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**DEVELOPMENT OF TECHNO-MANAGEMENT INFORMATION SYSTEMS
FOR
RESEARCH AND DEVELOPMENT PROGRAMMES**

**SUBMITTED TO
INTERNATIONAL DEVELOPMENT RESEARCH CENTRE
OTTAWA, CANADA**

JUNE 1992

**BAIF DEVELOPMENT RESEARCH FOUNDATION
"KAMDHENU", SENAPATI BAPAT MARG, PUNE - 411 016.**

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CONTENTS

1.0 INTRODUCTION

2.0 OBJECTIVES

2.1 General Objective

2.2 Specific Objectives

3.0 METHODOLOGY

4.0 RESEARCH STUDY

4.1 Graphic Information System

4.2 Electronic Communication

4.3 Development of application systems for national programme monitoring and analysis of research data

4.4 Development of expert systems

5.0 PROJECT AREA

6.0 DURATION

7.0 BUDGET

ANNEXURES :

Activity Phasing : Annexure 1

Budget Summary : Annexure 2

Budget Notes : Annexure 3

DEVELOPMENT OF TECHNO-MANAGEMENT INFORMATION SYSTEMS
FOR
RESEARCH AND DEVELOPMENT PROGRAMMES

1.0 INTRODUCTION :

BAIF has taken up various rural and tribal development programmes like Dairy Cattle Production, Agroforestry, Socio-economic rehabilitation of tribals, Renewable Energy Sources and other such projects. BAIF's programmes are spread over six states and reach out to over 6,00,00 families in over 800 villages. As the programmes grew it became essential to design effective systems to provide the management with information and the field programme coordinators with feed-back. Electronic data processing became important and with the help of IDRC an EDP cell was formed under the Information Resource Centre project.

With the support from IDRC the Information Resource Centre was housed in a new premises at Pune now named as the BAIF Information Resource Centre (BIRC). A number of micro-computers were procured and installed at the BIRC, the Central Office and the research campuses at Urulikanchan, Wagholi and Vandsa. The EDP Cell identified various areas for computerisation and a number of application systems were taken up for development. Several research studies, experiments and data from field programmes were analysed using computer software. At the Headquarters nearly all staff have been given extensive in-house training in various software packages so that every programme that is being taken up from the Headquarters could make use of software tools for analysis and data processing.

As BAIF is involved in various programmes covering a large number of families the administrative functions are many. Computerisation has played an important role in the Finance and Administrative departments of BAIF. It is due to computerisation of the Financial Accounting, Socio-economic Rehabilitation programme monitoring, Dairy Cattle Field data recording that BAIF is now capable of giving administrative support to the programmes as they are being replicated in other geographical areas.

BAIF's programmes in different states are run and managed through various regional associated organisations. The programmes differ from region to region and keeping this in mind BAIF has decided on a distributed data processing approach. Keeping this in mind the EDP drawn a plan to install micro-computers at regional headquarters and campuses. A few application systems have been developed and implemented specifically to be used at either the project area or the research campuses. Various recording formats have been designed by the EDP for capturing and reporting information about ongoing programmes. Software development, analysis and training are being taken up centrally at BIRC, Pune. The effect of the applications developed has been a direct help to the rural families by way improved quality of programme services and faster processing of payments for the work that had be done and also to the field coordinators by analysing actual performance with targets that had been set.

With the support of IDRC it has been possible to acquire the latest software systems, appropriate hardware and to get up-to-date information about latest information technologies. The EDP personnel have been able to attend various seminars, workshops and training programmes which has helped in enriching the expertise of the team to take up assignments in areas of BAIF's interest. With the experience of the first five years and keeping in view the growth of BAIF's programmes it was felt to develop application systems which would take a holistic approach to the socio-economic developement of a given area. This project will make use of different computer technologies to meet its objectives of providing information suport to the management and the field coordinators.

2.0 OBJECTIVES :

General :

The objective of the project is to design and develop computer applications for improved management systems of Development Research programmes.

Specific :

- 2.1 To make use of GIS Techniques for planning and implementing research and development projects and Integrated Area development programmes.

