R E P O R T

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AGROFORESTRY - AGROMETEOROLOGY SUBPROJECT

COMPUTER CONSULTANCY

NEW DELHI: August, 1989

Consultant Report by

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1. SUMMARY

The consultancy was undertaken to evaluate microcomputers manufactured in India and to recommend whether or not they should be purchased for the agroforestry and agrometeorology subprojects. Five firms manufacturing IBM compatible microcomputers in India were interviewed. On the basis of appearance, performance and nation-wide service and maintenance networks, I recommend a PIL be prepared to authorize the purchase of 23 IBM compatible microcomputer systems. Bid specifications are provided for each of the recommended systems.

2. OVERVIEW OF CONSULTANCY

The research and technology transfer work envisaged under the Agroforestry and Agrometeorology subprojects involves extensive use of electronic data processing (EDP) equipment including computer hardware, software and peripherals. Originally it was envisaged that such equipment would be imported from the United States. However, during the last few years after the formulation of the subproject documents the Indian computer industry has made rapid strides and a wide range of Indian made EDP equipment has become available in the market at competitive prices and support services. Therefore, a current assessment of factors which effect the procurement of EDP equipment under these two subprojects was undertaken. That assessment would include a recommendation as to whether or not computers should be purchased from Indian manufacturers. The complete terms of reference are given in the Appendix A.

ICAR identified a group of four scientists to work with the consultant during this assignment. The individuals were:

Dr. Prem Narain
Director, IASRI

Dr. S.S. Pillai
Jt. Director (CS), IASRI

Dr. P.C. Bhatia
Principal Scientist, ICAR

Dr. B.V. Ramana Rao
Project Coordinator (Agromet), CRIDA, Hyderabad

3. EVALUATION METHODOLOGY

Winrock International developed an interview schedule with five of the leading manufacturers of microcomputers in India (Appendix B). The team met prior to the first interview to

discuss the data processing requirements of the agroforestry and agromet subprojects and to formulate a set of issues that each manufacturer would be asked to address. The issues were considered under the premise that scientific applications would be the major data processing activity associated with the use of computers on these two subprojects. Scientific applications were defined as:

Statistical analyses using commercially available software, i.e. SPSS, SYSTAT, and BMDP.

Computer modelling using commercially available programming languages, i.e. Fortran, Basic, Pascal, and GPSS.

Data base development and management using commercially available data base software in conjunction with electronic data loggers to facilitate the capture of information.

The following issues were addressed by each manufacturer:

Computer Processor Capability
- Microprocessors
- Coprocessors
- Speed
- Memory
- Multiuser-multitasking

Peripheral Availability and Capability
- Disk Drives
- Tape Drives
- Printers
- Plotters

Software Availability and Support

Training

Maintenance and Service

Facility Requirements

Following the presentations, on-site visits were conducted at three of the firms offices (Appendix C). During these visits equipment was demonstrated and training and service procedures were discussed.

4. FINDINGS

A range of microcomputers were overviewed by the firms. They included:

a. An IBM compatible with an Intel 80286 16-bit microprocessor having a clock speed of 8-12 MHz.

b. An IBM compatible with an Intel 80386 32-bit microprocessor having a clock speed of 16-20 MHz.

c. An IBM compatible with an Intel 80386 32-bit microprocessor and 32-64 KB of RAM cache memory having a clock speed of 20-25 MHz.

Each can be configured with a math coprocessor, a range of RAM, floppy and hard disk drives, cartridge tape drives, monochrome and color monitors, printer and plotters.

Based on the presentations and site visits, the visual appearance of the microcomputers and their operation were similar to IBM compatibles marketed in the U.S.

All of the firms interviewed had a strong service orientation. Most of the firms had between 40 and 80 service centers distributed throughout India. The centers are staffed with engineers and limited inventories of hardware replacement components. Annual service contracts can be written to provide assistance on demand or on a periodic schedule. Remote locations can be included under these contracts.

Floppy and hard disk drives, cartridge tape units and dot matrix printers are directly available from Indian manufacturers. Laser printers and plotters can be procured by Indian firms from U.S. manufacturers.

Software required by the subprojects is available from all of the firms that were interviewed. It is obtained by these firms under licencing agreements with the U.S. manufacturers. Its cost appears to be significantly greater in India.

5. RECOMMENDATION

On the basis of appearance, performance and nation-wide service and maintenance networks, I recommend a PIL be prepared to authorize the purchase from Indian manufacturers of any of the three IBM compatible microprocessor based systems referenced in the previous section.

