dialogue. Knowledge sharing along the research cycle.
- Policies requiring that scientists back up important information, including that they deposit data in documented ways when they leave the Center.
- A documentary 'Seed Hunter' that documented the work of an ICARDA scientist (<http://www.seedhunter.com/>)
- Set up of a database of 'trip reports' to capture and organize results and actions from staff travel. Many staff members seem unaware of this.
- Posters: Much effort is spent on posters documenting different projects and ICARDA services and units. The impact is unclear, though it certainly livens up the building.
- The intranet, that acts as a repository of information on and from different parts of the organization. This seems to be rather static; access is via one person.
- The Center has several email lists that can be used to reach all staff, or subgroups. Feedback suggests this needs to be better managed to avoid overloading people.
- The Center has several newsletters for internal and external readers; like the intranet and the web site, these get a mixed feedback from staff.
- Some staff in CODIS have participated in training and workshops on social media;
- During the ICARDA Food Legume Brainstorming Meeting in 2008, a Wiki was set up to support collaboration by the scientists (<http://icardalib.pbwiki.com/>)
- There is a mailing list in CODIS; it is not clear how contacts with other people in contact with ICARDA are tracked and shared.
- The ICARDA lunchroom that seems to be a forum for lively discussion.
- The ICARDA social club and other informal mechanisms where staff interact.

These represent the tips of many icebergs. Some of the tools mentioned could be seen as mainly facilitating communication; which must also be seen as an enabling factor for learning and collaboration to happen.



The outset situation for the KM Specialist stated that: “there is no knowledge management/sharing strategy” in place in ICARDA; that “responsibilities and working processes of institutional knowledge sharing” are not in place resulting in “some duplication and inefficiencies;” and that “lesson learning from projects and sharing of good practice results through knowledge products is not systematically done and has not been institutionalized.” How much has changed in two years? What can now be done to address these issues?

The Panel’s interviews suggest there is much knowledge across the Center, and much informal information and knowledge sharing among Center staff and partners. There are many interactions with NARS through research activities. There is also much knowledge that, as one respondent suggested, is “hidden and unused.” Much is inside the heads of a small number of people.

Some efforts have been made to capture and share this knowledge. These need to be taken forward and systematically encouraged. Some behaviors need to be required of all staff and rewarded accordingly. Others are more personal and need to be encouraged. In general, we recommend much more decentralized and participatory approaches to knowledge and information creation and sharing.

KS Directions

The Panel recommends that ICARDA continue to structure and extend activities directed to knowledge capture and sharing.

This can be done by creating a positive climate, encouraging desirable behaviors, trying out some concrete demonstration activities, emphasizing the human, creative and fun elements, and making sure to document the results and the benefits. A mega approach is not called for. Instead a range of concrete actions derived from a mapping (or self assessment⁵⁵) process should be taken up. These can be inside the Center and with partners. They should involve more than the KM Specialist, also other colleagues in CODIS and in the rest of the Center

Without pre-judging the next steps, what types of activities might emerge?

- Exit interviews. There has been much turnover of staff at the Center so these interviews are an excellent initiative.
- Just as people are departing, many people are also arriving. An ICARDA ‘survival guide’ developed by any interested staff could help orient new staff to the way things are done at ICARDA. The idea is borrowed, with acknowledgement, from CIMMYT which use a similar tool to orient new staff on how to make a purchase requisition, send a fax, book a meeting room, organize an airport pickup *etc.* – essentially how to operate the organization’s ‘infostructure.’ This involves developing a shared understanding, a mental map of the organization’s information resources and knowledge of its processes and workflows. Instead of producing a paper document, this is perfectly suited to an open wiki that ALL staff can contribute to.

⁵⁵ See for example recent exercise at IFAD: <http://ifad-un.blogspot.com/search/label/self-assessment>

- Staff members also travel. The current system does not really function as an effective device to capture and share important knowledge. Streamlining this system, making it easier to use, reviewing the information collected, ensuring that travelers must share their reports in a timely way, indexing the reports so they can be easily searched, and advertising the system would help ensure that ICARDA staff can build on, learn from, or act upon these missions.
- Aside from traveling, staff members spend much time in meetings, workshops and events of various types. Many CGIAR centers have worked towards more participatory meetings and workshops – and developed a toolkit of tools and methods that can be used to make meetings – and other processes - more effective (<http://www.kstoolkit.org/>). Making sure that events draw on all participants' knowledge and ideas is a relatively quick win; documenting and sharing the results can also be enhanced, for instance with social media⁵⁶. With staff located in different regions and countries, there is scope to use a mix of new tools and applications to ensure remote staff are able to participate or follow important organizational discussions.
- Beyond meetings, participatory knowledge sharing approaches can be used in monitoring and evaluation (storytelling⁵⁷); internal reports, such as are provided to the Board, can be compiled using, for instance, blogs or wikis so the content is available for other purposes – a wiki was recently used for the IDS annual report⁵⁸.
- Social media⁵⁹ such as blogs, wikis, social bookmarking, social networking and video/podcasts are increasingly used in research and development organizations to enrich and extend the knowledge sharing and communication capabilities of individuals and teams. Many CGIAR centers are experimenting with different applications, relishing their potential to unleash staff creativity, enrich communication and interaction with partners and audiences, and enhance participation among staff. Examples could include:
 - An ICARDAPEDIA – a wiki about ICARDA, with information on ICARDA, ICARDA staff, history, projects or Tel Hadya or anything official and unofficial that someone at ICARDA might want to know.
 - ICARDA presence on Facebook, LinkedIn and similar social networking sites.
 - Giving staff a personal web page to post photographs and biographical information. This can enable people to discover interests in common, put a name to a face, find a person who speaks a certain language or worked with a particular person etc.
 - An ICARDA wiki 'Recipe Book': A collaboratively edited collection of things ICARDA does repeatedly and knows how to do – preparing an annual report, holding a workshop, facilitating an external review, booking hotels in Damascus, finding an editor, getting a document translated etc. etc. Anything done on a recurring basis is potentially something that can be done a little bit better each time. Capturing and sharing lessons can help ensure a consistent or improved outcome next time around.

