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ABSTRACT

A guide to understanding the major environmental and procedural factors in planning state-level information systems is presented. Attention is directed to: assessment of the developmental environment (agency authority and role, institutional concerns), selection of a procedural approach to information-system planning, assessment of information needs generally, selection and evaluation of specific data elements, and assessment of resource requirements (staffing, computer and systems support, and institutional costs). The way that organizational and individual behavior affect information-system design is considered, along with the influence of the agency's planning environment and institutional relationships on the information-system planning process. Stages of organizational development, stages of individual development, and organizational decision-making processes are identified. The following environmental considerations are addressed: the state agency's managerial role, staff style, length of experience with state-level data reporting, and costs and benefits. Additional topics include the importance of documentation, a framework for information system planning, and identifying sources of data and definitions. Background information on the State-Level Information Base project is included. (SW)

PSE
Information Planning
at the State Level

2

Planning Guide

A guide to understanding the major environmental and procedural factors in planning state-level information systems: the agency role in state-level planning, the organizational context for information systems, and the balance of state-level information needs with institutional reporting burdens.

Postsecondary-Education Information Planning at the State Level

Five documents have been published as a result of the State-Level Information Base project under the general title of *Postsecondary-Education Information Planning at the State Level.* The specific documents are as follows.

Overview. The *Overview* briefly describes the project's purpose, history, and results.

Planning Guide. The *Guide* provides a context for understanding the major environmental and procedural factors influencing the development of state-level information systems. Specifically, it discusses assessment of the developmental environment (agency authority and role, institutional concerns), selection of a procedural approach to information-system planning, assessment of information needs generally, selection and evaluation of specific data elements, and assessment of resource requirements (staffing, computer and systems support, institutional costs).

Selection of Data to Address Planning Issues. As a companion to the *Planning Guide,* this document provides a framework for reviewing common state-level planning issues, the questions that focus analysis on those issues, and the general data requirements associated with the more common questions and analyses. The document includes a section summarizing references to applicable data sources (in either published or machine-readable format), including, when possible, descriptions or examples of these sources. The Glossary section of the document contains standard data definitions and suggested categories for collecting and presenting data.

Pilot-Test State Case Studies. The *Case Studies* describe the background and functions of each of the eight pilot-test state agencies, its approach to information systems, and its planning responsibilities (comprehensive planning, budgeting, program review). Each agency's data set is also described, and each state's information-system costs are summarized. This document also discusses attempts to develop state-level information about adult/continuing education in two pilot-test states and about educational outcomes in two others.

Systems-Related Experiences in Eight Pilot-Test States. As a companion to the *Case Studies,* this document describes pilot-test state experience with systems development, including evaluation of information needs, hardware and software choices, survey administration, staffing considerations, data organization, and data storage and linkage considerations. The ranges of developmental costs among pilot-test state agencies are summarized, and caveats related to difficulties in obtaining reliable and informative data on costs are discussed.

This report has been produced as part of a project supported by the W.K. Kellogg Foundation of Battle Creek, Michigan, with supplemental funding from the National Center for Education Statistics.

Postsecondary-Education Information Planning at the State Level

Planning Guide

Roger Bassett

1979

National Center for Higher Education Management Systems
P.O. Drawer P Boulder, Colorado 80302
An Affirmative Action/Equal Opportunity Employer

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COMMENTS FROM THE PILOT-TEST STATES

For Those Who Follow

The documents provided by the State-Level Information Base project represent the individual experiences of the eight states that have attempted to establish a common methodology for collecting, displaying, and using information with the project's issues and data framework as a guide.

In the course of implementing or upgrading our individual state-level information systems over the last three years, we have learned that inter- and intrastate data comparability, while a worthwhile objective, is occasionally an administrative quagmire. Goals that appeared to be theoretically possible and administratively reasonable often proved to be elusive when placed in a practical setting.

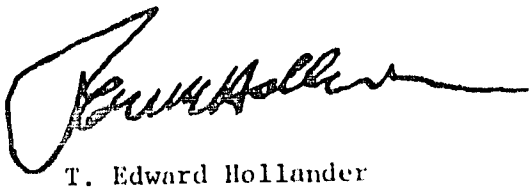
During the course of our efforts we have reported our findings to the project Task Force, the Participant States Group, and NCHEMS staff. Modifications have been made in the earlier documents to incorporate our changing thoughts. These documents accurately reflect our experiences, emphasizing the value we have found in implementing the project's concepts while providing cautions regarding the occasional pitfalls we have encountered.

It is important for the reader to understand that each of our states has derived different but important benefits from the concepts represented in the documents. Organizational, political, and economic constraints precluded "successes" in some areas in spite of the dedicated work of our institutional colleagues and our support staff. That we have achieved our results in different ways should be viewed as one of the more important outcomes of the project and as evidence of our collective feeling that no magic solutions exist in the area

of information-based state-level planning. The existence of the project documents and other services will not end all data ills but can, however, substantially aid states contemplating implementation of a statewide information system to support state-level planning responsibilities.

We convey the project documents to you with the hope that you will profit from our experiences, and we trust that you will join us in sharing the insights you gain in implementing the project's concepts with those who follow.

Patrick Callan
Executive Director
California Postsecondary
Education Commission



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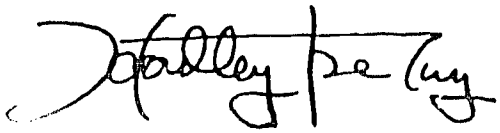

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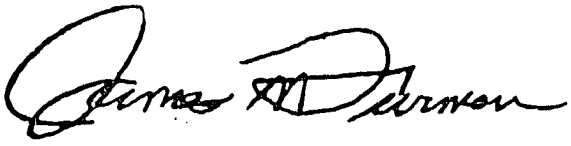

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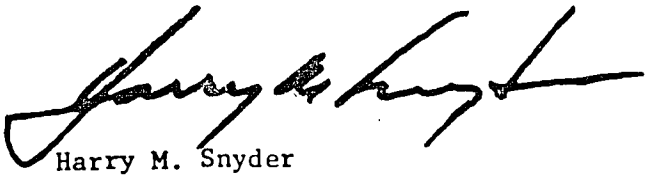
Education



Harry M. Snyder
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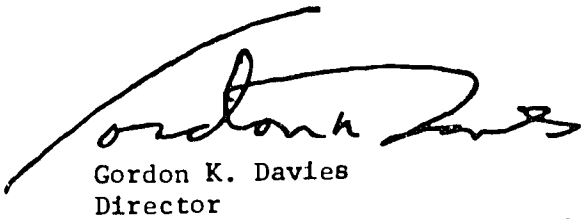
Kentucky Council on Higher
Education



Gordon K. Davies
Director
The State Council of Higher Education
for Virginia

PREFACE

The State-Level Information Base project was initiated in July 1975 with funding from the W. K. Kellogg Foundation to assist state-level planners in postsecondary education with their information needs. The project since then has developed a set of services to guide information-system planners in the development and maintenance of information systems to support postsecondary-education planning at the state level. Differences among state-level postsecondary-education agencies in their responsibilities and analytical requirements are extensive. Therefore the project documents are designed to serve as reference frameworks from which each state can develop a more tailored approach.

In order to respond to the range of responsibilities and to the data intensity of various approaches among the postsecondary-education agencies at the state level, the project has developed five published documents (described on the inside cover), a program of staff assistance, and a series of topical and general workshops.

The five documents published as a result of the State-Level Information Base project are:

1. Postsecondary-Education Information Planning at the State Level: Overview
2. Postsecondary-Education Information Planning at the State Level: Planning Guide
3. Postsecondary-Education Information Planning at the State Level: Selection of Data to Address Planning Issues

4. Postsecondary-Education Information Planning at the State Level: Pilot-Test State Case Studies

5. Postsecondary-Education Information Planning at the State Level: Systems-Related Experiences in Eight Pilot-Test States

The Overview document briefly describes the project's purpose, history, results, the other four documents, and the availability of project-supported assistance to interested state-level planning agencies. Planning Guide and Selection of Data to Address Planning Needs are companion documents that provide overall planning concepts and a supporting framework for states considering the development of a postsecondary-education information system at the state level. Pilot-Test State Case Studies and Systems-Related Experiences in Eight Pilot-Test States are companion documents that describe the specific environmental and procedural factors related to the development of information systems in the pilot-test states during the first three years of the project.