In addition to the microprocessor and peripherals, power conditioning, short-duration UPS systems and life of project

service contracts should be considered an integral part of the data processing package. This package should be placed on bid and procured as a single item.

There may be significant saving to the project if software is procured directly from U.S. distributors. Installation and training in its use could be a component of the hardware and service contract.

6. SELECTION CONSIDERATIONS

Before bid solicitations can be prepared, the type or combination of types of microprocessor based systems described in Section 4 must be selected. All of the tasks envisioned in the subproject documents during the next 3-5 years could be performed on an IBM compatible computer with an Intel 80286 16-bit microprocessor. Computers with the Intel 80286 microprocessor will process data and project computer model outcomes more slowly than computers with Intel 80386 32-bit microprocessors. During the management and analysis of large data bases this difference could be significant. Under selected mathematical analyses, the accuracy of the computations may also have a lessor number of significant digits and, thereby, give less precise results. As existing software is modified and as new software is developed both will be designed to take advantage of the speed and numerical properties of a 32-bit microprocessor. The performance of the system in a multiuser/multitasking environment would be greatly enhanced with a 32-bit microprocessor. All of these factors would favor the acquisition of computers with Intel 80386 microprocessors.

The microcomputers with Intel 80386 microprocessors in conjunction with RAM cache provide processing capability that would allow these computers to perform similar to smaller mini computers in terms of speed of processing and support of multiuser work stations. Thus, this computer system offers excellent 3-5 year data processing growth potential for the agromet coordinating unit.

Compatibility of the microcomputer systems within a subproject should be emphasized. If all of the sites have microcomputer systems with similar microprocessors, it will facilitate the sharing of programs, operating procedures and data and it will simplify training.

Computer systems used for scientific computing need to have sufficient RAM and hard disk space to utilize advanced software available and currently in use. Statistical analysis and data base software systems require at least 2 MB of RAM to process data in an acceptable time frame.

High selection priority should be given to firms which can effectively service and maintain the microcomputers regardless of their location. Long-term service contracts are essential if equipment performance is to be maintained.

High selection priority should be given to firms which have research and development programs associated with the manufacturing of their computers. Research and development might be used as an indicator to separate firms that truly manufacture computer systems from those which are mainly involved with the assembly of computer components manufactured elsewhere. One would expect that manufacturers would generally provide better long-term service than firms concerned only with assembly.

Software systems identified for these subprojects are manufactured exclusively in the U.S. although Indian firms can supply the U.S. software. It appears that it may be cost effective to obtain "Not Made in India Certificates" for software and procure it directly from the U.S. This might reduce the cost of the software by 50 percent.

7. SUGGESTED SOLICITATION

Based on subproject requirements, computer firm presentations and site visits, and considerations discussed in Section 6, a solicitation for bids on the computer systems described below would be appropriate. This combination of computer systems would provide a price-performance-growth package that should meet the needs of the subprojects for the next 5-year period.

TABLE 1. Proposed Computer System Packages by Subproject Sites.

7 Agroforestry Subproject Sites
IBM compatible microcomputers with an Intel 80286 microprocessor.

15 Agromet Regional Sites
IBM compatible microcomputers with an Intel 80386 microprocessor without RAM cache memory.

1 Agromet Center
IBM compatible microcomputers with an Intel 80386 microprocessor with RAM cache memory.

Detailed hardware and software configurations for each of the microcomputer systems are given in Appendices D, E and F, respectively.

8. IMPLEMENTATION CONSIDERATIONS

Training needs to be an integral component of a computer systems package. All of the firms interviewed have the ability to provide training in the use of operating system, word processing, spread sheet and data base applications. In addition, numerous institutes in both the public and private sectors can also provide similar training. All scientists who will be using the computer systems should initially receive the following amount of training in the use of the software:

Hardware & Operating System	2 days
Word Processing	3 days
Spread Sheet & Graphics Applications	3 days
Data Base Applications	3 days
Statistical Applications	3 days

In ICAR, institutes such as IARI and NARM could provide this type of training although these institutes might most effectively concentrate on training in statistical applications.

The initial training should be provided immediately upon receipt of the computer systems. It might be included as a part of the installation contract. The training could occur at one or more central locations but the groups of trainees should be small enough to provide all of them significant hands-on experience over the 14 day period. This training is especially important for scientists at remote sites where easy access to technicians and software experts is not available.

Approximately three months after the scientists receive the initial training it would be appropriate and highly desirable to provide those who are using the systems with a 5-day refresher training. After three months they would be skilled in the use of basic applications and would likely be struggling with more advanced applications. Follow-up training at this point would greatly increase their effectiveness.