⁵⁶ Such social reporting is growing in popularity. See <http://ictkm.wordpress.com/tag/social-reporting/> and <http://iaald.blogspot.com/2009/03/social-media-for-agricultural-science.html>

⁵⁷ See for example www.odi.org.uk/RAPID/Tools/Toolkits/Communication/MSC.html

⁵⁸ www.ids.ac.uk/go/about-ids/annual-report

⁵⁹ See <http://iaald.blogspot.com/2009/01/participatory-web-new-potentials-for.html>

- Blogs and social bookmarks to share information among team members.
- As the content captured in the different repositories and collections becomes accessible to re-use across other platforms, various knowledge portals could be dynamically created to publish and disseminate different ICARDA knowledge.

Conclusions on Knowledge Sharing

The Panel recommends that ICARDA moves on from “knowledge management” and its negative connotations. Knowledge in and of the staff and partners is ‘the’ primary asset of the organization. It should be captured, shared and put to good use through a wide range of knowledge sharing approaches.

The Panel recommends that staff are actively encouraged to contribute to the development of searchable ICARDA information resources and rewarded for notably successful efforts at institutionalizing valuable information – meaning making it immediately available to anyone who needs it and is authorized to access it.

Again and again the Panel encountered information resources whose existence was not generally known and which could only be accessed by going through, or with the help of particular individuals.

The Panel proposes that the Center accelerate and revitalize activities designed to support ‘knowledge sharing.’ These can build on much that is already happening across the organization. New skills, toolsets, and mindsets will be needed.

The emerging ‘social’ web offers particular opportunities for knowledge sharing and communication, internally and with partners. To be a participant rather than a bystander, ICARDA needs to bring itself and its staff up to speed on these approaches.

The Panel recommends that a knowledge mapping exercise is initiated with involvement of people from different parts of the organization. This should result in a series of practical actions with visible benefits.

These actions can focus on many different types of activities, with a focus on ‘collecting’ and ‘connecting’ as well as ‘conversing.’

It is vital that incentives and organizational culture are sufficiently open and welcoming. Top level commitment and reinforcing in appraisal systems will be necessary.

Linked to other knowledge sharing initiatives, the Panel recommends that the personnel assessment system is modified to explicitly ask staff and their managers to identify and reward different types of knowledge created and shared.

Internal Communication

Email

Email has reached a point of near dysfunctionality in many organizations and ICARDA is no exception. Many ICARDA staff complained about the volume of email they received and indicated that they had difficulty keeping up with it.

One senior staff member reported finding 51 emails in his inbox about an internal issue that had blown up over a weekend. Others confirmed that the volume meant that attachments were often not looked at and that email was used for many non-essential communications (goods for sale e.g.) in the absence of another suitable channel of communication. It also appears that some routine messages are sent as PDF attachments (printed and scanned documents) simply to make them appear more official (a plain text message with a link to network copy would suffice). Training in maximizing the *effective* use of email is essential.

There isn't a single best way of cutting down on email. Different things work for different organizations. It's important to balance the need to get a message through with giving the recipient the right to receive selectively.

Other things that may work include posting announcements to a wiki page to which people can subscribe to receive email notifications; to the home page of the Intranet, *if* everybody looks at it regularly.

Having options and, where needed, some guidance and training about effective use can make a large difference to internal communications. Without these, new tools can be a plague if used in appropriately or inconsistently.

The Panel suggests:

- That the project office gets a web-based mailbox from which mail can be sent to donors using the address ICARDA@CGIAR.ORG and any other ICARDA alias as may be needed, such as that of the Director General. This will ensure that ICARDA staff can transmit (from home if needed) time-critical communications to donors regardless of the status of ICARDA's web servers, mail system or Internet links. (The Panel was advised that while the mail system was reliable remote access to it was not so robust; the measure proposed is desirable contingency measure in any case).
- ICARDA add the personal email addresses of the management committee to the mail system and create a distribution list containing these. This will enable members of the management committee to receive messages and to communicate about confidential or personal matters as required. (The Panel was advised that delegated access to mailboxes had the potential to inhibit communications).

Document Management

The Panel recommended (earlier) that an effective Center-wide document management system be implemented as a high priority.

CBSU has wished to implement Microsoft SharePoint for this. The Panel endorses this strongly but advises that hardware, software, training and personnel costs will *all* be required and should be committed from the beginning, with management support and some patience.

SharePoint is a network complement to Microsoft Office. With it

- Instead of sending attachments staff can file documents and send links⁶⁰
- Documents can be updated *in situ* without a need to redistribute them
- The organization's document collection becomes searchable (subject to permissions)
- Revisions of documents can be tracked
- Document routing and electronic forms such as leave requests can be automated
- Users can subscribe to information that interests them (new documents or updates to documents mentioning certain countries, projects, donors etc.) and automatically receive notifications by email.

Since ICARDA uses Microsoft Office on a Microsoft network and has access to academic pricing on Microsoft software, then deploying SharePoint is logical. SharePoint can play a large role in ending the debilitating culture of dissemination that is so costly in terms of staff attention.

It does require some work to commission it and set it up for each organizational unit and it takes some time for people to become familiar with it. It should be as indispensable as email.

It should not necessarily be seen as an open solution that facilitates communication with partners and other stakeholders.

