Computer Services Committee

Final Report

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1 Summary of Recommendations

This section lists all recommendations contained in this report. To facilitate implementation, a first list contains those recommendations that are oriented toward management, while the second list contains more detailed, technical recommendations.

1.1 Managerial recommendations

1.2 Technical recommendations

2 Introduction

2.1 Background

The Computer Services Committee (CSC) was created by the Director on 6 May 2003 to evaluate the IIASA computing environment and the performance of IIASA's Computer Services (CS) department.

The following questions were established as terms of reference for the CSC:

- What computing services are required at IIASA?
- Are these requirements met?
- What are the reasons that the requirements are not met?
- How can such problems be solved and IIASA's computing environment be improved?

The members of the CSC are: Ulf Dieckmann, Eryl Maedel, Marek Makowski (chair), Ian McCallum, Wolfgang Schoepp, and David Wiberg.

This report summarizes the findings and recommendations of the CSC.

2.2 Evaluation process

The evaluation process conducted by the CSC involved the preparation and analysis of a user survey, individual meetings with all departments and projects, a joint meeting and several individual interviews with all CS staff, preparation of draft recommendations on the proposed management information system (MIS), meetings with the MIS Core Team, more than 30 CSC meetings, and the writing of this report.

2.3 Summary of survey results

The user survey was posted on the Web and received a total of 134 responses, with 95 responses coming from researchers (including 33 YSSPers) and 39 from support staff. Six categories of information were solicited in the CSC survey:

- User profiles, showing the demand for various basic types of computing;
- Overall satisfaction of users with the key elements of IIASA's computing environment (software, network, hardware, and support);
- User priorities for improving IIASA's computing environment;
- Satisfaction with regard to selected specific issues the CSC had identified as potentially problematic;
- Satisfaction with and importance attributed to all aspects of computing support; and
- Free-form suggestions for improvements.

A summary of answers to the first three categories is provided in Tables 1 to 3 below. In both tables, 'percentage of answers' denotes the percentage of all answers that were included in the statistics; answers 'not at all' and 'no opinion' were excluded. Answers in the survey ranged from 1 to 5, with 1 corresponding to 'high' or 'a lot', and 5 corresponding to 'low' or 'little'. The detailed results of the CSC survey, including an overview of answers to the last three categories in the list above, are available at www.iiasa.ac.at/~marek/csc/surv03.html.

Type of computing	Percentage of answers	Average	Standard deviation
Office	96.27	1.90	1.43
Graphics	60.45	3.09	1.25
Databases	52.99	2.89	1.40
Web design	47.76	3.03	1.44
Modeling	46.27	2.74	1.50
Programming	38.81	2.54	1.69
Statistics	36.57	2.71	1.40
LaTeX	30.60	2.51	1.53
GIS	22.39	2.93	1.55

Table 1: Intensity of various types of computing

Table 1 shows that office-type applications, especially text processing and graphics, clearly dominate computing at IIASA. Modeling, databases, statistics, and programming are also used by large groups of users, especially in the research staff.

Category	Percentage of answers	Average	Standard deviation
Software	82.84	2.23	1.08
Network	86.57	2.22	1.02
Hardware	82.09	2.40	0.99
Support	77.61	2.10	1.09

Table 2: Overall satisfaction of users with categories of the computing environment

Table 2 shows that overall user satisfaction is uniformly high across all categories. Yet, the survey and interviews brought out several elements in each category for which there is a wide demand for improvements. These problems are addressed in the subsequent sections, together with the corresponding recommendations. The diverse feedback obtained through the interviews conducted by the CSC allowed focusing these recommendations on those issues that users felt strongly about.

Description	Aa		Ac		Ra		Rc		Sa		Sc	
Common information management system for administration	7	5.76	7	4.93	7	6.56	7	6.00	2	3.67	1	2.71
Improved communication on services and software available and new tools on the market	4	4.98	4	4.29	3	4.89	3	4.02	4	5.00	4/5	4.68
Improved network and internet speed	1/2	4.78	1	3.99	1	4.59	1	3.71	6	5.24	6	4.71
Improved scientific computing power	5	5.35	5	4.56	2	4.84	2	3.82	8	6.89	8	6.53
In-house software development	8	6.52	8	6.09	8	6.62	8	6.13	7	6.25	7	6.05
Training for CS staff	3	4.80	3	4.19	4	4.93	4	4.26	3	4.29	3	3.91
More frequent upgrading of computer hardware	6	5.60	6	4.89	6	5.84	6	5.1	5	5.09	4/5	4.68
User training	1/2	4.78	2	4.01	5	5.23	5	4.51	1	3.56	2	2.91
Video communication and networking	9	7.20	9	7.28	9	7.09	9	7.04	9	7.57	9	8.06

Table 3: Priorities attributed to potential improvements of the computing environment (A = all users, R = researchers, S = support staff, a = all answers, c = self-consistent answers; in each column the right number gives the average ranking across users, while the left number shows the resulting ranking for the average user)

Table 3 shows how users ranked a list of potential improvements in terms of where they thought CS resources should best be used. Not unexpectedly, individual priorities varied widely, resulting in relatively small differences in average ranking. Some conclusions can yet be drawn:

- To the support staff at IIASA, an information management system and user training are particularly important.
- The emphasis of the scientific staff is on improvements in network speed and scientific computing power.
- Training, both for users and CS staff, ranked quite highly overall.
- Video conferencing is as yet a low priority for the average user.

2.4 Current status of the CS department

The CS department has five full-time and three part-time staff members. Over the past year, CS lost one full-time staff member (resulting in the cessation of database support and development). Another full-time position was changed to part-time (resulting in a reduction of some hardware-related services).

According to information provided by CS, the current allocation of personnel resources to the various tasks covered by CS is roughly as follows: system administration 30%, consultation 25%, development 20%, presentations and hardware support 8%, documentation 3%, user training 2%, and general administration 12%.

At IIASA, there are currently about 220 PCs, 150 of which are active.

2.5 Organization of this report

The remainder of this report is organized in sections that summarize the main problems identified, in conjunction with the corresponding recommendations by the CSC. The following areas are covered in turn: organization and strategic planning, computer support, hardware, software, management information system, IIASA Web, and feasibility studies. All recommendations are highlighted in bold, clearly labeled with an 'R' followed by the section and recommendation number, and duplicated in Section 1 to facilitate implementation.

Three appendixes are included with this report: Appendices I and II contain CSC recommendations to the MIS Core Team, and Appendix III provides a detailed assessment of the extent to which suggestions provided in the CSC report of 1998 were implemented.