Selected scientists in the subprojects will need to receive advanced training in the use of the operating system and in spread sheet, graphics, data base and statistical applications. An estimate of the additional training that might be required in each of these areas is:

Hardware & Operating System	4 days
Spread Sheet & Graphics Applications	6 days
Data Base Applications	12 days
Statistical Applications	6 days

Individuals who receive training in one or more or these areas could provide training to other scientists in the subprojects as appropriate over the life of the projects.

Effectively service and maintenance of the microcomputer systems, regardless of their location, is absolutely essential. Long-term service contracts are available, necessary and cost effective.

The computer systems must be provided power conditioning equipment and UPS systems. These two items will significantly reduce maintenance problems. Furthermore, a 10-minute UPS backup system is essential in regions with unscheduled power outages if effective use is to be made of the systems.

Ideally, the computer systems would be placed in air conditioned rooms. These could provide a cleaner environment and, thereby, reduce service problems and extend the life of the equipment. Since the annual operating costs of air conditioners can be significant, the requirement of an air conditioned environment should be relaxed if it prohibits the use of the computer system.

Peripherals which use imported consumables such as laser printers and x-y plotters have high operating costs associated with their use. In general, these equipment also require more service. They may most easily be maintained at research institutes with larger operating budgets and a large number of research programs.

APPENDIX A - TERMS OF REFERENCE

A consultant with an understanding of simulation modelling aspects of the Agroforestry and Agrometeorology subprojects will:

1. Review computer specifications outlined in subproject documents to determine if they are adequate for applications to proposed research and if same hardware may be used for both subprojects.

2. Review specifications of equipment now being manufactured in India, interview local suppliers of this equipment and examine their products to determine if it is suitable for these subprojects.

3. Recommend whether or not a PIL should be prepared to authorize the purchase of these computers in India. Alternatively, the consultant would indicate reasons for non-suitability of locally available equipment.

APPENDIX B - FIRMS INTERVIEWED

HCL Limited
Bajaj House
97 Nehru Place
New Delhi - 110019

International Computers Indian Manufacture Limited (ICIM)
5 Sansad Marg
Jeevan Tara Building
P.O. Box 76
New Delhi - 110001

Modi Olivetti
77, Friends Colony
New Delhi - 110065

Pertech Computers Limited (PCL)
E46/10
Okhla Phase II
New Delhi - 110020

WIPRO Information Technology Limited
2nd Floor Skylark Building
60 Nehru Place
New Delhi 110019

APPENDIX C - FIRMS VISITED

HCL Limited
Bajaj House
97 Nehru Place
New Delhi - 110019

ICIM
5 Sansad Marg
Jeevan Tara Building
P.O. Box 76
New Delhi - 110001

WIPRO
2nd Floor Skylark Building
60 Nehru Place
New Delhi 110019

APPENDIX D - HARDWARE AND SOFTWARE SPECIFICATIONS

AGROFORESTRY SUBPROJECT SITES

Seven (7) units of the following equipment, supplies, and services should be included in one or more solicitations:

Computer

- Intel 80286 12/16 MHz microprocessor
- 80287 12/16 MHz coprocessor
- 2 MB 16-bit RAM
- 1.2 MB 5.25" floppy disk drive
- 60/80 MB 1:1 interleave fast access hard disk
- 40 MB cartridge tape backup system
- Dual floppy disk/hard disk/tape controllers
- 2 16-bit expansion slots
- 1 8-bit expansion slot
- 2 serial ports and 1 parallel port
- printer/serial card
- 14" VGA color monitor with graphics adapter card
- 101 key Keyboard
- Necessary cables and cords
- Clock with battery backup
- Fully DOS and OS/2 compatible
- Users and technical reference manuals
- 220/240 V AC, 50 Hz, 250/350 W power supply

Printer

- 132 column 24-pin dot matrix printer with graphics card; pressure and pin feed; draft, standard & NLQ print options; and 220/240 V AC, 50 Hz power supply.