Intranet

The Panel recommends that bottlenecks to Intranet development at ICARDA be broken. This can be tackled partly through more open communication and knowledge sharing approaches (see previous section); and through adoption of more participatory technologies.

A free license for one of the most successful commercial Wiki packages (Confluence, which integrates with Active Directory⁶¹) was obtained for the CGIAR some years ago and it has been deployed in several other Centers⁶². Joomla and Drupal are also popular open source content management systems in the CGIAR and partner organizations, used for both internal and external sites. The best one for ICARDA is a decision for ICARDA staff, but the adoption of *one*, as soon as possible, in addition to SharePoint, is recommended.

The Panel recommends the adoption of instant messaging software on all ICARDA computers.

Several new staff noted that they had found it useful in organizations in which they previously worked and its absence was regretted. It would enable staff not in the same location to see if a colleague is online and possibly available for a quick interaction. It can save phone calls and emails trying to schedule conversations. Previous efforts to deploy a CGIAR-wide solution have not yet succeeded and ICARDA will need to decide whether that is worth pursuing or not.

⁶⁰ Sending attachments internally by email should be *exceptional* and may need to be unlearned.

⁶¹ The significance of this integration is that it enables security restrictions to be applied if needed, so that permission to read, update or delete pages can be granted selectively – enabling the benefits of a wiki to be shared by a group without the contents being public.

⁶² Other platforms in wide use for externally hosted wikis include www.pbwiki.com or www.wikispaces.com

A network logon messaging application⁶³ to display important announcements when a computer is turned on can be useful for reminding people about events without contributing to the inboxes of travelers. For occasional broadcast announcements between weekly bulletins this can work quite well, and is best managed using a single point of contact for posting messages (typically the IT helpdesk).

Bulletins and Newsletters

The current internal (and external) newsletters share much content. They are also distributed as a mix of PDF and HTML files (the external newsletter).

Depending what emerges from the various knowledge sharing activities, ICARDA will continue to need such communication tools that reach all staff, in accessible formats. They can be valuable additions to corporate memory and an invaluable resource when compiling reports as they provide both content, often including digital photographs of events, and a timeline, and links to additional information.

The Panel recommends that the current internal PDF version be re-considered; ideally turned into something more participatory and HTML based. ICARDA may wish to consider consolidating *Inside ICARDA* and *What's New at ICARDA* into a single e-product with different content tagged for different audiences.

Calendars

The Panel notes that a tool on the desk of every computer user at ICARDA is not as widely used as it could be: Outlook Calendar. Signaling one's availability for a meeting is a form of communication that can save interruptions to check on this, but it only works if it's kept up to date (unreliable record is useless).

It's not uncommon for Outlook Calendar to be unused in favour of the telephone for scheduling, sometimes for very mistaken reasons: Sometimes people who do not use it imagine that it reveals with whom they are meeting; or they don't like appearing to be available—an appointment with oneself solves that.

In view of the efficiency advantages to be gained from using it, particularly when scheduling meetings with people who travel frequently, the Panel believes that use of Outlook to schedule appointments should be a *norm* at ICARDA and suggests that the best way to achieve this is by management and senior staff example.⁶⁴

It is already a norm in some other CGIAR Centers for some travelers to have their schedules synchronized with their cellphones and for their secretaries (with delegated calendar access) to be able to track appointments they made using their cellphones (when synchronized with Outlook), and for colleagues to know of their availability.

Travel and Trip Reports

Internal communication can be difficult if it's hard to know where people are, or when they might be available. The Panel was advised that travel schedules at ICARDA are *closely guarded* and some frustration was expressed over both this and people having missed

⁶³ E.g., Message Manager Deluxe from RJLsoftware.com

⁶⁴ I.e., requiring that Outlook be used to solicit their attendance at meetings and by keeping their own calendars current.

travelers to ICARDA. Opportunities for discussion of collaboration or even just renewing contact have been lost when this could easily have been avoided.

The travel schedule of staff and visitors should be public by default. A few lines in a weekly bulletin is all that's required. Even if a scientist is going on a personal trip it can be useful for colleagues to know that someone is going to a particular country, if they're agreeable to disclosing the destination.

The Panel found that trip reports are shared selectively, shared with everyone (perhaps whether they are wanted or not), and shared only with supervisors. Some people submit them for filing on the Intranet and some don't.

There are times when compliance should be mandatory. This is one. However, the Panel recommends that compliance should be *facilitated* by means of appropriate process. There are very often simple process solutions to such problems.

The Panel recommends that

- Reimbursement of any travel expenses should be contingent upon a trip report having been submitted and stored in the appropriate location for access by all who may need to read it.
- The opportunity should be taken to solicit details of official contacts for an ICARDA database. A useful way of doing this is for business cards to be loaned for scanning (or photocopies for retyping). Giving business cards to the Helpdesk and getting back Outlook contacts can work to the mutual advantage of the organization and the traveler.
- A brief abstract should appear in the weekly bulletin with a link to the document (ideally in a SharePoint folder).

Open Communication

The Panel recommends that ICARDA make openness a 'default' setting for sharing content.

Instead of considering what should be shared publicly with the ICARDA community, the question should be what should *not* be shared. This level of transparency is standard practice in at least some other CGIAR Centers.

In principle, the Panel suggests that only designated confidential or restricted information should be restricted (HR records, board documents, parts of the minutes of management committee meetings *etc.*).

Effective internal communications requires everybody to have a shared understanding of the organization's processes and mental map of its resources and a culture that is attuned to and respectful of the needs of the organization.

The Panel calls on ICARDA to strongly encourage staff members to take ownership of problems and propose solutions.