- 2.2 To develop and strengthen the communication between the Field Programmes and the Headquarters by making use of Communication technologies.
- 2.3 To develop Expert Systems in relevant areas such as animal disease surveillance and diagnosis.
- 2.4 To provide data analysis support to various studies carried out under various research projects and for monitoring field programmes.

3.0 METHODOLOGY :

This project aims at applying new techniques like computer aided GIS, Electronic Communication and Expert Systems. The Computer Section will continue to develop and maintain application systems for various divisions/programmes of BAIF. Under this project the computer section will primarily work in the following areas, namely :

1. Geographic Information Systems
2. Electronic Communication
3. Development of Application Systems for Regional Programme Monitoring and Analysis of Research Data
4. Development of Expert Systems

The details of the proposed work are detailed out as research studies in section 4.0.

Also training will play an important role in all the activities mentioned above. Details of the same are given below :

Training :

Computerisation of procedures at BAIF has made training an important function of the Computer Section. A number of training programmes are being conducted for staff at different levels. In order to integrate computers into the working environment it is necessary to create a computer culture in the organisation so that managers and staff make use of the various software packages available.

It is planned to have a number of training programmes at the headquarters and at various campuses and regional centres. The programme designs will be flexible and based on the needs of the trainees. The efforts will be in these two areas :

- a) General orientation directed training directed towards increasing the computer awareness and literacy level. The focus will be on creating the ability to be able to appreciate the rationale for computerisation. The trainees will be Managers, Researchers & Programme Coordinators.
- b) System specific training directed towards enhancement of knowledge and skills essential to use specific computer application software. The trainees will be Computer Programmers, Librarians, Administrative and Secretarial Staff, Accountants and other staff related to various programmes.

4.0 RESEARCH STUDIES :

4.1 Geographic Information Systems :

Introduction :

Geographic Information Systems (or GIS) is a system of hardware, software and procedures designed to support the capture, management, manipulation, analysis, modeling and display of spatially referenced data for solving complex planning and management problems. GIS packages like PC-ARC/INFO have the ability to carry

out spatial operations and to link data sets together using space as the common key. At BAIF it is planned to use GIS techniques in BAIF's Water Resources Development programme and also for Integrated Area Development programmes.

a) Computer aided GIS for Planning Watershed Programmes :

Research Design :

BAIF has taken up Water Resources development as a priority programme. This programme has already been initiated in Akole and Bharatgaon in Maharashtra. In the tribal area of Vansda, Gujarat BAIF has been working in conserving water through various measures since a long time. Looking at this need the Computer Section has procured the hardware and PC/ARC INFO software with IDRC support and has initiated work for the Watershed Development programme in Akole area of Maharashtra.

*Did Mrs. Lahiri
(or anyone else)
do a consultancy
in selection of
GIS software modules,
etc?*

The Water Resource Development programme is being carried out in fourteen villages of Akole taluka of Ahmednagar district. The initial work on GIS using PC/ARC INFO for this project will be useful to develop and approach relevant for other Watershed Development programmes to be taken up in different areas.

The data needs are based on the objective of the programmes and all data which are related to the study area are collected through different existing maps, reports, field surveys and other types of documentation. The basic types of data include :

- Elevation/Contours :

From toposheets (1:50,000), Satellite Imageries

- Water Resources Development :

From toposheets, Published maps of Geological Survey of India, Revenue maps, Hydrometeorological data

- Wasteland Development :
Cadastral maps from Revenue Dept., Suitability criteria for species from Forest Dept.,
- Forest Land development :
Forest compartment maps, forest cover from satellite imageries etc..
- Agricultural Land Development :
Maps from Department of Agriculture for land capability and land irrigability etc..

The above maps will be digitised and the reports/documentations will be stored in a relational database accessible through DBASE III+ and PC/ARC-INFO. By overlaying of various data sources into a single coverage different outputs would be generated like :

- Contour Maps
- Slope Groups
- Possible sites for geophysical investigation, erecting water harvesting structures, sites for minor irrigation projects.
- Delineation of sub-watershed and micro-watershed, suggestions for soil and water conservation treatment.
- Inventory of Waste-land, Forest Lands and recommendation for its development.

b) Computer aided GIS for Integrated Area Development:

Research Design :

During the course of this project the Computer Section will prepare primary database of economic, social and spatial information and the analysis of these data sets will be used in deciding action areas, needs, priorities etc.. in planning and formulation of

projects for those areas. This integrated approach will only be possible by making use of computer aided GIS technology.