A program of staff assistance allows interested states to draw on both project staff and pilot-test state staff for direct assistance in such areas as: (1) the initial consideration of information-system requirements, (2) the development of a plan and process for implementing the system, and (3) technical assistance in the design of data-processing support and enhancements. Project-sponsored or cosponsored workshops address topics related to current postsecondary-education planning responsibilities at the state level, with an emphasis on those that are particularly data intensive. Published monographs document the proceedings of these workshops. The use of pilot-test state staff to assist new states and the sponsorship of workshops bringing state-level planners together on topics of common interest are both intended to promote a network for communication among state-level planners and information-system developers that will continue after the project is officially completed.

Developmental History

The State-Level Information Base project was initiated in 1975 under terms of agreement from the W. K. Kellogg Foundation. The high level of interest of the Foundation's program director, Dr. Peter R. Ellis, allowed the project to evolve in a way that assured maximum sensitivity to differing state-level needs. The entrance of the National Center for Education Statistics (NCES) into the project in 1976 allowed the scope and the depth of the project to be increased. A federal component of the State-Level Information Base project (the Federal Data Core project) was initiated to help NCES reevaluate federal data needs related to postsecondary education. NCES support also provided for special state-level efforts in determining data requirements dealing with educational outcomes and adult- and continuing-education planning. The depth of the project was increased through NCES support by the addition of three general pilot-test states and by further support for the direct staff-assistance portion of the dissemination effort.

The primary review group for the project was a Task Force composed of representatives of each of the eight pilot-test agencies, four representatives

of postsecondary institutions, and two representatives of other state-level agencies with an interest in postsecondary education. The Task Force was assisted in its review by a Participant States Group composed of representatives of all postsecondary-education agencies at the state level that expressed interest in the project but had not been selected as pilot-test states. One member of the Participant States Group was selected by the group to serve as a liaison to the Task Force.

The pilot-test states were selected in the first two months of the project. Each state higher-education executive officer was invited to express interest in pilot-test participation. Selection of pilot-test states from those responding was based on several factors, including size, geographic location, authority, and status of management-information-system development. The initial five pilot-test states were California (California Postsecondary Education Commission), Hawaii (University of Hawaii), Illinois (Illinois Board of Higher Education), Kentucky (Kentucky Council on Higher Education), and New Jersey (New Jersey Department of Higher Education). The three other states that were added when NCES entered the project in 1977 were New York (Office of Higher and Professional Education of the New York State Education Department), South Carolina (South Carolina Commission on Higher Education), and Virginia (The State Council of Higher Education for Virginia).

The first year of the project was spent conducting a survey of state-level planning functions and data-collection activities. From that survey, the staff proposed a preliminary data set for review by the Task Force and Participant States Group. The review resulted in some reduction in the total size of the data set and the addition of an issues framework intended to ensure that proposed data collection in any state would be justified in terms of real state-level issues and decision requirements. Also in the first year, the first edition of the State Postsecondary Education Profiles Handbook was developed and distributed in cooperation with the Education Commission of the States (ECS) and the State Higher Education Executive Officers (SHEEO). The document provided a basic set of characteristics on each state that included a description of the organizational structure of postsecondary education and the functions of the statewide coordination and/or governing agency, a summary of basic descriptive statistics, and an inventory of state-based research studies.

The second year of the project saw the addition of NCES support (initiation of the federal component of the project, three more general pilot-test states, and special data analyses in the areas of educational outcomes in two states and adult and continuing education in two other states). Also during the second year, the second edition of the State Postsecondary Education Profiles Handbook was published, and field-review editions of the State-Level Information Base project's preliminary documents, presenting the initially defined planning issues and data set, were widely circulated for review.

Twenty copies of the draft documents were sent to each pilot-test state for review by state-level personnel and institutional staff. Six hundred copies were sent to individuals on the NCHEMS general distribution mailing

list, a list comprised mainly of institutional administrative personnel. An additional 500 copies were mailed to a selected list of reviewers, including all state higher-education agencies, other state-level postsecondary-education systems, relevant national associations, state budget offices, and selected legislative staff offices. During the review period, the project staff also met directly with staff and committees of such organizations as the State Higher Education Executive Officers (SHEEO) and the National Association of College and University Business Officers (NACUBO) to promote and accomplish the review process.

The third year of the project was devoted to a synthesis of the pilot-test experience and field-review results into drafts of the final project documents. The pilot-test phase in each of the states was completed, and documents were drafted for Task Force consideration. The Federal Data Core project's field-review drafts were circulated for review, and final linkages were made between the Federal Data Core project and the State-Level Information Base project regarding data-reference aspects of the final documents.

The fourth year of the project provided for completion and distribution of project documents and for initiation of on-site staff assistance and topical workshops. The combination of project documents, direct staff assistance, and workshops helped to promote a network for communication among state postsecondary-education planners and information-system developers so that support activities and the exchange of ideas can continue beyond the end of the funded portion of the project.

Evolution of Project Activities and Services

When the project was initiated in the summer of 1975 the objectives were:

- To develop an information base designed to support state-level planning and decisionmaking, including a standardized data set and standardized support software with the capability for interstate access
- To pilot test and install this information base in selected states
- To assist states in the implementation of the information base by training staff in its maintenance and use

As the impact of diverse state-level planning needs and approaches became clear, it became necessary that the project reflect the following changes in focus:

- From one of a standardized information base and supporting software, to the development of an adaptable and flexible data-assessment framework with individual states making their own software choices based in part upon pilot-test state experience

- From states having direct computer access to the information systems in other states, to promotion of the exchange of profile information among interested states after specific issues have been identified and specialized definitions and procedures have been developed

- From generalized cost estimating procedures regarding the development of information systems, to cost summaries drawn from pilot-test state experience

- From the definition of an all-encompassing data universe to support state-level planning, to the definition and analysis of the decisionmaking requirements associated with common postsecondary-education issues as the basis for data selection

- From a concentration on state-level planning decisions only, to a consideration of federal planning issues, to coordination of definitions and data descriptions in areas of overlap between the state and federal data-reference documents, and to an increasing emphasis on the need for institutional involvement and consideration for institutional capabilities

The pilot-test state involvement began with the concept of installing a standardized information base and testing a standardized data set and supporting software. Their involvement then shifted to include a dissemination process as well as an evaluative process by:

- Promoting the development of new ideas and the exchange of state experiences with information systems

- Encouraging the evaluation of existing data collection and the selection of only that data needed for planning and decisionmaking needs

- Emphasizing the importance of managing data in a data-base management sense by developing an awareness of the data-integration needs within an information system

- Promoting the coordination of federal/state data needs that evolved from the State-Level Information Base project and the closely related Federal Data Core project

The pilot-test states' experiences and evaluations led to:

- Modifications to the preliminary list of common issues and related data needs

- Development of summary conclusions and recommendations regarding the overall methodology for developing information systems

- Recommendations that the project's dissemination process include workshops on specific topics of interest to the participants--thus serving the dual objectives of promoting improved state-level planning and promoting the use of State-Level Information Base project results

The final documents have been through an extensive review process that has included comments received from the national field review of the preliminary documents, the project Task Force, pilot-test states, Participant States Group, and the NACUBO Finance Management Committee and internal NCHEMS staff review.

ACKNOWLEDGMENTS

The State-Level Information Base project benefited substantially from the participation of many individuals during its three years of development. Any attempt to list all who contributed would inevitably and unintentionally suffer from important omissions. The project staff hopes that those who participate, but are not mentioned here, will understand our limitations and accept our appreciation.