3 Organization and Strategic Planning

Developing IIASA's computing environment requires long-term planning, strategic foresight, and proactive consideration of changing user needs. Three shortcomings, however, have resulted in weak and inconsistent strategic planning:

- First and foremost, the active input of users in this process has been unsystematic and insufficient. While many decisions about purchases and the operation of CS can be taken from a purely technical point of view, others require balancing the interests of users, budgetary constraints, and the interests of CS staff. Such compromises can only be reached efficiently if there is a reliable channel for determining and expressing the immediate needs of users.
- Second, it seems that a few strategic decisions taken by CS might not have been optimal: examples range from the belated upgrading of IIASA's mail server, to the insufficient protection of IIASA staff from spam, to the lack of development of IIASA's resources for numerical computing.
- Third, the CSC concluded that many constructive recommendations contained in the CSC report of 1998 were not implemented by CS (see Appendix III), which suggests that follow-up activities have been insufficient.
  These considerations lead to the following central recommendation.

R 3.1 Establish a standing Computing Advisory Committee at IIASA.

It is recommended that the Computing Advisory Committee (CAC) be involved in all decisions affecting the interests of computer users at IIASA. This committee should be composed of about six representative and experienced users of IIASA's computing environment. Members should be appointed by the director based on suggestions by the Internal Research Council on the one hand and by the group of department heads on the other. To balance the need for turnover with the need for a relatively stable composition of the committee, it is recommended that each year about a third of the committee members be replaced. Further it is recommended that the CAC meet at least once every quarter to review action required based on the issues listed below. Some of these meetings should be open to all users interested in contributing to the committee's work. The CAC should consult with individual CS experts, external experts, and IIASA collaborators as required. Work of the CAC should include at least the following elements:

- Participation in the long-term planning for the development of IIASA's computing resources.
- Input into the establishment of priorities for support provided by CS.
- Guidance for the implementation of improved facilities for numerical computing at IIASA.
- Help with the consolidation of IIASA's software standards.
- Oversight of the execution of endorsed recommendations from the present report.
- Advice on work plans and follow-up for CS's work on the feasibility studies recommended in the present report.
- Assistance to users proposing specific improvements of IIASA's computing environment.

4 Computer Support

Computer support was identified as one of the main areas of responsibility for the computing department. Overall, computer related support at IIASA was deemed to be helpful, and users were generally pleased with the contact they had with CS staff.

In recent years, however, the CS budget has been strongly cut, while demands have grown: the CS department therefore finds it increasingly difficult to meet the level of support expected by users. In the past year, a full-time database programmer position was lost. This has essentially reduced software/database development at IIASA to the maintenance of existing systems. Additionally, a technical engineer position was reduced to part-time, which no longer allows for presentations and hardware support during all office hours.

Through the survey, interviews, and discussions, we have identified below areas where it is felt that support could and should be improved. These points have been grouped according to general topics.

4.1 Information flow

The flow of information between CS and IIASA staff needs improvement. This would create a better computer-educated institute and might actually decrease or prevent some of the requests that CS get for support. Implementing the following recommendations would be helpful.

R 4.1 Create and maintain a searchable 'frequently asked questions' (FAQ) page on the CS website.

R 4.2 Make timely and systematic announcements regarding virus threats, software upgrades, unavailable hardware etc.

4.2 Training

A major deficiency identified in the study was the lack of funds for training – essentially the budget has been reduced to zero for both CS members and users. CS employees do their best to stay abreast of the latest technologies. However, in the long term this policy is not viewed as sustainable. The following recommendations address this issue.

R 4.3 Provide introductions to IIASA's computing environment on a one-to-one basis during the first days of IIASA affiliation, including a guided tour of the CS website.

Currently, such an introduction occurs only rarely.

R 4.4 Hold short 'problem solving sessions' focusing on specific issues identified by staff or the CAC.

An example would be a 1-hour session on how to use FTP.

R 4.5 Provide longer 'software training sessions' focusing on specific applications, given by CS staff to larger groups at periodic intervals as deemed useful.

An example would be a 4-hour session on the use of Adobe products for graphics-related tasks. The CSC concluded that external courses for such training needs are not likely to be cost-efficient.

R 4.6 Reinstall a training budget for CS staff.

An example would be the option of attending professional meetings about novel software and hardware solutions.

4.3 Help procedures

A variety of procedures are in place for obtaining help at IIASA. Due to the relatively small size of IIASA, the help system is somewhat informal. During office hours, there are several options for obtaining help via an online request, email to CS staff, direct phone calls to CS staff, the CS hotline 333, or visiting the CS department. In general, this system functions. However, there are occasions where help for some was difficult to obtain, particularly for new staff members, who are not comfortable with how the system works. Hence the following recommendation.

R 4.7 Detail all available help procedures on the CS website.

This implies dedicating a specific page for describing help procedures that clearly outlines all the aforementioned possibilities for obtaining help.

The next three recommendations are meant to improve the reliability and promptness of support.

R 4.8 Develop a policy for obtaining emergency computer help outside of office hours and post the procedures on the CS Web page.

R 4.9 Install an answering machine (voice mail) for the CS hotline 333.

R 4.10 Facilitate receipt of hotline calls by CS staff by use of mobile phones (or pagers) and systematic call forwarding.

The saving measures implemented in 2003 resulted in canceling one CS position, and reducing a second one from full-time to part-time. The canceled position was that of the database programmer, which results in a current lack of database user support. Given the fact the Oracle database system is more and more widely used in scientific applications, and is likely to serve as a basis for the planned MIS, we do need to establish competent Oracle user-support within CS. Support for database-centric scientific applications is especially important: currently, scientists who use Oracle have to rely on private contacts with external experts, on the expertise of some YSSP participants and collaborators, and on their self-education. This results in the loss of productivity and efficiency when developing and using such scientific applications. While such support had not been provided by former CS staff member Rok Perger, whose database expertise was limited to Access, the CSC is convinced that IIASA needs to reestablish the position of a database expert in CS, and to staff it with an Oracle specialist.

R 4.11 Reestablish database user support in CS, and provide the budget needed for recruiting an Oracle specialist for this position.

In addition, in 2003, a technical engineer position in CS was reduced to part-time. This means that the corresponding services, like setting up video projection for presentations, are now not available during all office hours. The problem of support for presentations is exacerbated by an outdated fragmentation of responsibilities for the provision of visual equipment. These two issues should be addressed in one go.

R 4.12 Restore the technical engineer position to full-time and endow it with responsibility for all visual equipment.

4.4 Technical support

The following recommendations are of more technical nature and should serve to simplify work by scientific and non-scientific staff.

A significant number of users at IIASA are utilizing local drives for data storage. This is due to a perceived and/or actual lack of storage space on network drives, and also because of slower data access from network drives. In addition, more and more laptops are in regular use, causing issues of synchronization, data transfer, storage, and versioning. Given that some of IIASA's most valuable assets are stored on our hard drives, users are requesting more assistance from CS in connection with data storage and secure backup procedures. The following three recommendations address these issues.