There are ways of generating ideas and discovering things that would make other people's jobs a lot easier that can be good for the organization's *esprit de corps*. One that the Panel has experience of is changing jobs with other people for a few hours (with an assigned list of tasks to be accomplished)⁶⁵. Exercises like this are not frivolous and they do work in

⁶⁵ The tasks can illustrate the consequences of missing information, poor communication, or perhaps just doing the impossible. Having fun is recommended.

stimulating understanding, compliance with existing processes and process innovations. The Panel encourages ICARDA to experiment and find what works for ICARDA staff.

Obstacles to communications can lead to bad decision-making and bad outcomes, resulting in stress, frustration and other adverse consequences for individuals and the organization. The Panel feels that it's in ICARDA's interest to ensure that *undue* deference to hierarchy doesn't happen. How to achieve this is a question, we think, for those who know ICARDA best.

The Panel recommends that internal communication be addressed as a high priority by the new Director of CODIS.

Cross-cutting Issues

Get the Whole Information Systems Picture

There are many different systems and services in ICARDA that deal with information, data and perhaps knowledge. They are spread across units, they are in different forms, they have different levels of visibility to outsiders. Each system had its own justification and niche. The Panel nevertheless struggled to understand the broad picture. The development of a higher level vision or architecture is crucial to ensure that the synergies among different investments can be obtained. While each service has its own features, the ability to query across and put different information and data together, so it can be re-packaged through completely new services, is an important additional feature of research today.

While the Panel encountered plans and aims for different units, it recommends that a succinct vision, set of principles and mapping for all information systems and services should be developed to provide more clarity and overall coherence.

This would help overcome some of the perceived fragmentation and would signal areas where greater integration is necessary.

For most of the systems the Panel encountered, we found that they have 'single' operators or champions. Sometimes, literally only one person seems to work on them. Just as data needs to be backed up, so ICARDA needs the knowledge and skills of the people running its systems to be backed up. Individuals have a tendency to move or become ill, which should not lead to significant impairment of a system.

The Panel recommends that immediate steps be taken to ensure that each system and service is documented and has backup expertise and staff to sustain it.

In a situation with many systems, the question of standards arises. Not standards of quality, but interoperability standards that allow systems and data to be searched, integrated and re-used across ICARDA, or indeed the world.

The Panel observed no ICARDA 'standard' thesaurus or vocabulary nor a metadata layer that would allow information from the different systems to be combined, if needed. There seems to be no way to easily search across all, or several, systems. Many systems were hardly visible on the Intranet, far less the Internet.

Each system seems to have its own standards, matching its particular community. The publications repository is aligned to standards in the library and publishing world, the genetic resources databases to its specialized community, the GIS to theirs etc.

If a part of the vision is that staff and visitors to ICARDA would be able to engage with the wider ICARDA knowledge base, and not with each system one by one, then more attention must be paid to standards and the interfaces among systems. Indeed, a new service could be to precisely present this knowledge together in different, more meaningful, ways.

The Panel recommends that systems and services adopt Center-wide metadata and standards to enable search, integration, exchange, and sharing of content.

These standards are one of the keys to another principle – that different types of information and knowledge are produced and designed to be re-usable. We found very little re-use of information and knowledge across systems and services. Once a 'knowledge object', for instance, is in one system it should be possible to re-use it in another. Smarter approaches

to content management, as part of the new web site project for example, could offer possibilities to put suitable workflows in place. The different repositories and systems should each be seen, and designed, as potential knowledge sources that populate several different services. Thus, a wide range of customized products can be generated from the individual systems.

The Panel recommends that content is captured, organized and made accessible in ways that will maximize its re-use across different platforms.

Better Manage Information Systems Development

Well-run and well-resourced organizations begin projects with all of the estimated resources required for completion committed and obligations to review the business case if the project's duration or costs deviate from plan by pre-determined variances.

Project management literature suggests that organizations that are less well-endowed or less well-managed – they are perpetually subject to unpredictable variation in funding, are funded from many sources, are simply underfunded, or attempt too many projects for the available resources – tend to expend resources without ever *really* reviewing the business case for continuing, regardless of what happens. Continuing projects is a default and incremental progress is simply assumed to be in the right direction. When funds are scarce it's cheaper to keep going than to change radically, and it can take an organizational crisis to kill a project. In a not-for-profit context the criteria for choosing one course of action over another can be hard to assess.

At ICARDA, the Panel observed:

- Professional practice in software development in MIS (use of recognized software development methodology)
- Talented and committed scientists engaged in developing software, sometimes doing so with no assurance of having sufficient resources to complete them, but proceeding as committed entrepreneurs
- The creation of scientific application “islands”
- A culture that accepts leaving the question of how to link systems until after they are built instead of at the design stage (this observation was made to us by an ICARDA scientist and evidence presented supported his assertion)
- Insufficient attention to the true long term sustainability of systems⁶⁶ (in ICARDA and beyond)
- Insufficient interaction among those involved in software development: little sign of institutionalized knowledge capture to help avoid past system development lessons, some of which were costly (and repeated), and no real community of practice

In general, information systems in ICARDA are a microcosm of larger CGIAR realities and the competition for resources and attention.

The Panel could not judge the merits of individual systems from brief presentations but could see generic issues arising repeatedly, all of which suggest a need for stronger project management of systems development from a business perspective. Following a software development lifecycle approach by the book isn't enough if the system should never have been developed in the first place.

We heard of the printed word: *“The fact that someone has a project and money doesn't mean that any book can be published.”*

⁶⁶ See comments elsewhere in this report on “one person systems”

Our impression is that when it comes to software, the developer is the publisher, not ICARDA. This may be fine for standalone open source projects perhaps, but for the information ecosystem of an organization it's not a good approach. A bad book is easy to throw away. Systems tend to last longer than originally expected and replacing them isn't always easy or cheap⁶⁷.

