

Workshop: "Decision Support Systems for Sustainable Development: Software Technology for Agenda 21"

The Workshop "Decision Support Systems for Sustainable Development: Software Technology for Agenda 21" has been organized by UNU/IIST (United Nations University / International Institute for Software Technology, Macau) and IDRC (International Development Research Centre, Canada) in Macau, 26 February - 8 March 1996. The Macau Foundation and Macau Polytechnic sponsored some events of the Workshop.

Forty four scientists from 21 countries attended the Workshop. The Workshop program included invited lectures, case study presentations, round-table discussions and presentation of scientific papers. Good working atmosphere and very high scientific level of most presentations were matched by participants' involvement in discussions, hands-on laboratory sessions and planning for future collaboration.

A position paper based on plenary discussions will be produced by the end of April and published in a major journal concerning information technology in development. The position paper will identify main issues of development and deployment of decision support systems in developing countries to improve decision making in such areas as social services, environmental protection, health services, natural resources management. The paper endorsed by all participants will discuss the role and contribution of information technology specialists in implementation of Agenda 21.

The following post-workshop activities are being carried out:

- exchange of messages on the list server (iist-uw@cousteau.uwaterloo.ca)
 - preparation of the position paper (Pat Hall, e-mail: p.a.v.hall@open.ac.uk, fax: 44-1908-552140),
 - editing of a DSS book (editors: A. Yeh, G. Kersten, M. Rais); a list server will be made available for the correspondence regarding the book at Carleton University;
 - sample software suite for DSS development (J. G. Krishnayya e-mail: jgk@soochak.ncst.ernet.in, fax: 91-212-477902, B. Adams e-mail: b.adams@facet.com, fax: 1-604-739 7753);
- please send suggestions which free software should be included in a DSS suite.

Please send your comments regarding post-workshop activities and new ideas to the listserver, or specific activity group or to me (zmikolajuk@idrc.ca).

Information, access to information, knowledge, development policy and decision-making are imminent topics in discussions on sustainable development. Agenda 21 underlines the necessity to improve decision-making concerning economic development and environmental protection at local, national and international levels. Decisions taken by every man and woman, municipal and provincial authorities, government departments, multinational corporations and international organizations will determine the realization of sustainable development. Agenda 21 calls for research programs and implementation of information systems which support decision-making based on sound information and procedures. Global sharing of knowledge, collaboration and coordination of decision-making at all levels will need new tools and methods.

A practical, and in my opinion, critical issue in achieving sustainable development is how the wide range of decisions will be made and coordinated on local and global scales. Technical aids are essential for both information- and judgment-driven decision-making. Interdependence of international, regional and national development, poses stronger than in the past, requirements for exchange of information and sharing of knowledge and coordination of actions. Local, as well as global factors must be taken into consideration and available academic as well as traditional knowledge must be applied to solve sustainable development problems. Computerized decision support systems, well integrated with decision-making processes and valued by decision-makers, will contribute to the implementation of objectives of sustainable development.

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Sustainable development implies a holistic approach to human development and preservation of the natural environment. Decisions regarding economic, political, or social activities should solve concrete problems, and at the same time, all implications from the point-of-view of the paradigm of sustainable development should be analysed. Many decision-makers are not prepared for handling the complexity of such an analysis. DSS with built-in knowledge concerning the analysis and capability to investigate and correlate large amounts of data are needed.

Since the 1970s, DSS research has concentrated on financial (banking, insurance) and medical systems. New application domains need to be investigated from the viewpoint of decision-making for sustainable development :

- land and water management;
- food production and distribution;
- poverty alleviation;
- primary health services;
- public services and administration;
- education;
- pollution control;
- urban planning and management;
- natural disaster recovery;
- population growth control; and
- economic planning.

There are many definitions of decision support systems and their functions in decision -making processes. Some definitions are so broad that simple software tools such as spreadsheets or database packages are labelled as DSS. They are used in a technology driven market to "sell" a particular technology, e.g. relational data base management, GIS, expert systems, document management. One can develop a sophisticated DSS using a spreadsheet or data base package, but it would be more appropriate to call these packages DSS generators or simply software tools. A combination of different software tools is needed in the case of development of DSS for sustainable development applications.

A decision support system can be defined by its functional characteristics as a system designed to support:

- the analysis of decision problems,
- determination and evaluation of alternative decisions,
- selection of a particular decision (or rejection in given conditions), and
- monitoring of the execution of selected decisions and suggesting corrective actions.

DSS provides software for collecting and processing of data, applying encoded domain knowledge and communicating with users. In the area of sustainable development a DSS is designed to support decision-makers and not to replace them as opposite to some automatic control or manufacturing systems which aim at replacing human decision-making in industrial processes.