R 4.13 Allow for backups of local drives where requested, providing daily backups of defined directories.

R 4.14 Provide support for synchronization of defined directory trees on local drives with network file systems, which is particularly relevant for working with laptops. Enable Windows "online folders" on network drives.

R 4.15 Regularly monitor all disk space and promptly advise users when reorganization is needed.

While Windows clearly is the dominant operating system at IIASA, Solaris and Linux are also in use, and have an important role to play in IIASA's computing environment. Linux in particular is seen as very promising and could provide certain benefits over standard Windows systems. It is thus felt that in-house knowledge of and support for all three operating systems would improve the efficiency of computing at IIASA.

R 4.16 Provide the same level of user support for Windows, Solaris, and Linux.

With the high usage of computing technologies at IIASA comes a high demand for basic supplies to support this technology. A variety of supplies are required on a daily basis across the institute (e.g. memory sticks, rewritable CD's and DVD's), and bulk purchasing of these items for the stock room is the most efficient way of dealing with them. Future updates of this sort should be initiated by CS.

R 4.17 Update the warehouse stock to include inexpensive new technologies that are tedious to order individually or cheaper using bulk purchasing.

In the current setup, IIASA does not provide an optimal solution for ftp access. To facilitate file transfer, users will profit from a user-friendly ftp interface as part of their standard setup. For both internal and external users, Web pages of projects and departments should contain links to the corresponding ftp/incoming and ftp/outgoing directories. Instructions should be provided such that all administrative staff knows how to use such facilities.

R 4.18 Provide user-friendly ftp interfaces to salient directories, both anonymous and secure, and both client-based and Web-based.

With email taking a central role in the work of most computer users at IIASA, efficient access from inside and outside the institute is a key requirement, which is not yet being met by the currently implemented variety of heterogeneous solutions. The implementation of a comprehensive email solution is especially important for the work of IIASA's highly mobile scientists.

R 4.19 Provide efficient Web email allowing seamless access through a single fast interface that can be used equally well internally and externally.

Alternatives to the emailing of large attachments are available, and their use should be encouraged. Since such attachments put an extra strain on the email server, processing priorities should be adjusted accordingly and users should be educated about efficient email usage.

R 4.20 Queue emails according to size and educate all users about sending and receiving large emails. At the same time, provide instructions on other options for data transfer (ftp and www).

4.5 Ergonomic computing

Several staff members have mentioned computer-related health problems. While we have not made any specific recommendations regarding this issue, we have discussed it, and highlight it here as it is important. Even though some provisions are already made at IIASA for providing ergonomic equipment, we urge the management to be proactive in this area and inform employees of the steps they can take if they are affected by workplace injury/discomfort.

5 Hardware

5.1 Summary of the current situation

Table 4 below provides an overview of how investment into computer hardware has varied during the past six years. Despite dramatic cuts in the investment budgets of 2002 and 2003, desktop PCs, the network infrastructure (including the outside connection), and peripherals (printers, scanners) are generally of satisfactory quality. Although there are still several rather old PCs that should be phased out, the budget cuts have primarily resulted in two detrimental developments:

- Deterioration of the quality of servers and of Unix workstations.
- Postponement of other major hardware investments.

While office-type applications are still adequately supported by the hardware, we already face problems with some aspects of central computing (servers for email, Web, and databases). In particular, we are not sufficiently prepared for any large-scale computation. This restriction is already recognized by some projects as a hindrance to their productivity. In the coming years, reliance on larger and more complex models will only grow, and so will the demands on numerical computing power.

Investment	1998	1999	2000	2001	2002	2003
Investment budget in 1000 €	258	199	304	213	98	64
Number of desktop PCs bought	40	40	30	51	40	33
Number of laptops bought	1	2	2	7	1	2

Table 4: Changing investments in computing environment

5.2 Hardware investment

With the exception of PCs and the network, hardware capacity has deteriorated as a result of the investment cuts in 2002 and 2003, causing the following problems:

- The mail server is too old and does not allow for adequate spam handling. Although the mail server is currently being upgraded, spam email has been the single most disturbing computing-related problem for several months.
- We are lacking a firewall and a Virtual Private Network (VPN) or other solutions allowing for seamless remote work. This makes access to our local area network (LAN) by collaborators from their locations and working from home and during travel unnecessarily difficult. The ad-hoc security measures implemented after the hacker attacks in 2002 seem to have effectively protected our LAN, but hinder access from outside to our resources by staff and collaborators.
- Unix workstations have not been upgraded since 1998. Their monitors, in particular, are no longer of acceptable quality.
- We lack uninterruptible power supplies (UPS) for servers and workstations with file systems used by our Web. This results in instability of our LAN and causes risks for expensive hardware every time a power failure occurs.
- We do not have adequate capacity for demanding computation. Consequently, some projects are currently throttled in their research activities. Forthcoming models (e.g., the new version of RAINS and GGI models) will require a computational grid. Some new models will intensively use the Oracle database and the Web, thus requiring far more efficient servers. Moreover, at least some of these models will be used remotely, and are thus likely to require more bandwidth for our Internet connection.

- Although our current 2 Mb/s Internet connection is adequate for most needs, it is based on copper wires, which cannot be upgraded to a broader bandwidth. In the medium term, the bandwidth will need to be increased, and we thus need to make arrangements for a fast upgrade of the Internet connection. This requires switching to a fiber-optic connection.
- We make practically no use of wireless technology. While wide use of it may not be justified yet, we should explore this technology and make it available at least in the Wodak, Gvishiani, and Raiffa rooms.

In general, then, IIASA needs a more systematic approach to planning its hardware investments.

R 5.1 Review the adequacy of all hardware annually and use the results to define an investment plan with a three-year rolling horizon for keeping our infrastructure at an appropriate level that is meeting the needs.

In particular, the following requirements should be considered based on the problems outlined above.

R 5.2 Install a computational grid composed of a cluster of Linux PCs for numerical computation.

R 5.3 Implement a solution for seamlessly working from home and during travel (firewall plus VPN, or another solution).

R 5.4 Maintain regularly updated multiprocessor servers for Web services, Oracle applications, and numerical computation, a mail server powerful enough for handling spam and virus-checking, and enough capacity on other servers (file, DNS, NIS, gate, GIS, print, general purpose).

R 5.5 Regularly upgrade Unix workstations and PCs.

R 5.6 Prepare for timely increases of the bandwidth of our outside connection.

R 5.7 Replace old monitors.

R 5.8 Install uninterruptible power supplies (UPS) for servers, workstations, and main switches.

R 5.9 Provide wireless networking in all meeting rooms.

5.3 Operational improvements

IIASA's central investment budget is used primarily for purchasing desktop PCs. By contrast, laptops are currently purchased from the project budgets. Desktop PCs are still much cheaper than equivalent laptops, so projects have a budget incentive to limit purchasing laptops to meet actual needs. The following recommendations deal with the handling of desktop and laptop computers.