Project Task Force and Pilot-Test State Representatives

As mentioned in the Preface, the primary review group for the project was a Task Force composed of representatives of the pilot-test states, of other interested state-level agencies, and of public and private postsecondary-education institutions. Task Force participation was a sensitive and time consuming responsibility, and each of the members deserves special recognition for service rendered. The members were:

Thomas Braun
Deputy Executive Director
for Administration
Kentucky Council on Higher Education

Charles A. Brooks, Jr.
Coordinator of MIS Computerization
South Carolina Commission on Higher
Education

Richard Dunn
Executive Budget and Management
Officer
Wisconsin State Department of
Administration

Frederick R. Ford
Executive Vice President and
Treasurer
Purdue University

William Fuller
Executive Director
Nebraska Coordinating Commission
for Postsecondary Education

John Harrison
Associate Director for Administration
California Postsecondary Education
Commission
Horace Crandell, Higher Education Specialist at the California Postsecondary Education Commission, preceded John Harrison as the California pilot-test state representative.

Adolph Katz
Director
Office of Planning and Research
New Jersey Department of Higher
Education
J. Bruce Robertson, currently Commissioner of Higher Education for the State of Missouri, preceded Adolph Katz as the New Jersey pilot-test state representative.

Stephen W. Keto
Chief Fiscal Officer
Idaho Office of the State Board of
Education

James McGovern
Associate Director
Illinois Board of Higher Education
David Nyman, currently with Deloitte, Haskins, and Sells, and Paul Lingenfelter, Associate Director for Fiscal Affairs of the Illinois Board of Higher Education, both preceded James McGovern as the Illinois pilot-test state representative.

J. Michael Mullen
Assistant Director
The State Council of Higher Education
for Virginia

Larry H. Litten
Coordinator
Institutional Research
Carleton College

Joseph A. Malik
President
Grays Harbor College

Jane Ryland
Director
SHEEO/NCES Communication Network
Liaison representative from the
Participant States Group
Norman Fischer, Institutional Research Analyst for the Washington Council on Higher Education, preceded Jane Ryland as Participant States Group liaison representative to the Task Force.

Kenji Sumida
Director of Finance
University of Hawaii

Robert Wetnight
Vice President for Finance
Western Michigan University
Robert O. Benfield, currently Vice President for Fiscal Affairs at Texas Women's University, preceded Robert Wetnight as a Task Force member.

Richard E. Willey
Budget Analyst
Pennsylvania House Appropriations
Committee

Paul Winp
Coordinator Postsecondary Research,
Information Systems and Institutional Aid
New York State Education Department

Peter Woodberry
Postsecondary Education Specialist
Rhode Island Department of Education

Ex Officio

Curtis O. Baker
Acting Head, Systems Design and
Methodology Section
Systems Design and Analysis Branch
National Center for Education Statistics
Katherine Wallman, currently with the Office of Federal Statistical Policy and Standards, preceded Curtis O. Baker as the NCES ex officio representative to the Task Force.

Participant States Group

The second advisory group for the project, composed of representatives of state postsecondary-education agencies and other organizations interested in project developments and results, also played an important role during the developmental phase. Since the group represents a large number of potential users of the project results, members of the Participant States Group (PSG) were especially valuable in assessing the relevance and utility of alternative approaches considered by the project staff and the Task Force. The PSG met the day before each Task Force meeting and presented its advice to the Task Force through a liaison representative.

The following state-level agencies and other interested groups were represented at one or more meetings of the PSG:

ALABAMA

- Alabama Commission on Higher Education

COLORADO

- Colorado Commission on Higher Education

CONNECTICUT

- Connecticut Commission for Higher Education

FLORIDA

- State University System of Florida
- Department of Education, Division of Community Colleges

GEORGIA

- University of Georgia
- Georgia Board of Regents

IDAHO*

- Idaho Office of the State Board of Education

INDIANA

- Indiana Commission for Higher Education

IOWA

- Iowa Coordinating Council for Post High School Education
- Iowa State Board of Regents

KANSAS

- Kansas Commission for Postsecondary Education
- Kansas Board of Regents

LOUISIANA

- Louisiana Board of Regents

MARYLAND

- State Board of Higher Education

MICHIGAN

- State Department of Education

MINNESOTA

- Minnesota Higher Education Coordinating Board
- Minnesota State College Board
- State Department of Finance and Information Systems

MISSISSIPPI

- Board of Trustees of State Institutions of Higher Learning

MISSOURI

- Missouri Department of Higher Education

MONTANA

- Montana University System

NEBRASKA*

- Nebraska Coordinating Commission for Postsecondary Education

NEW MEXICO

- New Mexico Board of Educational Finance

NEW YORK*

- New York State Education Department

NORTH DAKOTA

- North Dakota State Board of Higher Education

OHIO

- Ohio Board of Regents

OKLAHOMA

- Oklahoma State Regents for Higher Education

OREGON

- Oregon Educational Coordinating Commission

* Became a pilot-test state during second year of project.

PENNSYLVANIA

- Higher Education Office of the Pennsylvania Department of Education

RHODE ISLAND*

- Rhode Island Department of Higher Education

SOUTH CAROLINA*

- South Carolina Commission on Higher Education

TENNESSEE

- Tennessee Higher Education Commission

TEXAS

- Texas College and University System

VIRGINIA*

- Virginia Community College
- State Council of Higher Education for Virginia**

WASHINGTON

- Washington Council on Higher Education

WEST VIRGINIA

- West Virginia Board of Regents

WISCONSIN

- The University of Wisconsin System

Other Interested Groups

- Education Commission of the States
- National Association of Independent Colleges and Universities
- Southern Regional Education Board
- Western Interstate Commission for Higher Education

Pilot-Test States

Eleven states were involved in the pilot-test of project results. Eight of these were considered general pilot-test states in that they worked with the overall information requirements of state-level postsecondary agencies. Five of the eight, California, Hawaii, Illinois, Kentucky, and New Jersey, were involved from the beginning of the project. Three others, New York, South Carolina, and Virginia, were added during the second year.

Three other states were considered to be focused development pilot-test states in that they were primarily concerned with the information requirements associated with particular issues. Concentrating on information related to adult- and continuing-education planning were Idaho and Nebraska. Concentrating on state-level outcomes analysis were Hawaii (which was also a general pilot-test state) and Rhode Island.

* Became a pilot-test state during second year of project.
** The State Council became the pilot-test state agency.

The states and participating agencies were:

General Pilot-Test States

CALIFORNIA

- California Postsecondary Education Commission

HAWAII

- University of Hawaii

ILLINOIS

- Illinois Board of Higher Education

KENTUCKY

- Kentucky Council on Higher Education

NEW JERSEY

- New Jersey Department of Higher Education

NEW YORK

- New York State Education Department

SOUTH CAROLINA

- South Carolina Commission on Higher Education

VIRGINIA

- The State Council of Higher Education for Virginia

Focused Development Pilot-Test States

Adult and Continuing Education

IDAHO

- Office of the State Board of Education

NEBRASKA

- Coordinating Commission for Postsecondary Education

Outcomes Analysis

HAWAII

- University of Hawaii

RHODE ISLAND

- Department of Education

The role of a pilot-test state in this project involved more than testing the work of project staff. Each state-agency representative participated fully in project design and development through direct contact with staff and through membership on the project task force. All users of project results owe a debt of gratitude to the 11 pilot-test state representatives for the time they spent and for the quality of their contributions.

The name of the lead representative from each state is included in the list of project Task Force and pilot-test state representatives. Many other pilot-test agency staff participated in the project-related work in their agencies. Notable among them were Raleigh Awaya, Director of the Management Systems

Office at the University of Hawaii; Rose Bowman, Program Administrator, and Cliff Trump, Deputy Director for Academic Planning with the Office of the State Board of Education in Idaho; Steve Sabin, Assistant Director of the University of South Carolina Computer Services Division; and John Wittstruck, Coordinator of Information Systems with the Nebraska Coordinating Commission for Postsecondary Education.