Power Conditioning Equipment

- Power stabilizer, surge protector and noise filter
- UPS which will provide 10/15 minute 220/240 V AC, 50 Hz, 440 W backup power supply.
- Window air conditioner Unit

Consumables

- 4 boxes each containing 10 DSDD 5.25" diskettes
- 4 40 MB tape cartridges
- 1 case of printer paper

Software	Priority
DOS 4.01	1
WordPerfect 5.0	1
Lotus 1-2-3	1
dBASE IV	1
SPSS	1
Micrsoft Chart	2
Harvard Presentation Graphics	2
BASIC Compiler	*
FORTRAN Compiler	*
PASCAL Compiler	*

Note: * - Priority based on individual research program requirement

Installation and Service

- Installation at the 7 Subproject Sites
- 1-year warranty
- 3-year contract providing service at the 7 Subproject Sites
- 14-day training program on the hardware and operating system and in the use of the application software

APPENDIX E - HARDWARE AND SOFTWARE SPECIFICATIONS

AGROMET REGIONAL CENTERS

Fifteen (15) units of the following equipment, supplies, and services should be included in one or more solicitations:

Computer

- Intel 80386 16/20 MHz microprocessor
- 80387 16/20 MHz coprocessor
- 2 MB 32-bit RAM
- 1.2 MB 5.25" floppy disk drive
- 60/80 MB 1:1 interleave fast access hard disk
- 40 MB cartridge tape backup system
- Dual floppy disk/hard disk/tape controllers
- 1 32-bit expansion slot
- 4 16-bit expansion slots
- 2 8-bit expansion slots
- 2 serial ports and 1 parallel port
- printer/serial card
- 14" VGA color monitor with graphics adapter card
- 101 key Keyboard
- Necessary cables and cords
- Clock with battery backup
- Fully DOS, UNIX and OS/2 compatible
- Users and technical reference manuals
- 220/240 V AC, 50 Hz, 250/350 W power supply

Printer

- 132 column 24-pin dot matrix printer with graphics card; pressure and pin feed; draft, standard & NLQ print options; and 220/240 V AC, 50 Hz power supply.

Power Conditioning Equipment

- Power stabilizer, surge protector and noise filter
- UPS which will provide 10/15 minute 220/240 V AC, 50 Hz, 440 W backup power supply.
- Window air conditioner Unit

Consumables

- 4 boxes each containing 10 DSDD 5.25" diskettes
- 4 40 MB tape cartridges
- 1 case of printer paper

Software	Priority
DOS 4.01	1
WordPerfect 5.0	1
Lotus 1-2-3	1
dBASE IV	1
SPSS	1
Micrsoft Chart	2
Harvard Presentation Graphics	2
BASIC Compiler	*
FORTRAN Compiler	*
PASCAL Compiler	*

Note: * - Priority based on individual research program requirement

Installation and Service

- Installation at the 15 Regional Centers
- 1-year warranty
- 3-year contract providing service at the 15 Regional Centers
- 14-day training program on the hardware and operating system and in the use of the application software

APPENDIX F - HARDWARE AND SOFTWARE SPECIFICATIONS

AGROMET COORDINATING UNIT

One (1) unit of the following equipment, supplies, and services should be included in one or more solicitations:

Computer

- Intel 80386 20/25 MHz microprocessor
- 80387 20/25 MHz coprocessor
- 64 K Static RAM Cache and controller
- 4 MB 32-bit RAM
- 1.2 MB 5.25" floppy disk drive
- 120/160 MB 1:1 interleave fast access hard disk
- 40 MB cartridge tape backup system
- Dual floppy disk/hard disk/tape controllers
- 2 32-bit expansion slots
- 4 16-bit expansion slots
- 2 8-bit expansion slots
- 2 serial ports and 1 parallel port
- printer/serial card
- 14" VGA color monitor with graphics adapter card
- 101 key Keyboard
- Necessary cables and cords
- Clock with battery backup
- Fully DOS, UNIX and OS/2 compatible
- Users and technical reference manuals
- 220/240 V AC, 50 Hz, 250/350 W power supply

Printer

- 132 column 24-pin dot matrix printer with graphics card; pressure and pin feed; draft, standard & NLQ print cptions; and 220/240 V AC, 50 Hz power supply.

Power Conditioning Equipment

- Power stabilizer, surge protector and noise filter
- UPS which will provide 10/15 minute 220/240 V AC, 50 Hz, 440 W backup power supply.
- Window air conditioner Unit

Consumables

- 4 boxes each containing 10 DSDD 5.25" diskettes
- 8 40 MB tape cartridges
- 1 case of printer paper

Software	Priority
DOS 4.01	1
WordPerfect 5.0	1
Lotus 1-2-3	1
dBASE IV	1
SPSS	1
Micrsoft Chart	2
Harvard Presentation Graphics	2
BASIC Compiler	*
FORTRAN Compiler	*
PASCAL Compiler	*

Note: * - Priority based on individual research program requirement

Installation and Service

- Installation at the coordinating unit
- 1-year warranty
- 3-year contract providing service at the coordinating unit
- 14-day training program on the hardware and operating system and in the use of the application software