R 5.10 Support laptops according to the same rules applied to desktop computers.

R 5.11 As long as the price difference between laptops and desktops remains substantial, continue to purchase laptops from project budgets.

R 5.12 Review the quality and cost of repairs on laptops bought in the past years, and keep or modify the purchasing policy accordingly.

The security and air-conditioning of the server room needs to be improved. Moreover, all the backup tapes are stored in one location only. The resulting risks associated with fire or theft are unacceptable for an institute of IIASA's scale.

R 5.13 Improve security and address problems with air-conditioning of the server room.

R 5.14 Make sure that a full backup not older than two weeks is stored in the GP building.

The presentation facilities in the Wodak, Gvishiani, and Raiffa rooms need to be improved in order to bring them in line with current technology.

R 5.15 Provide remote controls (e.g., wireless mouse) for presentation PCs, and an electronic switch (with remote control) for connecting several PCs and laptops to one video projector.

Scanners are now very cheap and should be made widely available. Consequently, each project and department should be offered a scanner. There is also need for an A3 color printing.

R 5.16 Ensure adequate distribution of scanners, and of DVD readers and writers; install a public A3 color printer in CS.

Copy machines with scanning capabilities have proved very useful. However, the PDF file that is created by the machine is currently emailed to the user, which unnecessarily loads the mail server and causes long delays in document delivery.

R 5.17 Equip more copy machines with scanning capabilities and ensure that scanned documents can be provided without using email.

The current policy of blocking certain types of incoming and outgoing connections has been useful, by preventing unnecessary burdens on our Internet connection. However, this policy should be made transparent and be reviewed by the CAC.

R 5.18 Evaluate and publish the current policy of blocking certain types of downloads.

6 Software

This section focuses on improving the software environment at IIASA in three respects: enhancing the flow of information from CS to users about software available at IIASA, streamlining the process for software that users need to have delivered to their computers, and filling a few larger gaps in IIASA's current software environment. In general, the monitoring of software licensing issues may require additional attention.

6.1 Information about software

Information about what software is actually available at IIASA is widely perceived as being insufficient. What is currently referred to as the "software database" appears to be hardly used, lacks some key information and links users would find important, and is largely regarded as being cumbersome to access. Our recommendations for improving CS's current strategy for providing general software information to users involves two dimensions: enhancing access to information, and enhancing the quality of that information.

The following two suggestions are being made to enhance access to information about software.

R 6.1 Design a new software database to provide access to the required information via easily used Web pages, containing fact sheets for each software product available at IIASA (listing redundant information is to be avoided).

R 6.2 Post information about software regularly – at minimum, post one news item for each purchased product, installable free software, upgraded application, or approved system/security update.

The following four suggestions are meant to enhance the quality of the software information provided by CS.

R 6.3 Create a dynamic Web page with 'CS news', pooling informal information for staff about new software (i.e., shareware, freeware etc) available on the market that may be useful for work done at IIASA, as well as tips, links, ideas etc.

R 6.4 Develop, in consultation with groups of users, IIASA standards for which software products are going to be (a) regularly and automatically upgraded, (b) part of the standard setup, (c) supported by CS in terms of helping with user questions, and/or (d) recommended for a particular task (e.g., for graphics).

R 6.5 Each fact sheet about software available at IIASA should contain the following standard elements: (a) product name, (b) supported product version(s) and corresponding date(s), (c) operating system, (d) IIASA software category (see recommendation 6.4), (e) 2-3 user-oriented sentences summarizing the product's function, (f) links to salient Web pages (including a general product description by the issuing company, FAQs, reviews, and information about new features introduced with recent upgrades), (g) CS contact for questions, (h) contact details of a small number of expert users at IIASA willing to help with the occasional question, (i) a place for comments and evaluations by IIASA users, (j) pointers to news and discussion groups (if applicable), and (k) information on how to install (or have installed) upgrades.

R 6.6 Improve information on using LaTeX at IIASA, such that all LaTeX users can gain knowledge of the LaTeX front-end Scientific Workplace and of conversion filters to and from Microsoft Word.

6.2 Software delivery

Users appreciate that software is being installed for them by CS staff, either on the occasion of a personal setup or upon specific request. In the latter case, however, delays are likely to occur, and the process of testing whether available software matches personal needs is unnecessarily cumbersome. We therefore recommend giving all users interested in such options more immediate control over the software they would like to use.

R 6.7 Upon request, give users the relevant local administrative privileges on their personal computers to install software and share drives on their computers. Clearly highlight this option on the CS website and in user introductions.

R 6.8 Each software fact sheet (see R 6.5) should contain sufficiently detailed instructions to allow users to install IIASA software directly. If there are specific technical issues to be considered or if extra information is needed to complete such installations, these should be stated clearly.

The CSC recognizes that the installation of some software packages will continue to require direct CS involvement, because bug fixes or workarounds must be applied that are likely to exceed the capabilities or patience of most users. However, by empowering users, this residual category can be kept as narrow as possible.

In addition, an enhanced system is suggested for distributing upgrades and updates from one central location at IIASA.

R 6.9 Regularly update those software packages that fall into the corresponding IIASA software category.

R 6.10 Pursue an improved and more proactive virus scanning and protection policy involving local virus scanners on every PC with automatically updated virus definition files.

R 6.11 Centrally administer updates of Windows; test and approve such updates before distributing them.

R 6.12 Officially announce the policy for installation of IIASA software "on" computers brought by short-term collaborators and YSSP participants: the physical installation of key components on network drives allows such software to be used while being connected to IIASA's intranet.

In some cases, increased standardization of installed software is desirable:

R 6.13 Ensure installation of uniform up-to-date presentation software on all IIASA presentation computers.

R 6.14 Offer standard configurations of PCs within service departments that prefer such a solution.

6.3 Missing software

Users have voiced specific suggestions about the improved software they would like to have available at IIASA.

R 6.15 Upgrade the software used for spam protection to modern international standards. Ensure that centralized spam filtering can be combined with user-configurable learning and management.

R 6.16 Solicit staff suggestions for which free (or cheap) software should be made available at IIASA. Include commonly used public-domain utilities, e.g., from the Gnu and OpenOffice collections.

R 6.17 Enhance supply of programming tools for Oracle, Web, C++, Perl, and Java.

IIASA's PCs (both desktops and laptops) primarily run Windows. Frequent changes of this operating system result in a rather fast technological aging of PCs. The new licensing policies of Microsoft also make the use of Windows increasingly expensive. Yet, so far there is practically no support for Linux at IIASA, even though Linux is a proven alternative to Windows for scientific work. Moreover, Linux provides the cheapest known solution for computational grids.