Other Contributing Organizations

One of the objectives of the State-Level Information Base project is to promote linkages and a network for communication among all national and regional organizations interested in state-level planning and information systems. A network for communication is a process that requires a mutual exchange of effort, and six organizations deserve special recognition for their support of project activities.

The SHEEO/NCES Communication Network (a project of the State Higher Education Executive Officers sponsored by the National Center for Education Statistics) through its director, Jane Ryland, not only played a major role in Task Force and Participant States Group deliberations, but also served as a regular communication channel with the state coordinating and governing boards--the primary audience for the project. The Network also presents a strong opportunity for continuing dialogue among states about planning-related information requirements after the funded portion of the project is completed.

The Education Commission of the States (ECS) has been cosponsor of the State Postsecondary Education Profiles Handbook together with NCHEMS and SHEEO. Special mention should be made of Dr. John Folger, Dr. Richard Millard, and Nancy Berve, all of ECS, for their efforts on the compilation of the Handbook. The Handbook provided a timely and thorough review of the data references suggested in the Selection of Data to Address Planning Issues document and on project descriptions of costing as a data-intensive, state-level planning activity.

The National Association for College and University Business Officers (NACUBO), through its Finance Management Committee (formerly entitled the Costing Standards Committee) and the efforts of NACUBO staff member K. Scott Hughes, provided a timely and thorough review of the data references suggested in the initial project documents and the final document entitled Selection of Data to Address Planning Issues. They also reviewed project descriptions of costing as a data-intensive, state-level planning activity.

The National Association for Independent Colleges and Universities (NAICU) is developing a statement of useful state-level planning information for independent higher education. Dr. James Olliver and Dr. Virginia Fadil, codirectors of the State-National Information Network (SNIN) project, have kept in close touch with the results of the State-Level Information Base project as those results related to independent higher education in ways similar to those offered by the SHEEO/NCES Network for state higher-education agencies.

The Southern Regional Education Board (SREB) has supported the State-Level Information Base project both by cosponsoring a workshop on enrollment planning and by advising project staff on processes and uses for interstate comparative information. SREB, through the efforts of Dr. E. F. "Tex" Schietinger, Director of Research, Dr. James R. Mingle, and Dr. David S. Spence, both Research Associates, represents the best working example of interstate exchange of postsecondary-education planning information observed by the project staff during the course of the project.

The Western Interstate Commission for Higher Education (WICHE), in addition to being the parent organization of NCHEMS at the time the project began, has cooperated with project staff in reviewing data requirements associated with state-level program review, including cosponsorship of a project planning workshop on the subject. Dr. Richard Jonsen and Dr. Lilla Engdahl have worked closely with the project staff on the design and implementation of a WICHE project that surveys graduate programs and program-review practices in the western states.

NCHEMS Staff

During the four years of the State-Level Information Base project, many current and former NCHEMS staff members have been directly involved in project activities.

To Dr. Melvin Orwig and Dennis Jones goes credit for shaping the early stages of the project and for guiding the general course of all project activities during its four years. To Dr. Nancy Renkiewicz, the initial project director, goes credit for organizing the activities that first brought the proposal to life. To Marilyn McCoy goes credit for her contributions to project results through major authorship of the State-Level Information Base Field Review and Overview documents, and through her leadership of the Federal Data Core project, a federal-level activity and complementary to the State-Level Information Base project. Dr. Sidney Micek was the activity leader for the focused development work on state-level educational outcomes analysis, and Dr. Roger Sell led the staff work on adult and continuing education. To Ellen Cherin goes thanks from all project staff for her coordination of project documentation.

Other former and current NCHEMS staff members who have contributed to the development of the project are Richard Allen, Kathy Allman, Dr. Kent Caruthers, Mark Chisholm, Michael Haight, Dr. Edward Myers, Dr. James Topping, and Dr. Robert Wallhaus.

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I.

INTRODUCTION

Purpose of This Document

The Planning Guide is intended to describe the major characteristics of the planning environment within which a state-level information system is developed. As such, it is intended for all who are involved in shaping and implementing such a system (agency leadership, staff analysts, other users of information, and information-system staff). Emphasis here is on understanding how the concept of management operates in a state-level planning environment, how key characteristics of organizational and individual behavior influence information-system design, how the agency's immediate planning environment and institutional relationships influence the characteristics of the information-system planning process, how general information needs can be related to the identification of specific data requirements, and how resource requirements can be assessed. Together with the document reviewing System-Related Experiences in Eight Pilot-Test States, this Guide relates the experiences and results of the State-Level Information Base project to a wide range of the general and technical considerations involved in state-level information-system development.

Management-Information Systems in a State-Level Context

Information systems, in the sense addressed by the State-Level Information Base project, are a management tool. As such, they are intended to serve an organization that is results-oriented, objective-focused, and cost-sensitive. In the absence of such a commitment by management, information systems (or at least management-information systems) cannot be fully effective. In the worst case (not as rare as one might wish), information systems are developed for their own sake, as symbolic evidence of a management commitment. The result is an isolated activity that operates inefficiently or is used for inappropriate purposes.

In applying management concepts in a postsecondary-education environment, one must consider two characteristics. First, the practice of management dominates organizational characteristics in a corporate environment but is only one of several elements of agency or institutional leadership in the essentially collegial postsecondary-education environment. Second, even as managerial approaches become accepted practice in institutional governance, they remain an often controversial characteristic of the state-agency role.

There are many definitions of management.[1] Ranging in sources from the econometrics approaches of the management sciences through the work of the organizational behaviorists to the patent medicine approaches of some weekend "how to do it" seminars, the message is basically the same. A well-managed organization is one with a clear, achievable set of goals and objectives (usually expressed as an annual staff agenda). It maintains a visible, understood relationship between the staff organization and specific staff assignments and deadlines (a staff work plan of some form). Available resources are related to the work plan on the basis of staff priorities and skills. And it maintains a system for monitoring staff progress against stated objectives and deadlines and makes provisions for corrective action where necessary. In other words, the staff knows what it is doing and is doing it.

To adequately consider the information needs of such an organization, the information-system planner must understand the different levels of decision at work and how they interrelate. Anthony's (1965) distinction among three levels of the decisionmaking hierarchy in a corporate enterprise is helpful:

> Strategic planning is the process of deciding on the objectives of the organization, on changes in objectives, on the resources used to attain objectives, and on the policies that are to govern the acquisition, use, and disposition of resources.
>
> Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives.
>
> Operational control is the process of assuring that specific tasks are carried out efficiently and effectively.

Sherman Blumenthal adapted the Anthony hierarchy to a postsecondary-education institutional environment. Table 1, a description of a university hierarchy, is taken from a further adaptation used by George Weathersby in a paper on "Decision Paradigms and Models for Higher Education" (1975) that will be referred to more extensively in the following chapter.

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1. See Robert N. Anthony, Planning and Control Systems, A Framework for Analysis (1965) for a concise, thought-provoking description of the subject, including an excellent appendix on the terminology of management with extracts citing the definitions used by most of the leading authors in the field.