The study area selected is Mysore or Dharwad districts of Karnataka and the tribal area of Vansda as BAIF has been working in these areas. There are campuses of BAIF situated in these project areas and the programmes are managed from these campuses.

It is proposed to capture all the information available for these regions and apply various GIS methods to find out the existing situation and to plan implementation of projects accordingly. Data for this purpose will be collected from different sources in the form of maps, reports and tables. The basic types of data include :

- Village level maps giving details of land holding.
- Soil Maps giving information about soil type.
- Land Use maps giving details about Land use, soil classification etc..
- Toposheets giving information on Slope and Aspect.
- Census data about population
- Socio-economic information about Services and facilities, Water supply, Education, Road maps, Government schemes etc..

The above data will be integrated and current data generated will be linked and various tabulations, coverages etc.. would be produced for situation analysis which would help in deciding strategies for development projects. Action areas can be worked out by analysing the data from time to time. Development of infrastructure, market and other strategies can be considered by viewing the entire area and programmes can be implemented by involving local Voluntary agencies.

4.2 Electronic Communication :

Introduction :

BAIF has been involved in various programmes which are spread geographically. The projects are managed regionally but the expertise and guidance has been given from researchers, managers and technical staff at BAIF campuses situated in Pune.

Communication between the project areas and the campuses is either through telephone, which is expensive, or through mail, which is often delayed. The Computer Section will provide the hardware and communication software at regional campuses.

Research Design :

At present there are a few computer installations at Pune and installations at Baroda and Vandsa in Gujarat, Allahabad in Uttar Pradesh and Tiptur in Karnataka. There are few applications that are being used at these locations but there is very little data transfer between the computer installations. A lot of data is sent to the BIRC for processing and which is sent back to the field after being processed. This method takes a lot of time so it is proposed to process all the data at regional level and transfer the summary information to the Headquarters. This involves developing application systems and installation of necessary hardware at regional level.

In this project an Electronic Message switching system will be procured and installed at the BIRC. This will store and forward messages through Telex, PSTN, I-NET and integrate as Wide Area Network. This switching system will make use of Telex, Telephone, I-NET and Wireless communications devices and will be able to switch from one mode to another automatically.

The regional campuses will be equipped with a micro-computer connected to a modem and a communication software to send and receive messages, transfer files and also have on-line access to the BIRC database.

With the help of this switching system the following will be achieved :

Messages can be sent and received by the management, Programme Coordinators and researchers without any delay.

Data transfer between various departments for administrative matters, financial matters and matters relating to programme implementation will be possible.

The regional campuses can avail of facilities like Telex, FAX etc.. which are located at the Headquarters.

Online access to information through the BIRC will be possible to all users. This will also help the BIRC in dissemination of information to remote locations with the help of the staff situated in different campuses/offices wherever there are computers.

4.3 Development of Application Systems for Regional programme monitoring and Analysis of Research Data :

Operations

Introduction :

BAIF's field programme is spread over nearly six states in India. The regional headquarters of every state have research staff, Programme Coordinators and Administrative staff. Monthly Progress Reports about every programme giving details of tasks accomplished and administrative and financial matters are sent to the the Regional Headquarters which are compiled and sent to the Headquarters. Data collected from different sources for Baseline studies, Impact studies, health studies, onfarm trials, laboratory experiments etc. is also sent to the Computer Section for Analysis.

?

Research Design :

Application Systems will be developed for programmes like Sericulture, Livestock management, Project Monitoring and Centre Management. Currently the

Monthly Progress Reports are being sent to the Regional Headquarters and then sent to BIRC for data processing. With the help of these application systems it would be possible to print reports required for monitoring the programmes locally. A few basic analysis required for efficient monitoring of the programmes would also be possible. The Summaries of the data will be sent to the Central Office at Pune.

This data from experiments, surveys and other sources will be analysed using softwares like SPSS/PC+, DBSTAT etc. Various statistical tests and techniques will be performed on this data to draw inferences and to generate summary reports. The information generated from the analysis will be useful for for planning , implementing and monitoring of programmes.