R 6.18 Provide users with the option of a standard Linux setup on PCs (resulting, if desired, in dual Windows/Linux setups).

7 Information Systems

IIASA is currently in the process of setting up a management information system (MIS). For this a Core Team has been formed. The Core Team kept the whole process of MIS selection transparent and encouraged staff involvement, to participate in the process. CSC received the copies of the Terms of Reference, plus background material. We suggest the Core Team consider exploiting, in their process of implementing MIS, the experience (both good and bad) other organizations have had with MIS.

The CSC contributed to the process by assembling recommendations (Appendices I and II). Here we present an updated list of our main recommendations related to implementing a MIS system.

R 7.1 Evaluate the need for additional hardware for MIS, operational support, and training of CS staff.

R 7.2 Consider hiring an additional person for MIS customizing and adjustments, potentially in conjunction with the function of database user support (recommendation 4.13).

R 7.3 Select a MIS that communicates well with Microsoft Office as well as with freeware (Open Office, Linux etc.).

R 7.4 Consider how to integrate and interface administration of the Young Scientist Summer Program (YSSP), of the Retirement Benefits Plan (RBP), and of conferences by CVS as part of the MIS.

Recommendation 7.2 is motivated by the fact that costs for external development are huge, in excess of €1200 per day.

Since an MIS is database-centric, IIASA could use this technological change for improving the handling of information flows other than those needed by management. In particular, IIASA could benefit from considering a systematic approach to document management, also outside the areas targeted by the currently planned MIS (see recommendation 9.2). The manual management of large sets of various documents is becoming more and more painful as those sets grow. The routine method for distributing even a simple text file within IIASA, by sending Word documents as email attachments, is quite inefficient. To implement a database-centric strategy at IIASA, a uniform platform for database tasks is required.

R 7.5 Phase out the use of Microsoft Access and encourage the use of Oracle. All non-personal databases should reside on the central Oracle database server. Migration should start with institute-wide databases like those maintained by the library and publications departments.

R 7.6 Phase out Filenet, the archiving system used by the archives office, and include its functionality either in the MIS system or in another more efficient document management system.

The need of an institute-wide address database is commonly recognized. Although several attempts to implement it have failed, we are convinced that such a database can be implemented successfully, if such a project is carefully prepared and executed. At least two members of the CSC offer help in such a process.

R 7.7 Implement an institute-wide address database, based on a careful requirement analysis.

Similarly, work efficiency at IIASA is hampered by insufficient and scattered information about the availability of staff members. The current situation would be much improved by having available a common tool for scheduling meetings at IIASA, which taps into salient information sources to determine known constraints.

R 7.8 Implement an institute-wide calendar and scheduling system, linked with the administration of staff travel and leave.

8 IIASA Web

Even though the design and updating of IIASA's Web pages is not an exclusive responsibility of CS, the computing department is critically involved by providing technical know-how, design templates, Web-based applications, coordination services, and some Web authoring. For this reason, recommendations on matters relating to IIASA's Web presentation are included with this report.

One of IIASA's most important links to the outside world, the IIASA home page, was determined to be in need of updating and improvement. However, it was felt that problems with the home page stem largely from the policy currently in place and are not attributable to the CS staff responsible for providing technical support. The CSC thus recommends an immediate review and improvement of IIASA's Web policy, along the line of the following three recommendations.

R 8.1 Increase resources assigned to the IIASA website.

This should result in at least three improvements: creation of an active Web committee, an increase of the time CS staff can afford to devote to work on IIASA's Web site, and training of selected CS staff through courses on Web design.

The current policy for updating IIASA's home page functions only when major events occur or scientists sporadically contact CS. We therefore recommend the following improvements.

R 8.2 Increase frequency of updates to IIASA's home page. Improve the flow of information suitable for posting. Redefine the current system of director approval to avoid delays in posting.

Careful, systematic rethinking of all IIASA material presented to outside users is needed. For instance, it is currently difficult for someone to search for a scientist and their publications at IIASA via the IIASA home page.

R 8.3 Add an externally available, attractive, searchable database on IIASA scientific staff and their publications.

Email addresses should be implemented graphically to prevent spammers from obtaining email addresses.

IIASA's internal Web pages are one of our main communication channels, but are often not used to their full potential. This is partially due to the organization of information on our Web, which in some cases makes it difficult and time-consuming, even for experienced users, to find needed information and/or be alerted that such information exists. The design of our Web page is also no longer adequate for the amount and complexity of the information available on our Web server: the available information on our Web is stored in thousands of hand-coded files. Given the fact that this amount of information is still growing fast, the current strategy is not a rational approach. The recommended approach is to store our information in a database and then to provide this data on the Web in an automated way.

R 8.4 Shift to a database-centric approach for IIASA Web-based systems.

All staff involved with designing Web pages at IIASA have to obtain information on access statistics, and will thus benefit from the following recommendation being implemented.

R 8.5 Create an internally searchable database on access counts, whereby access to a particular paper or internal Web page can easily be checked.

9 Feasibility Studies

The CSC has identified a number of topics as warranting feasibility studies to accurately determine the costs and benefits of implementing these topics at IIASA. Below, a brief description outlines the focal issue of each such study. Detailed work plans are to be developed in consultation between CS and the CAC.

R 9.1 Evaluate best strategies for cluster/grid or distributed computing.

Currently, a large number of high-powered PCs at IIASA lie dormant over all evenings and weekends and during parts of the daytime. This occurs at the same time as certain scientists are confronted with a lack of computing power. Distributed computing may provide a solution to this problem: by such an approach, a large problem is solved by giving small parts of the problem to many computers and by then combining the resulting solutions for the parts into a solution for the whole problem. Software exists that recognizes idling computers on a network and allocates distributed process only to where such idle computer power is available, thus not affecting active users.

R 9.2 Assess promise of adhering to a database-centric approach to support collaborative work and document management.

IIASA could greatly benefit from considering a Web-based database-centric approach to provide infrastructure for collaborative activities and document management. A brief summary of the problems and opportunities related to document management is given at the end of the CSC recommendations described in Appendix I. If the Oracle platform will be selected as the provider of IIASA's MIS, we should exploit the related solutions also for document management and for collaborative activities. However, if another system will be selected for the MIS, then we recommend exploring how database technology can be efficiently used for supporting daily tasks of scientists and support staff.

R 9.3 Consider implementation of IP telephony.

The phone system at IIASA is out of date. It currently has no interface with our computer systems. A study into the amount of effort and investment required to update and improve the phone system, with a look towards IP telephony, is therefore needed. IP telephony, known in the industry as Voice-over IP, is the transmission of telephone calls over a data network. IP telephony has advantages, in terms of economics and infrastructure requirements. Staff would be able to place internal calls with a simple click of the mouse, in addition to external calls. These systems can communicate computer to computer, computer to telephone, and vice versa.