Table 1

An Information-Systems Perspective of a University Hierarchy

DECISION-MAKING HIERARCHY	ORGANIZATIONAL LEVEL INVOLVED	DECISION OBJECTIVES	DECISION PROCESS INPUTS	INFORMATION SOURCES	DECISION PROCESS OUTPUTS
Strategic Planning	Trustees, president, V.P.s, deans	• Set objectives • Determine resources to be applied	• Staff studies • External situation • Reports on internal achievements	• Special "one-time" reports • Simulations • Inquiries (unrestricted)	GOALS POLICIES CONSTRAINTS
Management Control	President, V.P.s, deans, administration, department heads	• Allocate assigned resources to task • Make rules • Measure performance • Exert control	Summaries Exceptions	• Many regular reports • Format variety • Inquiries (restricted) • Data-Bank oriented	DECISIONS "PERSONAL" LEADERSHIP PROCEDURES
OPERATIONAL CONTROL	Administration, deans, department heads, faculty	Use resources to carry out tasks in conformance with rules	Internal events	• Formal • Fixed procedures • Complex • Concrete	ACTIONS

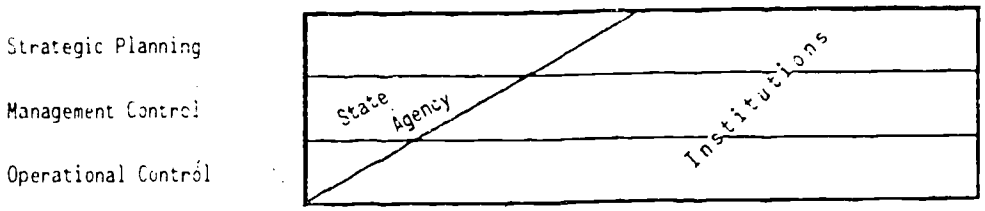
Source: George B. Weathersby, "Decision Paradigms and Models for Higher Education," paper presented at the 48th National Meeting of the Institute for Management Sciences and the Operations Research Society of America, Las Vegas, Nev. November 17, 1975. Adapted from Sherman C. Blumenthal, Management Information Systems (Englewood Cliffs, N.J.: Prentice-Hall, 1969), p. 29.

Adaptation of the Anthony hierarchy to a statewide postsecondary-education community requires further adjustment of focus and terminology. Anthony's focus is on planning and control systems in private companies and corporations. Application of his concepts to statewide postsecondary education requires a view of institutions, multicampus systems, and state postsecondary-education in a state. State agencies and institutions share in each of the three dimensions. The state agency is relatively more involved in strategic planning than operational control. The institutions have the major role in operational control. Both parties share responsibility for what Anthony calls management control, with the division of responsibilities between them determined by the governance structure in a particular state. The point here is not related so much to the drawing of lines, but rather to the importance of recognizing that state agencies and institutions view and exercise Anthony's concept of management control in different ways, through different activities, and using different perspectives. State-level agencies are involved in balancing and reallocating resources among institutions, while institutions and governing boards are concerned with allocations within the institutions or system.

In other words, all three activities occur at both levels. If one views the state postsecondary-education system as a single organization involving interrelated state and institutional roles, then the relative emphases (at the risk of oversimplification and overgeneralization) can be displayed as in the following figure:

Figure 1

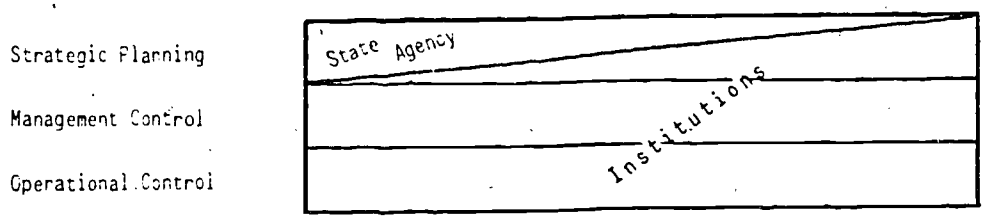
State/Institutional Management Activities



The location of the diagonal line varies from state to state. In a state with limited state-level coordination, such as a state with no state-level responsibilities other than the general planning activities assigned to 1202 Commissions, the emphases would be as in figure 2:

Figure 2

Alternative View of State/Institutional Management Activities



On the other hand, the diagonal line has no meaning at all in a single-university state, where state-level responsibilities are exercised by university leadership as one aspect of organizational management. For the following discussion, the situation illustrated in figure 1 will be the frame of reference.

When Anthony's hierarchy is related to a state with a strong coordinating agency, the relationship between strategic planning and the typical statewide comprehensive or master planning process seems straightforward. However, the relationship between Anthony's concept of management control and the typical state coordinating-agency role in analysis of resource requirements and allocations is less precise. State coordinating agencies have become increasingly involved in resource-requirements analysis as the result of the public (legislative) perception that postsecondary-education institutions are not concerned

enough about the state's interest in the effective use of scarce resources. This involvement is a quite different, somewhat more limited form of management control than that described by Anthony.

The relationship between operational control and typical state coordinating-agency responsibilities for monitoring institutional operations is the least precise. Few such agencies have operational-control responsibilities over institutional affairs. Instead, the development of specific objectives and activities typically falls to institutions, leaving the state agency to rely heavily on the power of persuasion to assure compliance with the defined interests (expressed as policies) of the state. A monitoring function, whether or not backed by authority to control operational decisions, can provide advance notice of situations requiring institutional or state-agency attention. In that sense, a monitoring function is essential to development of intelligent policies.

The emphasis at the beginning of this section on the importance of a management commitment as a precedent to establishment of an information system can now be given more definition. It is important that the state agency define its roles in the areas of planning, management, and institutional overview and relate its staff organization and agenda to the activities following from such a definition role. This being done, the risk of collecting and maintaining unused or misused information is greatly reduced, and the management orientation to be served by the information is demonstrated and reinforced.

This discussion of management in the context of statewide postsecondary education activities is intended to provide one perspective with which to frame the general dimensions of a state-agency information system and to develop the planning activities through which such a system can be implemented. Chapter II stresses the importance of understanding the basic characteristics of the organization in which the system is to be developed--another important aspect in information-system design. These two chapters together then form a basis for understanding the impact of different organizational contexts and management styles on the more specific guidance that appears in later chapters of this document and in the other project documents.

II.

ORGANIZATIONAL CONSIDERATIONS

This chapter stresses the importance of recognizing the organizational and personal factors that influence organization structure, behavior, and decision processes. Information systems exist to serve decision processes. The success of the match between the two ultimately depends upon the ability of agency leadership, staff analysts, and information-systems staff together to read the trends of organizational change. This is true in developing the initial system design; it is also true in considering changes in design and in data collection over time.

Several different perspectives of organizational and individual behavior will be described here. They are not offered as proven definitions of internal organizational relationships, but rather as ways of thinking about the role of information systems in different organizational settings, given such organizational characteristics as different stages of organizational development, different personal styles, especially among agency leadership, and different decision processes.

Each of these three characteristics has its own developmental alternatives or stages. An understanding of the various stages in each category and of how some combinations can promote conflict while others promote synergy is important to successful information-system design and evaluation.

George Weathersby (1975) has assessed the relationships among stages of organizational and individual development and the characteristics of those decision structures and planning and management systems that seem best to

relate to each of the stages. The content of this chapter is based largely on that paper.

It is important for the reader to understand that the interrelationships that follow are offered only as a way of thinking about the developmental environment surrounding information-system design and management. There is no universal agreement on theories of either organizational or individual development; the stages are meant to be descriptive, not normative; and there is no necessary relationship between any particular combination of stages and information-system effectiveness.

Stages of Organizational Development

Weathersby's description of phases in organizational development is based upon Greiner's (1972) study of corporate organizations. In that study, Greiner argues that organizations evolve through predictable phases, that the transition from one phase to the next occurs at different rates depending in part on the external environment, and that each transition is accompanied by predictable management crises. Admittedly, there are alternatives to Greiner's rational, problem-solving view of organizational development. But it is a useful complement to the similarly rational view of planning and management that is the focus of most management-information systems. Table 2 shows five phases and transitional crises noted by Greiner (p. 41).

Table 2

Organizational Phases and Transitional Crises

Phase of Dominant Management Style	Nature of Transitional Management Crisis
1. Creativity	
	Leadership
2. Direction	
	Autonomy
3. Delegation	
	Control
4. Coordination	
	Red Tape
5. Collaboration	

The creative phase, typical of a new program, institution, or agency, is characterized by a small number of creative individuals conducting a visionary effort using collegial decision processes and informal communications. As the organization grows in size, its internal and external relationships become more complex and formal. Creative, collegial processes give way to demands for stronger (that is, more directive) leadership, and a leadership crisis develops.

The directive phase is characterized by a more formal, functional organization structure, operational systems (accounting, personnel), and communication

through a chain of command. As a result, management becomes increasingly remote from the operational levels of the organization, and a critical demand for autonomy develops.