4.4 Development of Expert Systems :

An Expert System is a computer based system that can perform some tasks which require human expertise. The solutions are of such systems are often obtained by using accumulated experience. An Expert System can preserve valuable knowledge which would otherwise be lost when an expert is no longer available as well as be used at places where an expert is not available.

Research Design :

The objective will be to build the capacity of members of the EDP team to develop expert systems. A knowledge engineering group would be formed and training would be given to the group to be able to suggest and develop expert systems. The group will attend training programme(s) for a period of 10 to 16 weeks in the following topics :

- Applied Statistics
- Heuristic programming
- Cluster Analysis
- Discriminant Analysis
- Neural Networks
- Combinatorial programming
- Math programming
- Relational Databases
- Cost Analysis

Knowledge acquisition through the human expert is the most important task of development of an Expert System. With the help of scientists and Experts who are working in Research campuses and at various locations the following tasks will be carried out :

- Selection of Experts.
- Conducting meetings and documenting its results.

*Subject
one that
BAIF
knows
well!*

*is expertise
available*

But

*- Problematique?
- need?*

The areas identified for developing an Expert System are Disease Diagnosis of Animals and for management of Dairy farms which will involve breeding plans and fodder cultivation calendars. An appropriate Shell will be procured and with the help of expert veterinarians, Horticulturists, Agro-foresters and other experts systems will be developed and implemented at regional computer installations.

The knowledge representation will determine the type of Inference Engine or Control mechanism that will draw conclusions. The Expert shell/Development language will be procured and various algorithms will be developed and programmed. The implementation of the Expert System is not very different from other software packages. Documentation and Training will be given to the users.

5.0 PROJECT AREA :

The Development and Research activities of this project will be carried out at BIRC, Pune and the implementation of the hardware, application systems and expert systems at the Regional offices in :

- a) Baroda and Bardoli in Gujarat
- b) Udaipur in Rajasthan
- c) Tiptur and Dharwad in Karnataka
- d) Allahabad/Lucknow in Uttar Pradesh
- e) Aurangabad in Maharashtra

6.0 DURATION :

The entire development and implementation of the project will take Five financial years.

7.0 BUDGET :

The details of the budget outlay of IDRC Contribution is as given in Annexure 2 and BAIP Contribution in Annexure 4. The budget Notes are given as Annexure 3.

ACTIVITY PHASING

Sr. No.	DESCRIPTION	Year 1		Year 2		Year 3		Year 4		Year 5	
		a	b	a	b	a	b	a	b	a	b
A. COMPUTER AIDED GIS FOR PLANNING WATERSHED DEVELOPMENT											
1.	Capture of Spatial Data	-----									
2.	Capture of Tabular Data	-----									
3.	Developing Procedures	-----	-----								
4.	Sedimentation Yield Estimation			-----							
5.	Crop & Irrigation Estimation			-----							
B. APPLICATION SYSTEMS DEVELOPMENT & DATA ANALYSIS											
1.	Centre & Project Mgt. (Regional)			-----							
2.	Administrative Applications				-----						
3.	Data Analysis	-----		-----		-----		-----		-----	
C. INTEGRATED AREA DEVELOPMENT APPLICATION											
1.	Data Collection				-----						
2.	Capture Spatial Data				-----						
3.	Capture Socio-economic Data					-----					
4.	Develop Procedures							-----			

Note : 'a' & 'b' represent the two semesters of a Year.

ACTIVITY PHASING

Sr. No.	DESCRIPTION	Year 1		Year 2		Year 3		Year 4		Year 5	
		a	b	a	b	a	b	a	b	a	b
D. ELECTRONIC COMMUNICATION THROUGH NETWORKING											
1.	Hardware/Software Procurement	-----			-----						
2.	Routines for Automation			-----							
3.	Training Staff		-----			-----					
E. EXPERT SYSTEMS DEVELOPMENT											
1.	Training Knowledge Engineers			-----							
2.	Knowledge Acquisition					-----					
3.	Select Inference Engine						-----				
4.	Develop Routines							-----			
5.	Implement the E.S.										-----
F. TRAINING											
	Trainings for Staff & Computer Professionals	-----		-----		-----		-----			-----

Note : 'a' & 'b' represent the two semesters of a Year.