R 9.4 Review potential for wireless networking.

In a wireless network, all computers in a room or building broadcast their information to one another using radio signals. This can render networking extremely easy and makes it simpler to move computers around. Particular implementations are based on Bluetooth technology. Such technology may have applications in IIASA's conference/meeting rooms, where multiple laptops could then conveniently be used. Ideally, a wireless solution would give all participants in a meeting the ability to simply access network and projector.

R 9.5 Review the benefits of using a Web proxy.

A proxy server is used by other computers to access Web pages and can increase efficiency as well as security. When another computer requests a Web page, it is retrieved by the

proxy server and then sent to the requesting computer. The net effect of this action is that the remote computer hosting the Web page never comes into direct contact with anything on the IIASA network, other than the proxy server. Proxy servers can also make Internet access work more efficiently. When a page on a Web site is accessed, it is stored on the proxy server. This means that the next time a user visits that page, it normally does not have to be downloaded again from the original Web site. Instead it loads instantaneously from the proxy server.

R 9.6 Prepare plans for how best to make ADN's easy-to-use publications database available to all projects.

Between spring 2001 and autumn 2002, CS assisted the ADN project with developing a publications database application. In this solution, project publications are entered once and then are utilized for a great variety of sorted and formatted lists embedded in ADN's Web pages and brochures, which can be generated automatically. Annual listings can be produced, just as well as listings according to a set of project-specific research foci, or listings including full abstracts. A special feature of this application is that internal and external publications can be displayed in conjunction, wherever such pairings exist. The application greatly facilitates an accurate, timely, and well-designed presentation of publication lists in the variety of formats required by the project, without incurring too much continual effort on the part of project secretaries. It would thus be desirable to make this carefully developed functionality available to all projects. In the course of such an adjustment, it might be advisable to switch the underlying database from Access to Oracle, and to reconsider the language CS had chosen (erroneously) for implementing the user interface.

R 9.7 Assemble information on options for video conferencing/networking.

A system of video conferencing or networking could be implemented on various levels – the simplest being a camera attached to a scientist's computer with some corresponding software, up to dedicated hardware and facilities for conducting meetings, seminars, and conferences. Such facilities offer savings in terms of reduced travel time and expenses, and benefits in terms of tighter communication between scientists, especially for coordination in larger projects. Many solutions allow for the display of papers using the electronic document camera, showing information directly from a personal computer, playing pre-recorded video, or even taping a presentation.

Appendix I: Recommendations by the Computer Services Committee concerning implementation of a management information system at IIASA

In response to the Director's request, the Computer Services Committee (CSC) summarizes its recommendations for the implementation of a management information system (MIS) at IIASA. The purpose of this document is to provide timely input to the activities of the MIS Steering Committee and the MIS Core Team. Analysis and recommendations below are based on the input the CSC has received from a representative survey of user concerns and on deliberations in the CSC itself. These are preliminary recommendations to the Director and we understand that we will have the opportunity to discuss these recommendations in detail with the MIS Core Team.

Problems to be addressed

Two groups of problems need to be addressed, related, in turn, to the benefits an MIS might provide and to the dangers and costs its implementation could imply.

(A) First are concerns that users have consistently expressed about the following aspects of IIASA's current information flows:

- Lack of a computer-based workflow (too many paper forms).
- Insufficient database integration.
- Use of a database for document management
- Absence of several facilities falling into the MIS remit (e.g., an institute-wide calendar and scheduling system).

In general, the user feedback collected by the CSC indicates a widely recognized need for MIS-related solutions at IIASA.

(B) The second group of concerns addresses serious problems perceived in the procedure by which a MIS at IIASA is currently planned to be implemented. (Below we provide a summary of issues, without attempting to evaluate to what extent these widely expressed worries are justified):

- As yet, there is almost no consultation about the new procedures arising from switching to an MIS with those who will be affected by the changes.
- New procedures being developed during MIS implementation will cause additional, not necessarily fruitful, workload for those involved.
- Having an MIS in place makes it more likely for the directorate (or a future directorate) to fall into the trap of trying to micromanage projects or departments.
- MIS software designed for (large) production companies will enforce procedures that are not rational at IIASA.
- We may end up with using a MIS that will not support important functionality currently available (developed over many years to address various needs) because restoring such functionality will be either impossible or too expensive.
- Selecting SAP is a bad choice for IIASA (expensive product; we would have to buy many modules that are not needed; we will have to continue using SAP even if it will become much more expensive in the future).
- With the exception of FAB, the documents prepared so far by the MIS Core Team are deficient (they are too long, lack important baseline information, and do not yet specify lean interfaces between the key information flows).
- Actual costs of the MIS implementation will be much higher than the costs presented so far.

Recommendations

Most of the problems belonging to group (A) above are currently being addressed by the MIS Core Team. We highlight the following exceptions, and recommend these to the Core Team's attention:

- Administration of the Young Scientist Summer Program (YSSP) and the Retirement Benefits Plan (RBP) are not yet foreseen in the Core Team's specification of information flows. Also the organization of conferences by CVS could be supported as a MIS information flow.
- There is need for an institute-wide calendar and scheduling system, linked with the administration of staff travel and leave.
- In the longer run, document management at IIASA could be much improved by encouraging a database-centric approach, as described in the following section. Extending the more narrow focus of an MIS, a flexible information management system helping all scientific users might be desirable.

Concerning the problems belonging to group (B) above, the CSC believes that most of these issues can be clarified by improving communication within the institute, by addressing some shortcomings of the outsourced feasibility study, and by making the foreseen MIS implementation process more inclusive:

- At an appropriate stage in the MIS-selection process, all relevant information streams at IIASA ought to be quantified to obtain rough estimates of the numbers of users and documents involved, and of the complexity of document contents.
- A call for tender should make it clear that a MIS based on (a) the Oracle database and on (b) the Unix operating system would integrate best with IIASA's current computing environment. In selecting a specific MIS, (c) availability of the source code, (d) an open and well-documented interface to the underlying database, and (e) Web-based user interfaces should be regarded as strong advantages.
- Bidders should be requested to include with their offers reference lists of users, especially in research and educational institutions.
- The cost specifications of bidders should explicitly include the following items: (a) costs of development of user-specific functionality, (b) costs and resources needed for migrating to a new version of the offered solution (and information about the expected frequency of such upgrades), (c) costs and resources needed for migrating to a new version of the underlying database or operating system, (d) costs for developer and user licenses (based on an analysis of the corresponding numbers of active users), (e) costs of internal resources (including numbers of person months needed for different tasks to be performed by IIASA staff), (f) costs of user training and user support, and (g) costs of external support/consultancy.
- Based on an open call for tender, IIASA should actively ensure that not only all big players but also small companies are informed.
- Make the list of potentially successful bidders and their reference lists of users available and encourage staff to use private contacts for exploring actual user experiences.
- Ensure that the planned presentations by bidders are open to all interested IIASA staff.
- Ask bidders to install demo versions of their solutions, and organize hands-on test sessions with interested users; also provide an opportunity for CS to test the offered solutions in IIASA's servers.
- In general, keep the whole process of MIS selection fully transparent and encourage staff involvement, especially of those colleagues who will be most affected by new procedures and/or altered information flows.