The delegation phase is characterized by increasingly formal delegation of authority and responsibility to the operational level. Agency leadership manages by exception and focuses on overall agency concerns. However, as operational units go their own ways, coordination and accountability become increasingly difficult, and a control crisis is precipitated.

The typical response to the control crisis is development of formal coordinative systems. In the coordinative phase, the central staff is expanded and assigned some responsibilities from the previously autonomous subunits. Large numbers of rules and procedures, designed to achieve consistency among subunits, constrain individual actions. More emphasis is placed on justifying operational-level actions to the central staff. Bureaucratic processes (that is, red tape) become valued over substance, and a communication and trust gap can develop between top executives and staff. The result might be either a move to a collaborative phase (Greiner) or a cycling back to the directive phase, with a greater emphasis on trust, mutual acceptance of organizational and personal goals, and flexible rules (Weathersby).

The collaborative phase has been little observed in either corporate or educational organizations. Greiner describes it as problem-oriented and based on strong interpersonal independence. Central staff is reduced through reassignment to teams that are disciplinary and multidisciplinary. Management-control systems are simplified and supplemented by frequent conferences of team leaders. Innovation becomes valued once more. There is little evidence to suggest what kind of crisis follows this phase. Greiner suggests that it may flow from the emotional and physical exhaustion of teamwork intensity and may be dealt with by a phase of alternating work and renewal. Weathersby offers an alternative explanation that collaborative organizations may reach a stability crisis, causing the organization to "fission" into several creative organizations.

The application of this phase theory to state-level postsecondary-education agencies requires a dual focus: the agency as an organization separate from the state postsecondary-education system or community and the agency as a part of that system or community. Viewed as a separate organization, the brief description of each phase can be applied to a state agency as readily as to an institution or a corporation. Viewed as a part of a larger system or organization, the relationship is more complex.

In those states where the state agency is a governing board that evolved out of the growth of a single institution (usually the state university) into a multicampus system, Greiner's phase theory can be directly helpful. In most states, however, the state agency has been established after each of the public institutions has developed a delegative relationship with the state. Faced by fiscal pressures that aggravated attempts at voluntary coordination and accountability, state legislatures established or added to the authority

of state governing or coordinating boards at a brisk rate during the 1960s and early 1970s. Federal categorical grant programs and other interests in the "price tag" of the enrollment boom contributed to the trend.

If state coordinating agencies can be seen as a response to a control crisis, then the coordinative phase offers an apt description of the role for such agencies in the organizational development of public higher education. And the characteristic purposes and pitfalls of the coordinative phase can guide the design activities involved in establishing information and other state-agency planning and management decisions. The transfer of previously local initiatives to the state level, restrictions on institutional actions by state-level rules and procedures, shifts of resources away from the substance of educational services toward administrative overhead, and the potentially disruptive overlay of bureaucratic processes on collegial processes all characterize the introduction of a state-level presence into a previously locally governed system or set of institutions and form part of the information-system planning environment.

Stages of Individual Development

Weathersby's description of the phases in individual development is based on five major stages of adult ego development set forth by Loevinger (1970). The five stages and some of their key characteristics are presented in table 3.

Table 3

Characteristics of Five Developmental Stages

Developmental Stage	Key Characteristics
1. Presocial	Infancy
2. Self-protective	Wary, manipulative, exploitive, opportunistic, sees information as power
3. Conformist	Identifies with authority; concerned about social approval, material goods; sees information as way of insuring conformity
4. Conscientious	Self evaluative; aware of behavioral relationships; concerned about communication; sees information as related to personal analysis of options and consequences
5. Autonomous	Conscious of value of autonomy; recognizes issue, organizational, and people complexities; resolves conflict openly; tolerates ambiguity; motivated by personal growth; sees information as experiential, based on actual environments, integrating theory, and practice

The conformist, conscientious, and autonomous stages serve also as general descriptors of administrative style. The administrative style of agency leadership will not always be compatible with the developmental stage or style of the organization. This is not an indictment of any particular match of organizational style with leadership style; rather it is a caution against assuming that the stated mission of the organization is the only (or even the primary) determinant of the purpose and uses of the information system.

Conformist leadership in a coordinative agency can be expected to emphasize the use of management information as a check against standard practice (that is, as the basis for an audit function). Autonomous leadership in the same agency can be expected to rely very little on management information. The conscientious manager, so the hypothesis goes, would use management information to consider options, and consequences and interrelationships among them, in an evaluative mode.

Organizational Decisionmaking Processes

Table 4 is a brief, graphic description of the relationship between organizational stages and decision processes as described by Weathersby.

Table 4

Organizational Stages and Decisionmaking Processes

Organizational Stage	Decisionmaking Process
1. Creative	Simple, informal; direct communication and open sharing of information
2. Directive	Formal, structured, hierarchical; filtering of information through functional managers
3. Delegative	More specialists; decision process and information more decentralized, fragmented
4. Coordinative	Consolidation of implementing units; separate planning/evaluation function; formalized use of external (environmental) and internal (evaluative) information in decision analysis
5. Collaborative	Organized around problem-solving teams, multifunctional staff relating information and problem definition in flexible, interrelated ways

The point of this discussion is that each organizational stage or style has its own set of decisionmaking characteristics. That information, by itself, is helpful to those involved in information-system design. It is even more important to observe the occasional incongruities that develop

between the established style of an organization and the decisionmaking process preferred by agency leadership. In the long term, such incongruity will be resolved by a change in either the organizational style or the decision process. In the short term (usually following a change in agency leadership) the incongruity can place information-system activities and plans in flux.

For example, introduction of a highly structured, hierarchical decision process into a coordinative organization will disenfranchise separate planning/evaluation units and all others outside the formal chain of command from the decision process and will lead to a need to redefine not only the way in which information is presented but also the channels through which it flows.

The information-system planner is seldom charged with revising basic decision processes, so the task is one of observing how well matched the decision system is to the organization in question. This schema offers one framework for making that set of observations. Knowledge of such potential conflicts can help avoid establishing unreasonable expectations of information-system performance, an important step in the long-term success of the effort.

Information Systems

Selection of a workable information system should reflect the organization's stage of development and agency leadership's view of decisionmaking and information.

The relationships among these factors, as explored in Weathersby, can be summarized as shown in table 5.

Most state agencies fit somewhere in the directive/delegative/coordinative stages as described here, depending upon their degree of control over institutional governance (that is, governing board versus coordinating agency) and their length of time in existence. There is some cycling between coordinative and directive orientations, often triggered by conflicts between legislative pressure for more control over institutional affairs and institutional pressure for increased self-governance. The value of the Weathersby framework lies in the light it sheds on otherwise obscure interrelationships among organizational style, individual style, decision structure, and information systems. Each of these factors influences the development of the others, although compatibilities among them can occur. An information-system design that recognizes these evolutional patterns and interrelationships has a greater chance of meeting agency information needs and continuing to be useful and flexible.

Table 5

Summary of Suggested Interrelationships

Organizational Phase	Decision Structure	Type of Data	Type of Information System
1. Creative	Simple, informal, direct communication	Personal observations, experience, direct access	Informal, interpersonal, synthesis, consensual
2. Directive	Formal, hierarchically structured; information filtered through functional	add: functional transactions (accounting, student records)	add: Standard reporting formats, functional budgets, annual reports, computerization
3. Delegative	More specialists; decision process and information more decentralized, fragmented	add: More detailed transaction data by operating unit, sources and uses of resources	add: Unit cost analysis; comparative data on costs, workload, and performance; computers required
4. Coordinative	Consolidation, separate planning/evaluation function; formalized use of environmental and internal information in decision analysis	add: Standardized data elements	add: Objectives expressed as programs, PPBS, simulation models, program cost analysis, regular data exchange, extensive computerization
5. Collaborative	Oriented to problem solving, multifunctional teams	add: Personal feedback, process feedback	add: Flexible output formats, eliminate standard reports, PPBS, standard unit-cost analysis

Source: George B. Weathersby, "Decision Paradigms and Models for Higher Education," paper presented at the 48th National Meeting of the Institute for Management Sciences and the Operations Research Society of America, November 17, 1975, Las Vegas, Nev., pp. 69, 71.