Workshop Programme:

Monday, 26 February 1996

Welcome UNU/IIST, IDRC, Macau Foundation DSC&C,
A Framework for Research on DSS for Sustainable Development,
Zbigniew Mikolajuk, IDRC, Canada

General DSS Issues and Survey of Research in DSS
Gregory E. Kersten, Carleton University, Ottawa, Ontario, Canada

Population Growth and Health & Social Services
Brent Hall, University of Waterloo, Canada

Population Growth and Health & Social Services: Case Study
Brent Hall and Serge Poulard, University of Waterloo, Canada and ECLAC,
Santiago, Chile

Tuesday, 27 Feb. 1996

DSS: State of the Art
Jian-Kang Wu, Institute of Systems Science, NUS, Singapore

Finding Decision Rules in Data for Knowledge-Based Decision Support Systems,
TuBao Ho IoT, Hanoi, Vietnam, pt., JAIST, Japan

Monitoring and Evaluation Information System of Major Natural Disasters in China: GIS Development and
Application
He Jianbang, State Key Lab of Resource and Environment Information System,
Chinese Academy of Sciences, Beijing, China

Multi-Criteria /Multi-Objective Decision Procedures using GIS: IDRISI Case Study
Demo, J. R. Eastman, M. Ramachandran, The Clark Labs, Clark University, USA

Multi-Criteria /Multi-Objective Decision Procedures using GIS: IDRISI Case Study
Hands-on, J. R. Eastman, M. Ramachandran The Clark Labs, Clark University, USA

Wednesday, 28 Feb. 1996

DSS for Sustainable Development, J. G. Krishnayya Systems Research Institute,
Pune, India

Uncertainty and Decision Risk in Multi-Criteria Evaluation: Implication for GIS Software Design, J. Ronald
Eastman, The Clark Labs, Clark University, USA

Building DSS Planning in India: Some Lessons, Subhash Bhatnagar
I.I.M., Ahmedabad, India

Guandong Flood Protection and Disaster Reduction, Auxiliary Decision Support System -- A Study of DSS
for SD
Chen Shijing, Liao Qifang, Guangzhou Institute of Geography, China

Decision Support Systems in Chernobyl GIS Project,
V. S. Chabanyuk Intelligent Systems, Inc., Kyiv, Ukraine

Thursday, 29 Feb. 1996

GIS Development and Application in Management of Natural Resources and Environment Vladimir
Tikunov Moscow State University, Moscow, Russia

GIS Based DSS for Sustainable Development
Mukand Rao, V. Jayaraman, M. G. Chandrashekar ISRO, Bangalore, India

Spatial Decision Support and Tourism Planning
Robert D. Feick and G. Brent Hall University of Waterloo, Canada

C4.5 Tool Presentation: Hands-on TuBao Ho IoT, Hanoi, Vietnam,JAIST,Japan

SAAM-APIC: Demo Visit, B. V. Bossche, Macau Water Supply Co. Ltd. (SAAM), Macau

Friday, 1 March 1996

Round-table discussion:

DSS for SD: Definitions, Contexts, Experience and Expectations

Organizational and Institutional Issues in the Deployment of DSS

Improving Accessibility to Primary Health Care Services

Robert L. Bowerman, G. Brent Hall, Paul H. Calamai University of Waterloo, Canada

A Succinct Presentation of Research Theme in the Project Initiated by the CARI for the Creation of An African Regional Group of Research on DSS.

Koussoubé, J. L. Ndoutoume, R. Noussi, African's Computer Science Institute, Gabon

Round Table Discussion, cntd.

Monday, 4 March 1996

GIS in Decision Support Systems for Sustainable Development,
Anthony Yeh, Hong Kong University, Hong Kong,

A Decision Support System for Sustainable Land Development in China Using Remote Sensing and GIS,
Anthony Gar-On Yeh, Li Xia, University of Hong Kong, Hong Kong, Guangzhou Institute of Geography, China

Computer Assisted Programming of Rural Water in Cameroon

J.P. Weti, Department of Rural Water Ministry of Mines, Water Resources and Energy, Yaounde, Cameroon

The Design of Decision Support Systems as Federated Information Systems,
D. J. Abel, CSIRO, Canberra, Australia

DSSA-ADAGE: Decision Support Capabilities, Will Tracz, Loral Federal Systems, Owego, USA

Tuesday, 5 March 1996

From Decision Theory to Decision-Aid Theory and Decision Support Systems,
M. K. Luhandjula University of Kinshasa, Zaire