Potential of a database-centric approach to document management

In the longer run, IIASA could benefit from considering a systematic approach to document management, also outside the areas targeted by the currently planned MIS. The manual management of large sets of various documents is becoming more and more painful as those sets grow, causing a significant loss of efficiency. Also, the routine method for distributing even a simple text file within IIASA (by sending Word documents as email attachments) is quite inefficient.

Salient document types for which a more systematic approach should be considered include the following:

- Documents containing scientific information (papers, drafts, notes), shared within various groups of users (a project, GGI, cross-project activities, etc.).
- Other documents circulating within the institute: drafts of research plans, research reports, agendas for meetings, guidelines for preparing documents, trip reports, requests for comments, etc.
- Archive data (managed mainly by IMA, but also by project and departments, as well as by individual staff members).
- Web pages and documents posted on our Web (various types of, with various access rights, and with various expiration dates), as well as items appearing on IIASA's news page.

To overcome these and related problems, a database-centric document management could be implemented. Some CSC members believe that such a more modern approach would greatly increase the efficiency of handling and integrating the (growing) deluge of documents and document types at IIASA. This future potential for a broader approach to information management might already affect decisions that currently have to be taken for implementing the currently envisaged, more narrowly focused MIS.

September 2, 2003

Ulf Dieckmann, Eryl Maedel, Marek Makowski (chair), Ian McCallum, Wolfgang Schoepp, and David Wiberg

Appendix II: Recommendations by the Computer Services Committee concerning the selection procedure for a management information system at IIASA

In reply to the call for comments/suggestions on the selection procedure, the CSC proposes to organize:

1. An open meeting, which will include the following agenda:

- Discussion of the set of criteria to be used for selection of the software;
- Presentation of additional information promised by vendors;
- Evaluation of presented systems by our external experts (in terms of the criteria suggested below, even if not all of them will be used for actual selection);
- Structured discussion on the key elements of the evaluation to be presented by our external experts.

We think it is essential to structure the discussion, and to start it with the evaluation by our external experts, which will hopefully provide a good basis for an efficient aggregation of various types of expertise we have at IIASA.

2. Visits of members of the Core-Team (with invited colleagues from the CS) to the institutions using the proposed systems to become familiar with the experiences of the users and of the CS departments supporting the used system. Such visits will also help to verify the cost/resource information to be provided by vendors with actual costs and resources' requirements. Additionally, we should explore how much problems are caused by upgrades of already installed systems.

We propose the following criteria for the selection of the software:

- Purchasing cost of the system.
- Annual cost of licenses for (to be defined) set of various types of users.
- Frequency and costs of major and minor upgrades.
- Evaluation of annual costs and quality of support.
- Cost of installation/customization needed for a (to be precisely defined) functionality of the first stage implementation.
- Cost of installation/customization needed for a (to be precisely defined) final functionality (if a multi-stage implementation will be planned).
- Evaluation of a quality (incl. functionality, easiness of use, amount of needed training) of the implementation.
- Evaluation of (both internal and external) resources needed for later (after the installation of the final set-up) modifications, which will be required for fitting the system to our new/modified needs.
- Evaluation of the CS and external resources needed for day-to-day operations (incl. overlap with skills needed for other tasks of the CS).
- Evaluation of the technology used by the system (including forecasted life-time of the basic technology used, and the skills needed for modifications of the system to most likely changing needs).
- Evaluation of how other needs (than already specified MIS focused on management) of information processing (including modern approaches to the Web-centered collaborative work) of all IIASA users and collaborators can be covered (and at what additional costs) by the proposed solution.
- Evaluation of how well the proposed system will fit to our needs, and if we will buy only the functionality actually needed.

- Evaluation of the expected implementation process (including timing, response to our actual needs and preferences, and user-friendliness).

The CSC is looking forward for a continuation of the open and transparent process of selecting a MIS system, and its members are willing to participate in this process. You may contact all members of the CSC by email sent to csc@iiasa.ac.at.

November 4, 2003

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Appendix III: Comparison of Findings of the Computer Services Committees in 1998 and 2003

Once the results of the 2003 survey and some of the interviews were in, the CSC looked back at a review of CS at IIASA from 1998 to see if similar issues existed in 1998 and to find if improvements had been made with regard to some of the common issues. The full 1998 report can be found on the Web at www.iiasa.ac.at/~marek/csc/csc98.html. The comparison below was used internally by the CSC to aid in developing the report; results are not meant as comprehensive lists of issues raised during the process or mentioned in the final report.

In 1998, CS staff was reduced by 30%, from 10 person-years in 1997. Users' comments about CS reflected that CS was doing well at providing services for the computing infrastructure and trouble-shooting support. Comments on CS's personal support were positive (only about 5% negative) and text processing support was considered good. The LAN and Internet connection were upgraded in 1998.

Table 5 lists the main problems found in the 1998 CSC report vis-à-vis the information gathered in 2003. Based on the available material, the second and third columns show if these problems were deemed significant in the corresponding year. Specifically, these interpretations relied on information from the CSC report of 1998, the CSC survey of 2003, and on interviews and CSC meetings from 2003.

Table 6 shows the suggested solutions and action items that the 1998 CSC proposed, in conjunction with the status of those recommendations. The broad recommendations of the 1998 report can be summarized by the following four general guidelines, which were discussed in the 1998 report:

- Improve training and available information about hardware and software to reduce the demand for support.
- Store Web pages and data in a database connected to the Web and use standardized Web forms for news postings.
- Improve administrative database updating and management.
- Create tools needed for document management, group scheduling, group data analysis, and report-driven conferencing.

A standardized Web form for news postings is now available. Other than that, these guidelines still reflect the issues in 2003.