Unless they are collaborative open source products being developed with external partners, we recommend that information systems should be treated like research projects. They should be rigorously justified from the beginning (and managed using a formal methodology such as PRINCE2).

The equivalent of a literature review must have been undertaken first and reasonable confirmation obtained that a solution doesn't already exist or is somehow unsuitable. The Panel noted cases where even token efforts to check with other Centers hadn't been made before work began.

The Panel acknowledges that this is probably the case in many CGIAR Centers and feels that ICARDA has an opportunity take a lead in committing to proactively share information about its information assets with other centers and in applying formal business as well as software development project management methodologies to software development.

If a proposed system truly doesn't exist it may still not be worthwhile to develop. A business case should be made which should, as a matter of routine, include an IT impact assessment and risk assessment as well details of costs and benefits.

An IT impact assessment is required because systems do not exist in isolation and it is important to assess the effect on other systems, implications for their future operation *etc.*

A member of the Panel has experience completing a 20 page impact assessment form for a back-of-the-envelope system (at a large oil company). This approach (risk aversion in fact) is *not* advocated, but even a 1 page form with the right questions would be a *significant* improvement.

The Panel recommends that ICARDA commission an external audit of the institute's experiences and practices in all aspects of information systems development to assess current practices and capabilities and where and how they should be improved; capture real lessons from experience; and provide guidance on how to improve software project management in general.

The Panel recommends that that core metadata on each proposed system be made available in an information asset inventory⁶⁸ before clearance is given to proceed with internal development.

A common system development management capability in the CGIAR would, the panel believes, benefit ICARDA considerably and offer significant risk mitigation. If all development costs were correctly attributed, the panel feels that the total investment of ICARDA and others in systems development is large. A shared management resource could bring some rigor and transparency to decisions about where to commission system development in the

⁶⁷ Although the Y2K bug was hyped-up it revealed how many old systems were still running in 1999; ICARDA's last reimplementation of its Oracle Financials system cost \$1.3m

⁶⁸ A complete information asset inventory is an important part of a disaster recovery plan; metadata standards for this have already been agreed in the CGIAR but sharing of information about information assets across Centers has yet to happen.

system, and outside⁶⁹. It would also help provide some assurance that developments were sustainable.

To put these observations in some context, the Panel's conservative estimate of the cost of recent misadventures with Oracle alone is in the order of \$100,000 (\$40,000 on an abandoned travel automation module⁷⁰; an unknown amount redeveloping it — 6 months of senior developer time; and probably further staff time doing and undoing and coping with changes to the organization's chart of accounts, the original business case, *including impact assessment*, for which was never made).

Anecdotally, the Panel is aware of similar and larger losses elsewhere in the CGIAR that would also have been avoided by better management of system development. We do not believe that there is anything unusual about ICARDA in this respect.

The Panel does not believe that CBSU or its replacement should provide governance in respect of software development. Its role should be service (development), facilitation and support. Decisions about starting, continuing and stopping software projects belong higher up, with a *project board* (in project management terminology) which oversees the entire portfolio. A separation of responsibilities is advisable.

One option, taken by some CGIAR centers, is to have scientific software development homed in a biometrics unit; leaving the IT department responsible for corporate applications.

Engage the 'Users'

Current strategies on information management and communication recognize the importance of 'user' engagement and ownership of the various processes and products. In general, ICARDA has a more centralized approach where a few people are authorized to edit and update each system and most staff members are passive consumers. For some systems – HR, finance etc – limited editing access is necessary for quality control. For many other systems, the limited access acts as a bottleneck. Often a system's reports can only be generated by a very few people (training, project information), some systems (intranet) require that all content is sent to one person, some systems are difficult to use.

This centralization is potentially exacerbated by relatively weak formal linkages between information providers and their customers. None of the committee's set up to provide space to discuss aims and priorities still function. Only one program (water) has recruited its own knowledge sharing and communication specialist – the rest rely on centrally-provided services or take on these tasks themselves. Emerging 'communities of practice' (COPs) that link, for example web developers, across the Center never got off the ground. Together with the scattered and fragmented information systems, the Panel saw formal information management responsibilities clustered in a few locations.

Potential improvements in the area include:

ICARDA is quite control-oriented in its information culture: Too strong a desire for quality can ensure that information is not published or even captured in the first place. The Panel considers a wiki⁷¹ and wiki culture (anybody can edit anything, but who edited what is visible and edits are reversible) should have a place in ICARDA.

⁶⁹ This has sometimes been controversial and ICARDA has reportedly been affected.

⁷⁰ The forced abandonment was by caused changes to the chart of accounts which necessitated changes to the source code which ICARDA did not have, since the first version of the model was externally sourced without rights to the code. This was later offered to ICARDA on unacceptable terms.

⁷¹ The success of Wikipedia as an example of the social construction of information is well known and it has been widely emulated in building internal information resources in many organizations, including other CGIAR Centers.

The Panel recommends more participation in creating resources and content in general, and more openness in using them.

The Panel recommends that ICARDA identify and support information, IT and knowledge/communication champions across the organization to provide front line support, track demands and needs, and act as links between users and providers.

Rather than only building information and communication skills in central units, the Panel recommends that the programs should also increase their own efforts, within Center-wide guidelines and priorities.

Empowering users across the organization to create and share their information and knowledge is a high priority. People need to be given updating rights in some systems and tools. Systems like the Intranet and the web site can benefit from active participation by program staff in their maintenance. Organize permissions and workflows so that Center-wide platforms like the Intranet are much more open and participatory.

The Panel recommends that staff should be encouraged to innovate in the ways they create, capture, share and communicate their work.