An Evaluation Model for Configuring Computer-based Decision Support System,

Clement Dzidonu, Michael Mulvey, Dublin Institute of Technology and University of Dublin, Ireland

Integrated Rural Energy Decision Support Systems, Shaligram Pokharel, Ministry of Water Resources, Nepal, pt., Univ. of Waterloo, Canada

On The Interactive System to Support The Management of Industrial HEVEA Plantations, S. Koussoubé, J. L. Ndoutoume, R. Noussi, African's Computer Science Institute, Gabon

A Semi-Automated System for the Location of Forest Ecosystem Networks: Hands-on,
Blair Adams, Facet Decision Systems, Inc., Canada

Wednesday, 6 March 1996

Handling Uncertain Information in a Decision Support System for Planning:
Application to Water Supply Problems, M. K. Luhandjula, University of Kinshasa, Kinshasa, Zaire

Land Use Planning in India: DSS Requirements, M. Rais NISTADS, New Delhi, India, pt., UNU/IIST, Macau

Various Data Collecting Systems and Their Role as DSS for SD in Mongolia,
H. Yakhanbai, Ministry for Nature and Environment, Ulaanbaatar, Mongolia

Satellite Images and Geographical Information Systems: The Tools of the Future: APIC Case Study,
Chris Audroing, Francis Asia Ltd., Macau

Knowledge Based Method Applications in Remote Sensing, Image Classification
for Environmental Monitoring and Landuse, Zhu Honglei, State Key Lab of Resource and Environment
Information System, Chinese Academy of Sciences, Beijing, China

Intergraph Demo Visit, Vicente L. Gracias, Direccao dos Servicos De Cartografia e
Cadastro, Macau

Thursday, 7 March 1996

Economic Planning and Water and Sanitation Management
E. D. Gamboa, EcoKnowMICS Project, Manila, Philippines

Economic Planning and Water Sanitation Management: Case Study Hands-on,
E. D. Gamboa, EcoKnowMICS Project, Manila, Philippines

Decision Support System: Integrating Scientific Research and Local Knowledge
for Sustainable Development, S. Gameda, J. Dumanski, Agriculture and Agri-Food Canada

Knowledge Centres/ Networks for Empowering Knowledge Rich-Economically Poor Communities and
Innovators: DSS for Solution Augmentation for Sustainable Development, Anil K Gupta, Srinivas
Chokkakula SRISTI c/o, I.I.M., Ahmedabad, India

Natural Resources Conservation and Crop Management Expert Systems,
Ahmed Rafea Central Lab for Agricultural Expert System, Cairo, Egypt

Software Internationalization Architecture for Decision Support Systems,
Patrick A.V. Hall, The Open University, UK

Organizational Memory Information Systems: Case-Based Approach,
F.V. Burstein, H.G. Smith, R. Sharma, A. Sowunmi, Monash University, Australia

Friday, 8 March 1996

Round Table Discussion and Closing Session

Future collaborative work and world-wide working group on DSS for SD.
Requirements for new generation DSS, training and absorption of
technology by developing countries.

Excursion, Macau Foundation

Post-workshop activity coordinated by Prof. J.G. Krishnayya:

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Executive Director
Systems Research Institute
17-A Gultekdi
Pune 411037, India
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"A Suite of Integrated Software Tools for the Development of Decision Support Systems"

The purpose of this activity is to support the network of scientists established at the Workshop in achieving the following objectives:

- A) Integration and expansion of the network of scientists interested in developing decision-support systems.
- B) International collaboration in developing practical portable decision-support systems using an affordable (free of charge or very low cost) suite of software tools.
- C) Sharing of expertise and research achievements by dissemination of research materials produced by the Workshop and follow-up activities.
- D) Identification of application domains for DSS in developing countries and development of research project proposals.

To achieve these objectives, the Systems Research Institute in collaboration with IDRC and institutions represented at the Workshop will carry out the following activities:

- integration, testing and dissemination of application software and software tools presented at the Workshop using Internet,
- analysis of software presented at the Workshop and other software available free of charge in order to identify and integrate a suite of software tools to be distributed to researchers of the DSS (Macau) group,
- discussion on requirements for a DSS Development Workbench and proposals of research projects in this area,
- exchange of information on current research and development activities (a listserv has been already established at the University of Waterloo),
- dissemination of the first version of low cost package of software tools for DSS development.

Expected outputs/results:

- 1) Expanded network of collaborating scientists in the area of decision-support systems for sustainable development.**
- 2) Tested and verified package of software tools and documentation for development of decision support systems disseminated to institutions in developing countries.**
- 3) A report on requirements for a DSS Development Workbench.**
- 4) A draft proposal for an international research project on software tools for DSS development.**