Problem description	Problem in 1998	Problem in 2003	Comment
1. Support/training	Y	Y	Users are generally happy with support given limited resources, but based on their priorities would still like more support and training.
a. Lack of programming support.	Y	Y	People have adjusted to a lack of programming support by learning programming on their own. However, database programming support is needed.
b. Not enough training.	Y	Y	High priority on increasing training.
2. Problems with common databases	Y	Y	
a. Access and Oracle support not so good.	Y	Y	
b. Improvements needed in library catalogue.	Y	Y	
c. Too many different address databases and not all updated. Address database not easy enough to use.	Y	Y	
d. Lack of a document management system.	Y	Y	
3. Information and organization	Y	Y	
a. Inadequate information about CS policies and constraints, i.e., what CS is responsible for and what they are not, what are the priorities.	Y	Y	
b. Poorly designed Web pages. Information difficult to find. (news articles removed too early, no indication of current news, searching difficult, posting in viewable format difficult).	Y	Y	The Web pages have been improved, but many more improvements are still needed and are recommended in this report.
c. Lack of intelligence on new software tool developments and promotion of these new tools.	Y	Y	
d. Lack of knowledge sharing within institute (who uses what software and what do they know).	Y	Y	
4. Common forms not computerized (the workflow committee in 1998 identified 50 forms to be computerized).	Y	Y	One or two forms have been implemented online, but most have not. These issues are now being addressed by the MIS committee.
5. Software			
a. Upgraded too quickly; a more stable environment may be better.	Y	N	No mention of this problem in 2003.
6. Hardware			
a. PCs too slow for software.	Y	N	This is much improved.
b. Servers 4 to 5 years old and overloaded.	Y	Y	Still a problem.
c. Not enough laptops for travel.	Y	Y	More people have their own, but providing and supporting laptops is still an issue.
d. Pool of computers for visitors not available.	Y	N	No mention of this in 2003.
e. Better monitors needed.	Y	Y	
7. Network			
a. Spam.	N	Y	
b. External access to network.	N	Y	

Table 5: Problems in 1998 and 2000: The second and third columns show whether this was/is a problem (Y) or was/is not a problem (N) in the corresponding year.

Recommendation	Status	Comment
1. Improve communication between CS, users, and admin to provide users with an understanding of existing possibilities and constraints, provide CS with information about the demand for different types of support, and to spread knowledge between users.	4	
a. Annually update and post the CS development plan.	4	
b. Improve information on computing problems and plans by regular Web postings.	4	
c. Organize regular seminars to teach software usage and new tools, techniques, trends, opportunities.	4	
2. Precisely define the scope and priorities of services by CS and make them known to staff.	2	
3. Define each person's job within CS clearly and publish their roles.	4	
4. Improve CS's Web page for help requests and encourage its use. Keep track of requests, the responsible person, and their status.	4	
5. Suggestions/comments box should be maintained on Web.	4	
6. Increase support and training and make it a priority.		
a. In-house training for basic software.	5	
b. Organize training courses for different skill levels.	5	
c. Introductory session for each new user.	4	
d. Purchase self-education tools/tutorial as books, CD-ROMs and videotapes.	4	
e. Keep a FAQ database and also maybe tips-and-tricks database, which can be updated by CS as well as other knowledgeable users. Link to FAQ databases and information on other pages.	4	
f. More graphics training and development of procedures for standardizing graphics in documents at IIASA.	4	
g. Improve software database to keep it up to date and list software supported by IIASA, software available but without onsite support, new acquisitions, orders, most recent versions supported.	3	
h. Improve access to hardcopy documentation of software and training books.	4	
i. Update "The guide to computing at IIASA" regularly.	3	
j. Acquire and distribute expertise on Java.	5	Database expertise is a higher priority, but often these go together.
7. Provide each user with a rwx-w--w- directory on his/her I: drive and in the incoming directory on the anonymous ftp server.	4	
8. Online info about each user should be provided and sorted in ~user/.project files.	1	This has been done, but should be advertised so that users know how it works.
9. Standard setup should include a virus checker, Quickview Pro, and WinZip.	3	This is essentially done, but does not yet seem to be consistent for all computers.
10. Policy for upgrading software based on hardware requirements.	6	No longer an issue.
11. Continue both Unix and NT.	1	
12. Use only one version of Solaris Unix and of NT on all machines, but have one machine that runs older versions of software for testing.	1	
13. Continue LaTeX support and graphics support.	1	
14. Reorganize website to make information more readily available.	2	Needs improvement.
15. Improve Web usage with easy to use forms for news, documents.	2	Needs improvement.
16. Provide zipped copies of documents as well as pdf and ps.	4	
17. Implement SSL and consider SET.	1	SFTP and SSH should be available on all servers now, as well as SSL.
18. Computerize frequently used forms.	3	Now being considered by MIS.
19. Document management through Oracle.	4	Should be considered with MIS.

20. Improve archives system.	2	Filenet was used, but archives should be done with Oracle and/or joined with the MIS.
21. More support for Access and Oracle.	4	Specifically for Oracle, Access should be phased out.
22. Support need for scientific applications using databases.	4	
23. Consistent approach for administrative databases. Usable centralized address database needed.	4	Should be considered with MIS.
24. Port library and publications databases to up-to-date technology.	4	
25. Bibliographical database needed.	6	
26. Commercial firewall needed; passwords on gate should be different than normal login password.	4	
27. Make it easier to send faxes by computer and automatically schedule them to send at times with lower connection prices.	2	Needs improvement and advertising, but scheduling no longer necessary.
28. Systematically upgrade servers.	3	
29. Purchase a new machine for numerical computations by summer 1998 with two 300 MHz processors and 512 MB RAM.	6	We do need machines capable of scientific calculations, perhaps with grid computing.
30. Improve common network file services with dedicated file server or 1-2 Intel PCs running network file services under PC Unix and appropriate fast storage.	6	A dedicated file server is still a good idea, but very expensive and not a priority.
31. UPS for all servers.	4	
32. Implement Section 2.3 of plan for development of IIASA's computing environment.	3	Should be periodically reviewed by CAC.
33. Good quality switches.	1	A switch that supports VPN is now needed.
34. PCs should not be older than three years.	1	Continued efforts needed.
35. Recognize computing needs of YSSP and encourage them to bring laptops. Lease computer for YSSP program if necessary.	1	Leasing was explored, but found not feasible.
36. Purchase additional RAM as a cheap upgrade alternative.	6	
37. Plan for upgrading outdated Unix workstations.	4	
38. Provide a computer with CD-writer in public place.	2	We now need a DVD-writer.
39. Review adequacy of presentation facilities at least once per year.	2	Wireless access to mouse, network, and projector are now recommended for the presentation rooms.
40. Regular backups of local drives	4	Perhaps, backups of just some user-specified directories on the local drives are needed.
41. Improve remote access to the LAN, mail, and files from home directory, complete remote login.	4	VPN needed.
42. Audio conferencing via Internet as an alternative to telephone.	4	Feasibility study recommended.
43. Possibility of staff to personally purchase PCs with the discount we get for our annual PC purchase.	6	Not possible.

Table 6: Recommendations of the 1998 CSC report. The status of each recommendation is indicated as follows: 1 = Done, 2 = Done but now needs improvement, 3 = Partially done and needs improvement, 4 = Not done and still needs doing, 5 = Not done and not directly recommended here, but would be beneficial, 6 = No longer recommended.