Social media offer opportunities to experiment; other approaches can also pay dividends - the 'Seed Hunter' video is a good example of innovative science-led communication.

This approach is in line with the report of the 2006 External Program and Management Review which argued that "dissemination of research is best if placed directly under the research programs for efficiency and management considerations. The subject matter specialists in the research programs are more capable of assessing the practical value of outputs and (with support) packaging their research."

Such empowerment can challenge more centrally-managed systems and structures, so the whole issue of trust must be put up front. If someone is trusted to speak for the Center in an event, they can surely be trusted to contribute content to a web site, the Intranet, etc.

The Panel recommends that critical committees are re-activated to engage more staff in guiding the directions chosen for different systems and services (IT, web communication, knowledge sharing, information and data management).

The Panel recommends that Communities of Practice that could act as communication, learning and coordination channels for related professionals working across different units should also be activated as appropriate.

Re-focus the Roles

We observed above that much more could be done to engage staff across the organization in information and knowledge tasks. We propose that ICARDA also re-look at the division of roles and responsibilities among different units.

Historically, in many organizations information related activities have been 'siloe'd' by organizational unit according to responsibility for particular kinds of media: books, publications, multi-media training materials e.g., typically "belonging" to the library, publications and training units respectively. Today, when the same content may be repurposed for many media channels and when facilitating search and web services are growing in importance, it may be useful to review whether certain kinds of activities could be integrated functionally. That is, moving away from traditional silos and media.

An idea that hasn't yet found any organizational expression in the CGIAR, but which could be useful for discussion in considering alternative ways of organizing things, is that information functions today can be categorized as follows:

Information function	Typical activities
Creation	Content production, adaptation, re/packaging, design, content management, data curation
Search	Annotation, (collaborative) tagging, metadata, ontology management, translation, thesauri, web services
Communication	Fulfillment, customized outputs and interfaces, use of new technologies and approaches for delivery, training and capacity development
Dialogue	Nurturing communities (facilitation); conversations, PR; marketing, feedback, impact assessment, blogging, knowledge sharing

Search and Dialogue are historically new capabilities that depend on the activities identified above. The interplay between them leads to socially constructed knowledge. Is it possible to manage these horizontally, across the organization?

Recognizing that much information management, knowledge sharing, communication and IT work is actually done in units and programs, the Panel recommends that the capacities across the organization need to be enhanced (new skills) so that latent capacities are mobilized. In the various areas, these need to be facilitated and enabled by the 'central' groups with primary responsibilities in these areas.

The Panel recommends that ICARDA separate responsibilities for 'content' curation and management from responsibilities for technical hosting and software development and support. This implies decentralizing some skills and responsibilities and transferring others.

The Panel recommends that IT core support services form a unit that focuses on "core services", defined as those serving all users directly or indirectly via corporate applications. It should also advise and support web applications and software development, ensuring that Center standards and policies are followed and fostering communication among all involved. This IT services group should be located in corporate services.

The Panel recommends that people working on MIS applications be grouped within Corporate Services where they are close to their 'customers.' As noted above, people with web and programming skills should belong to a Center-wide community that works in unison.

Since Biometrics primarily serves research, the Panel recommends that it is moved out of CBSU and could be placed within research, close to its customers.

Many web-based content systems and applications (such as the intranet, some web sites, data repository) are currently managed by CBSU. This causes bottlenecks and some lack of coordination and coherence.

The Panel recommends that overall responsibility for content services and systems be transferred from CBSU to appropriate units within CODIS. With the proviso that they are managed in a decentralized participatory manner as argued elsewhere in this report.

There is no reason why specialized web sites (which currently are 'lost' off the main web site) should not be curated and managed by appropriate program units following guidelines and policies developed through CODIS, and with suitable involvement of other staff. The CODIS groups will require additional capacities to support such responsibilities.

It is important to ensure that people assigned to these critical roles across Center boundaries operate as communities or teams that work towards shared goals. A good example is the current knowledge sharing specialist in the water area. This role could be replicated elsewhere in ICARDA, involving several people in an overall knowledge sharing team that together brings necessary capacities and skills that ICARDA needs.

Following the subsidiarity model advocated above, management of specialized scientific systems should remain in the units closest to them. They should be able to call on IT, web and other necessary 'central' support, and should be required to follow ICARDA-wide policies and guidelines, including their listing in the repository/meta-directory of such systems.

The result would be a new IT Services Unit with a re-focused mission and role; a reinforced CODIS responsible for center-wide facilitation of information and communication systems content and its accessibility, knowledge sharing and communication (internal and external); biometrics services within research, and reinforced skills and capacities in all units to take more responsibility for their some information, communication and knowledge activities. This will need very good mechanisms to support and guide decentralized efforts and much communication as well as knowledge sharing on these issues.

A key part of this change will be to provide training to the different individuals – in the 'central' units and also across the Center.

Think Center, Act System

Earlier, we highlighted the CGIAR context of IT services. These arguments to varying extents apply to all of the activities covered by this review.

Ongoing discussions about the transformation of the CGIAR foresee quite a different system, in the way it is governed and funded, and also in the way research is carried out. The notion of mega-programs, for instance, suggests we will see increasing inter-center collaboration and therefore increasing calls for common information and communication support.

There has always been a tension between the activities of individual centers in this area, and the potential benefits of working together. If the CGIAR would put in place appropriate and reliable common IT, information management and some related communication activities, we believe these would greatly benefit ICARDA. They could have Center-specific benefits in many areas:

- hardware and software acquisition and support
- database and journal subscriptions
- bandwidth and connectivity
- print and multi-media publishing
- web, data, and database hosting
- software and applications for research management
- software and applications to enable science
- providing improved global access to outputs
- finance, personnel, and other corporate systems

In each area, there are existing initiatives across the whole system or involving groups of Centers. There have been many experiments and partial solutions. There are plans for

further collaboration. There are many potential opportunities. They have significant implications for Center investment priorities. The key questions are whether the potential will be realized, when, and the extent that the results will indeed be appropriate and reliable.