BUDGET SUMMARY

PROJECT NO. : 17

PROJECT TITLE : Development of Techno-Management Information Systems
for Research and Development Programmes.

(Rs. in '000)

Sr. No.	A/C Head	← YEAR →					TOTAL
		1	2	3	4	5	
BAIF Administered :							
1.	Salaries	300	330	380	398	435	1821
2.	Research Expenses	80	115	135	190	170	690
3.	Consultancy	50	50	50	30	30	210
4.	Reports & Documentation	60	65	70	70	70	335
5.	Training	60	60	60	40	40	260
6.	Travel	60	60	60	70	75	325
7.	Books & Periodicals	10	10	10	10		40
8.	Capital Equipment	5750	5770	700	600	550	13370
9.	Infrastructure	20	20	20	10		70
10.	Unallocated Fund	100	100	100	100	100	500
11.	Administrative O. H.	649	658	157	152	147	1762
SUBTOTAL (A) :		7139	7238	1722	1668	1617	19383
IDRC Administered							
1.	Consultancy						
2.	Training	45	45	45			135
3.	Travel	50	50	50			150
4.	Capital Equipment	50	50	30			130
SUBTOTAL (B) :		145	145	125			415
TOTAL CONTRIBUTION :		7284	7383	1847	1668	1617	19798

BUDGET NOTES

PROJECT TITLE : Development of Techno-Management Information Systems
and Research and Development Programmes.

(Rs. in '000)

A/C Head	Year					TOTAL
	1	2	3	4	5	
1. SALARIES :						
Annual Salaries for :						
Programme Coordinator (1)	60	66	72	79	87	364
Systems Analysts (2)	110	121	132	145	159	667
Programmers(4)	130	143	156	172	189	790
2. RESEARCH EXPENSES :						
Annual Charges for :						
Leased Line from P & T	20	20	20	30	20	110
Scanning/ Digitising		10	10		5	25
Telecommunication Charges		5	5	10	5	25
Maintenance of Hardware	60	80	100	150	140	530
3. CONSULTANCY						
In the following areas :						
Expert Systems	10	20	20	15	15	80
Wide Area Networking	20	20	20	15	15	90
G.I.S.	20	10	10			40
4. REPORTS & DOCUMENTATION :						
Expenses will be incurred for:						
Computer Consumables	40	50	50	50	50	240
Consumables for GIS work	20	10	10	20	10	70
Publications/Documentation		5	10		10	25
5. TRAINING :						
In the following areas :						
Computer aided GIS	10	10	5			25
Networking	20	20	20	10	10	80
For developing Expert System	15	15	20	10	10	70
Inhouse Training to staff	5	5	10	10	10	40
Other Training	10	10	5	10	10	45

PROJECT TITLE : Development of Techno-Management Information Systems
and Research and Development Programmes.

(Rs. in '000)

Sr No	A/C Head	Year					TOTAL
		1	2	3	4	5	
7.	TRAVEL :						
	Mainly under the following :						
	Local Conveyance	10	10	10	15	15	60
	To Campuses/Regional Centres	40	40	40	45	45	210
	To Seminars/Conferences	10	10	10	10	15	55
8.	CAPITAL EQUIPMENT :						
	Computers	1600	1800	300	200	200	4100
	Printers	580	600	50	60	50	1340
	Accessories	440	450	40	40	80	1050
	Software	1200	1070	250	200	100	2820
	Hardware Upgrades	400	350			50	800
	Software Upgrades	290	300			50	640
	Communication Equipment	1000	900	20	60	20	2000
	U.P.S.	240	300	40	40		620
		5750	5770	700	600	550	13370
9.	INFRASTRUCTURE :						
	For Computer Furnitures and Fixtures	20	20	20	10		70
10.	BOOKS AND PERIODICALS :						
	For Books and Journals on various topics	10	10	10	10		40
11.	ADMINISTERED OVERHEADS @10 % of total expenses	649	658	156	151	147	1761
12.	IDRC ADMINISTERED :						
	Consultancy for Expert Systems & GIS.	25	25	25			525
	Training in Networking, Expert Systems & GIS.	45	45	45			810
	Travel for attending training	50	50	50			750
	Capital Equipment : Specialised Software, Utilities, Accessories.	50	50	30			520