Note: Add means that the listed characteristics are in addition to the characteristics listed above in the same column.

III.

ENVIRONMENTAL CONSIDERATIONS

State postsecondary-education agencies have no reason for existence independent of their relationship to the institutional community. State-agency roles reflect statutory responsibilities varying from institutional advocacy to institutional control. However, the basic assumption upon which those responsibilities rest is the need for an effective linkage between the state's interests (particularly in the state's resource commitments) in postsecondary education on the one hand and institutional delivery of educational services on the other.

Similarly, state-level information systems have no reason for existence independent of the agency purposes they serve. They are not ends in themselves. They should reflect the state-agency role, staff style and agenda, and the state/institutional linkage involved in developing the system should be as thoughtfully respected and maintained as that involved in all other relationships with the separate institutions, public and private.

The purpose of this chapter of the Guide is to identify the major characteristics of the information-system planning environment that influence the potential for success and to comment on ways in which the state agency can help create the most positive developmental atmosphere possible.

The State Agency's Managerial Role

It is unfortunate that the term management is so often used as a synonym for control (in particular for state-level control of institutional operations).

If the state agency can be seen as a "rock and a hard place" manager, responsible for organizing and executing the exchange of requirements and responses between the institutional "rock" and the legislative and executive "hard places," then the application of the managerial role begins to make more sense. It is when the state agency is seen as a part of the "hard place" that the control aspect of management becomes a strong issue. On the other hand, when the state agency is seen as part of the "rock," legislative and executive agencies may move to fill what they perceive to be a vacuum, leading to even more troublesome interventions in institutional affairs.

The most effective way of translating the agency's managerial role into guidance for the information-system effort is through the agency-staff agenda or work plan. Staff work plans take many forms, some of which are too informal to be of much help. To be a helpful guide to management-system planning, the staff work plan should identify agency goals, describe the current issues to be addressed, and prioritize the staff activities and staff resources proposed to support them. Preferably, staff activities can be described in enough detail to indicate the data intensity of the analytical approaches to be used in addressing each activity.

With such a delineation of the activities of the agency for a given period, an effective link is created among agency leadership, staff analysts, and information-system staff. Without it, decisions regarding data collection and system design tend to emphasize individual staff needs over those of the agency and may place relatively greater emphasis on the preferences of the information-system staff, thereby furthering the impression that the information system is an end in itself.

Staff Style

Staff style is closely related to agency role and authority but is often overlooked as an environmental influence on information-system development. The style of each agency staff is basically a collection of individual styles, but one characteristics has particular relevance for information-system planning: the individual and agencywide preference for data-oriented analysis. The degree to which agency staff are comfortable and skilled with rational analysis plays a major role in obtaining the best mileage from (and therefore efficient use of) available data.

This is not to argue that all state-agency staff should be data-oriented or that state-agency analyses and decisions can be divorced from the political environment in which they are addressed or from the intuitive judgment (some would say whims) or decisionmakers at all levels. On the contrary, intuitive, political decisions benefit from choice among carefully developed, well-documented alternatives. Decisionmakers who depart from the analytically supported course are better off knowing the degree of departure represented by their conscious choice process.

Neither is this an argument that there is no role for an information system in an agency with little or no data-intensive analytical activities or

data-oriented staff. The point is that the design task will differ in such an agency from one that relies heavily on data.

Length of Experience with State-Level Data Reporting

A successful information system depends largely on establishing and maintaining a series of routine cycles for planning changes to the system and data set, schedules for survey administration and data collection, and so forth. Information-system planners therefore must allow extra developmental time for establishing routines in the early stages of system development and at any point where a major upgrading step is taken. Failure to allow for start-up time is a frequent weakness in project scheduling and leads to unrealistic expectations on the part of users and funders.

One of the less obvious benefits of state participation in the Higher Education General Information Survey (HEGIS) is state-level experience in developing and coordinating institutional data reporting to the state. Each of the eight pilot-test states had been responsible for coordinating HEGIS before its entry into the State-Level Information Base project. Though a state-level information system is a much more comprehensive undertaking than HEGIS coordination, the experience gained with such basic activities as institutional liaison, data-collection scheduling, and development of editing routines served as an important, common state/institutional experience upon which to build the more comprehensive effort.

Institutional experience with information systems is another important source of momentum. A state agency attempting to collect data from institutions with limited or no internal management-information-system experience will face a lengthened or altered developmental schedule and a greater investment in institutional staff liaison and training than if the institutions have considerable experience of their own. There is one caution. Integrating state-level data requirements and definitions into an already well-developed institutional system usually involves negotiated conversions in the institutional configuration. The problem is compounded when several institutions, each with an investment in a separate data set and definitions, must be integrated into a single state-level system. In such cases, information-system planning at the state-level must recognize the real financial costs and potential losses in operational effectiveness of the data-reporting institutions and seek solutions that will minimize the costs and produce recognizable institutional benefits. One example of such a solution is the use of intermediate files with common definitions and formats as an interface between institutional and state systems for a limited number of heavily used data elements (McGovern 1976). Another example is renegotiation of user requirements (where possible) to make better use of the existing institutional data and definitions.

The point here is that length of previous state and institutional experience with centralized data collection of some kind can shorten the developmental schedule, provided that the state-level systems-planning staff carefully determines the nature of that experience and, at the institutional level, appreciates the real costs associated with changing internal systems

to match what are usually perceived as purely state-level requirements. Depending on the situation in a given state and the success with which previous experience is assessed and used, as much as a year in the schedule and one to two staff years of time can be saved.

Costs and Benefits

An important aspect of any management-information system is its costs and benefits. More will be said later in this document and in Systems-Related Experiences in Eight Pilot-Test States about particular resource requirements. The emphasis here is on the impact of cost/benefit dialogue and expectations on the developmental environment.

Establishing and maintaining a centralized information system is an expensive effort at either state or institutional levels. Developers of operational data systems frequently cite cost savings as a major part of the justification for investing in new or expanded systems. Use of an operation data base to produce planning information is usually a supplemental benefit not directly involved in justifying the original investment of resources. The situation is quite different for developers of postsecondary-education information systems at the state level. Few agencies have significant requirements for operational data systems, so the planning uses of the system must carry the entire justificational burden. Under those circumstances, the cost-savings argument is of little or no help.

There are similar problems with the benefits side of the argument. The activity is state-level in nature and in primary use, yet depends almost entirely on institutions for the required data. Given the nature of state/institutional relationships in most states, few institutions will be satisfied with a statement of benefits that relies upon improving the effectiveness of the state agency. Even at times of good state/institutional relationships (for example, in the wake of increased state support levels for institutions), it is difficult to demonstrate a causal relationship between good information and improved funding levels.

The difficulty of describing the costs and benefits of a state-level system can be eased somewhat by recognizing two points:

- The need for (costs/benefits of) an information system per se is related to the reasons for the existence of the state agency. At that level of argument, a data-providing institution may feel no better or worse about supporting the information system than it does about supporting the agency itself. The key to the cost/benefit discussion as it relates to this project then is how to accomplish the purposes of the system at least cost, not whether the effort should exist in the first place.

- To be effective, any justification argument based upon costs and benefits must involve demonstrable costs and demonstrable

benefits. Though this condition limits the possible supporting points, it also reduces the number of misunderstandings and unrealistic expectations too often attributed to information systems at all levels.

Demonstrable costs have been hard to develop. Even where attempts have been made to maintain cost-accounting information for the state-agency activity and to identify institutional reporting costs, the results have not been satisfactory. A later chapter, which encourages information-system planners to develop demonstrable costs, offers some suggestions for doing so.