With regard to the wider CGIAR, the Panel recommends that ICARDA develop 'system' scenarios for major IT and IM activities to set out options with and without appropriate and reliable common services provided across the CGIAR.

These need to consider likely timeframes and the potential benefits to ICARDA. They can also identify areas where ICARDA considers it critical to push for system approaches, areas where such approaches are only desirable, and areas that can only be tackled in-house.

The Panel recommends that any internal investments are future-proof in terms of interoperability and compatibility with other CGIAR initiatives. This implies a commitment to open standards, formats, and applications.

The Panel recommends that a 'system' scan or check is introduced as part of the pre-design phase of all IT and IM development activities to ensure that any existing application is reviewed before any internal development takes place.

The Panel recommends that all IT and IM systems, software, products and services developed within the Center are shared and made available to others Centers – and other partners like NARS - so they have the potential to be taken up as 'system' or international public goods. This will require a complete inventory of such assets that is shared externally.

The Panel recommends that ICARDA make explicit to other Centers and the CGIAR that it actively seeks synergies and opportunities to share in the development and use of useful applications and services. It needs to also be explicit that it values this commitment from others.

Annex 1: TOR of the Panel

ICARDA has adopted a new strategy for the years 2007-2016. It has also had an external program and management review during 2006, and a major change in its organization. In view of the rapid changes in the external environment, it is important that ICARDA's activities are reviewed through both looking at the past and making suggestions as to the future to help meet ICARDA's objectives in the 21st century.

The EPMR has not specifically addressed the information technology, information systems and knowledge management area, although this is also crucial in the implementation of our new strategy. The Panel, is therefore, requested to review and advise ICARDA on the Information Technology, Information Systems, Information Management and Services, and Knowledge Management activities of the Center and make recommendations on the current and future activities, organizational structure and functioning of the Information Technology and Communication, Documentation and Information Services Units as related to these activities.

Principal Tasks:

1. Appraise the plans of the Computer and Biometrics Services (CBSU), Communication, Documentation and Information Services Unit (CODIS) and other organizational units within ICARDA on information technology and systems, information services and knowledge management activities in light of ICARDA mission and the new Center Strategy (2007-2016) and the pace of technological change, and examine the contributions made to the objectives of ICARDA.
2. Identify any major omissions or deficiencies in the current information technology and systems work plans in terms of their relevance towards achieving ICARDA's objectives, their synergy with the research programs, regional programs and other organizational units, and meeting the needs for information systems of the Center.
3. Comment on the quality and effectiveness of the information technology, biometrics/bioinformatics, and information services and support being provided, software development, appropriateness and actuality (in terms of state-of-the-art) of the software packages (made available from in-house development or obtained from outside) and tools, and suitability and actuality of network, hardware and software environments in current use and those planned.
4. Evaluate the effectiveness of knowledge management activities in marketing ICARDA and disseminating the knowledge gained through research by ICARDA scientists to their intended wider and mixed group of stakeholders (e.g. fellow scientists, 2nd line users, policy-makers, donors, investors), and considering long term view of preserving ICARDA knowledge.
5. Review knowledge management processes and culture in the Center and possible enhancements, both in relation to ICARDA stakeholders and within the Center.
6. Comment on the relationships and responsibilities to research programs, outreach programs and units.
7. Comment on the capacity building being provided to ICARDA staff and NARS personnel and the in-house development of staff.
8. Review the organizational aspects and staffing, the placement within the organization, and possible integration and optimization of available resources for the implementation of the next medium-term plan with respect to information technology systems and information services.
9. Provide any other comment and observation that may contribute to the improvement of the services being provided to the users and increase the effectiveness of both services.
10. Comment on whether all respective activities are sufficiently representative of the state-of-the-art, and if not how this can be addressed, so also in this area whether we can consider the outputs those of a center of science excellence.

Annex 2: Schedule of Meetings

Monday, 9th March

Head – CBSU and Acting Head – CODIS
DDG – Research

Dr. Zaid Abdul-Hadi
Dr. Maarten Van Ginkel

Tuesday, 10th March

Director General
Overview of ICARDA, IT, IS, KM
IT Infrastructure and Users Support

Dr. Mahmoud Solh
Dr. Zaid Abdul-Hadi
Mr. Colin Webster
Mr. Michael Sarkisian
Mr. Hashem Abed
Mr. Khaled El-Sham'aa
Dr. Kamel Shideed

Scientific Systems
Biometrics/Bioinformatics Support
ADG – ICC

Wednesday 11^h March

MIS Applications
Laboratory Management Information System

Mr. Awad Awad / Dr. Fadil Rida
Mr. Hani Simo

Plant Genetics Databases
ICARDA Website
Knowledge Management
Information Management & Services

Mr. Jan Konopka
Mr. Moyo Bolarin
Dr. Andrea Pape Christiansen
Dr. Nihad Maliha

Thursday 12th March

Resource Mobilization Facilitator
BIGM Director
ADG – GL
Int. Crop Information System
Soil Fertility Specialist
Water Comms and KS Specialist
SEPR Acting Director
DSIPS Acting Director
Pasture & Forage Systems Specialist
ADG – CS
ADG - ICC
Director General

Dr. Scott Christiansen
Dr. Richard Brettel
Dr. Majd Jamal
Dr. Akinnola Akintunde
Dr. Rolf Sommer
Mr. Venkataramani Govindan
Dr. Aden Aw-Hassan
Dr. Barbara Rischkowsky
Dr. Asamoah Larbi
Mr. Koen Geerts
Dr. Kamel Shideed
Dr. Mahmoud Solh

Sunday 15th March

Director of Finance
PSD Manager
Land-Resource Mapping Expert
GRS Head
Head - Seed Unit
Acting Head, Capacity Development Unit
Executive Assistant to the DG

Mr. Bruce Fraser
Mr. Frisco Guce
Dr. Wolfgang Goebel
Dr. Ahmed Amri
Mr. Abdoul Aziz Niane
Dr. Habib Ibrahim
Dr. Liz Bailey

Monday 16th March

Communication Specialist

Mr. Ajay Varadachary

Tuesday 17th March

Teleconference: North Africa Regional Program Coordinator
Presentation to Management and Staff
Wrap up with ICARDA Management

Dr. Mohamed El-Mourid

Annex 3: Research ‘Triple A’ Checklists

To ensure that public domain research outputs – in the form of information, data and knowledge – form part of a global ‘knowledge commons’ for agriculture, each output should be assembled, created, handled and disseminated in certain ways that make it a public good.

Each output – and each research information system – needs to be optimized to reach certain availability, accessibility and applicability objectives. These ‘Three A’s’ can be tailored to different types and domains of research and the specifics of each organization.

The first checklist provides a set of steps and actions that will help make information more accessible⁷². The second checklist tackles the area of research applicability, setting out some approaches likely to ensure that research knowledge is applied, that it is put into action⁷³.

Three A’s

Availability: Research outputs are stored in appropriate open digital formats and described using public metadata standards so they can be found through structured search and access systems. They may not always be publicly available in full. Availability means assembling and storing content so it will be permanently accessible, and describing it in systems so others know, and can find, what outputs have been produced.

Accessibility: Research outputs are publicly available online using accepted public formats and appropriate licenses so they can be queried, viewed, and obtained in full. Outputs are optimized so metadata and full content can be harvested and shared across different platforms and applications, and they can be incorporated into other systems and services. Accessibility means making outputs as easy to find and share and as open as possible, in the sense that others are free to use, reuse, and redistribute them, with appropriate acknowledgement and without restrictive legal, technological or financial barriers.

Applicability: Research processes are open and inclusive so that all perspectives and knowledge are taken into account during research design, planning, implementation and communication. Research outputs are customized and/or adapted for easy uptake and use by other actors in agricultural innovation systems, increasing the public benefits derived from the data, information and knowledge produced through research. Applicability means research and innovation processes that are open to different sources of knowledge, and outputs that are easy to adapt, transform, apply and re-use.

⁷² This ICT-KM checklist from December 2008 derives from drafts developed alongside ongoing discussions in CIARD – www.ciard.net [it is currently being revised]

⁷³ This checklist is largely derived from work by ILRI and the Harvard University Center for International Development. See: Kristjanson P. *et al.* 2008. *Linking International Agricultural Research Knowledge with Action for Sustainable Development*. CID Faculty Working Paper 08-173. Cambridge, USA: Harvard University CID. www.cid.harvard.edu

Increase accessibility of research outputs

1. Store and publish outputs, and their metadata, in appropriate digital formats that both preserve and safeguard their future use and ensure widest current access.
2. Publish and archive outputs using open formats that do not discriminate against some users.
3. Make research outputs accessible on the Internet.
4. License outputs so others are 'free to use, reuse, and redistribute' them with appropriate acknowledgement.
5. Employ the full range of output formats – audio, video, informal – as well as peer-reviewed articles and books.
6. Encourage and assist authors to publish outputs as open access.
7. With publishers and aggregators, negotiate or pay for open access to otherwise limited access outputs. Push publishers to make journals available through AGORA.
8. Adopt metadata standards and widely accepted vocabularies to create, collect and describe outputs, making them easy to find, harvest, and use across different services and platforms.
9. Expose metadata from document collections using the Open Archive Initiative Protocol for Metadata Harvesting.
10. Share the metadata and full content of outputs through international systems that maximize access (e.g. Google, AGRIS, CAB Abstracts, Consortium for Spatial Information); and through standard feed formats (e.g. RSS or Atom).
11. Adopt international accessibility standards for web-based systems and outputs, optimizing them for low and high bandwidth environments.
1. Optimize web sites and content for global and specialised search services.
2. Use 'social' media applications to help content travel and more accessible.
12. Ensure outputs will be accessible across different platforms – web, email, phone, ...

Enhance applicability of research

1. Adopt empowering strategies that 'level the playing field' and generate hybrid, co-created knowledge and deal with large (and largely hidden) asymmetries of power.
2. Adopt systems-oriented approaches that recognise that scientific research is just one 'piece of the puzzle.'
3. Use processes and tools that enhance efficient dialogue and cooperation between those who have or produce knowledge and decision-makers.
4. Define research problems in collaborative, user-driven ways, including 'boundary organizations' or 'boundary-spanning actions' that help to bridge gaps between research and user communities.
5. Construct informal new arenas, with joint 'rules of engagement' to encourage mutual respect, co-creation and innovation, in which different actors can engage in user-producer dialogues, joint product definition, and a systems approach.
6. Devise appropriate reward and funding systems that encourage risk-taking, learning, knowledge co-creation with partners, and communication via multiple channels.
7. Facilitate processes that create strong networks and build innovation capacity of the system. Co-create communication strategies and boundary products that are key to the longevity and sustainability of outcomes and impacts.
8. Partner with other 'intermediary' organizations who can help turn co-created knowledge into action (new strategies, policies, interventions, technologies).
9. Reinforce the knowledge sharing, communication and information dissemination capacities of intermediary partner organizations who are more likely to reach research 'end' users.