Demonstrable benefits are also difficult to develop. Among the more commonly used are:

- Institutional benefits of state-agency access to a state-level information system (closely related to the overall effectiveness of the state agency in which the information system is located)
  - Better state-level recognition of institutional needs and resource requirements, that is, ability to convince the governor and the legislature of the legitimacy of the needs of postsecondary education
  - Better recognition of the resource and other needs of postsecondary education versus those of other state-funded services
  - More comparable information among institutions
- Institutional benefits of an information-system approach to state-level data collection
  - Reduction in the number of separate data requests
  - More predictable, integrated data-collection scheduling

A description of demonstrable costs and benefits is an important part of the information-system planning process generally and of the dialogue between state agency and data-providing institutions in particular. Even if the decision is to proceed without clear evidence of benefits that outweigh costs, all parties involved should be aware of the trade-offs at work (particularly when other beneficial data-collection activities and budget commitments may be displaced).

Institutional Concerns

The burden that a state-level information system places on data-providing institutions depends partly on the sophistication of the institutional data systems involved. That burden will be seen as particularly great when the data are national or when institutions receive no reports in return. In any

event, there can be no doubt as to the need for a well-developed, decision-supporting information base in any state with an expressed legislative or executive interest in the coordi[illegible]on of postsecondary education. Whether or not the state agency has a[illegible]to require data collection and no matter how much state-agency staff d[illegible]e challenges it receives to new data-collection requirements it pr[illegible]d to many that exist, as well) agency leaders must remain sensitive [illegible]nstitutional burden involved. The most meaningful expression of sensitivity to that burden is a commitment to limit data collection to what can be justified by the current and planned agency agenda, thereby minimizing the displacement of institutional resources away from other program areas.

While no one likes to be constantly justifying his or her existence, it is especially important here. While not all data providers can be expected to endorse state-level requirements, all should understand them. The burden is on the state agency to provide the basis for that understanding without being intimidated in its efforts to execute its established responsibilities.

Relationship between State-Level Information and the Independent Sector

As stressed in the other documents, the State-Level Information Base project found substantial differences among the states in the planning responsibilities and authority of state agencies and in the related needs for and use of data. Variations in relationships between state agencies and independent institutions are even greater than those between state agencies and public institutions. The reason is the wider variety of institutional natures that exists within the independent sector. In view of this variability, the relationships between independent institutions and state-level information-system planning have not been extensively explored during this project, and issues related to the independent sector's involvement seem best resolved within the conventions and structures of each state. The considerable variability in control, funding base, and potential data burden that characterizes independent institutions suggests that information-system planners in each state need to consult fully with the range of institutions in their independent sector if the latter are to be included in such an effort.

Three issues have emerged as individuals, institutions, and agencies in the independent sector consider state-level data collection and use: (1) the need to preserve and enhance the hallmark of the independent sector--its independence, (2) the need to provide the independent sector with information suitable to the planning of its agencies and institutions, and (3) the need to provide information to the state so that state planning can be cognizant of the mission, capacity, and condition of the independent institutions. Data that appear to serve one function can easily compromise another. Further exploration of these problems should take place as the nature and functions of state-level information are worked out in each state and as the effects of various required and voluntary levels of independent-sector data provision are determined.

The reader is also referred to the Kentucky section of the Case Studies, where a project conducted by the Council of Independent Kentucky Colleges and Universities is mentioned. That project, funded by the Ford Foundation, began

after the initiation of the State-Level Information Base project and is independent of the NCHEMS project. Its purpose is to address the issues raised in the preceding paragraph, starting with the first, in the context of state-level information-systems development in Kentucky. Particular attention is being given to the possible negative effects of required reporting of financial detailed personnel and program data.

Assessing the Data Needs of Other State-Level Agencies

If duplicative state-level reporting is to be minimized, the information-system staff in the postsecondary-education agency must attempt to identify all other state-level users of information and arrange with them to specify their needs on a schedule compatible with the annual data-collection calendar. Whenever unreasonable or indefensible requirements are discovered, institutions can expect the state agency to confront and either deny or negotiate the requirement. The benefit is a common set of data and definitions for legislative and executive (for example, Budget Department) analysis.

IV.

PROCEDURAL CONSIDERATIONS

The planning of a state-level information base has procedural characteristics similar to those of any other planning process. As a practical matter, the agency's information-base planning approach operates best if reconciled to the approaches used in connection with its other responsibilities, particularly where techniques for involving institutions and other interested parties in the process are concerned.

In any endeavor involving and affecting so many parties, responsibility for final decisions and the process for reaching those decisions must be carefully described and followed. While responsibility for developing state-level information systems clearly rests with the state agency, placing responsibility within the agency, developing participatory arrangements, and documenting significant steps in the decision flow (including alternatives under consideration) all do much to develop support for final decisions and for the steps necessary to implement them.

Placement of Decision Responsibility within the Agency

Too many organizations assign total responsibility for information-system design and operational decisions to the information-system staff. The result (a form of "out-of-sight, out-of-mind") isolates the activity from the mainstream of agency decisionmaking, contributing to a separation between the staff units that use the information and those who provide it. Depending upon the degree of autonomy allowed individual staff units, the final results can be initiation of separate data-collection activities and a breakdown in the basic purpose and operation of the central information system.

The solution rests in the direct, continuing involvement of agency leadership in all major information-system developments. The effort cannot be viewed as a purely technical activity to be left to technical staff. Not only is the activity symbolic of agency leadership's attitude toward institutions and other external audiences generally, but user involvement in information-system decisions is a key to successfully justifying data burdens and responding to data demands. Agency leadership is in the best position to sense data demands and negotiate responses. Agency leadership is also responsible for insuring the internal staff discipline necessary for users and providers of data to develop requirements cooperatively.

There is no best organizational location for the information-system unit. A separate unit, reporting directly to the agency director or deputy director, is in a better position to resolve conflicting staff demands for services than one assigned to one of the competing staff units. On the other hand, assignment to the major information-using unit can be more time efficient. A centralized analytical-studies unit is a good example of a major user. So are agencies where the budget responsibility drives 75 percent or more of the information-system activities.

One rule of thumb that can be offered is to assign the unit in such a way that all staff needs will be considered objectively and conflicts over relative priorities can be resolved by agency leadership as a matter of pre-established routine. These conditions can be achieved either by placing the unit in an organizational location that assures its independence and forces a negotiative process on competing staff units or by placing it in a major data-using unit headed by a person committed to the concept of staffwide service and fairness in resolving competing demands.

The Degree of Participation in the Decision Process

The emphasis here on state-agency responsibility for all final systems-design and data-selection decisions is not meant as a recommendation for an authoritarian decision process. Many parties, external and internal to the postsecondary-education community, have an interest in the developmental process. It is important for each to develop a sense of partnership in the system. Participation in the decision process, directly or through representatives, is an important way to develop that investment. All internal staff sections engaging in data-intensive analysis need representation in the process. External agencies, especially legislative staff analysts and executive budget staff, should also be involved. Institutional data providers must be represented if the viability or effectiveness of the system is to be regularly tested.

The typical approach to developing and maintaining the necessary participation is the establishment of an advisory committee, advisory to agency leadership, with the following responsibilities shown in table 6:

Table 6

Advisory-Committee Responsibilities

Responsibility	Frequency	Expected Result
o Review initial information-system plan plus updates	o One time, plus updates as they are proposed	o Acceptance of plan and updates as appropriate
• Review proposed data set and definitions, including underlying assumptions about the data-requiring decisions involved in the issues or functions that make up the agency agenda	• Annually, six months to one year in advance of scheduled data collection	• Acceptance of data requirements in context of stated decision requirements
• Review data-collection formats, schedule, and editing routines	• Annually, three to six months in advance of scheduled data collection	• Acceptance of most feasible data-collection instruments and schedule
• Review system design and software acquisition proposals	• As necessary	• Test staff proposals for cost/effectiveness against objectives of the information-system plan

The exact membership of the advisory committee will vary by the size and complexity of the postsecondary-education community in the state. In smaller states, each data-providing institution and each external state agency can be represented. The results can be an ideal gathering of all data users and data providers into a single-decision advisory process. In larger states, one or more representatives of each sector will provide a more feasible advisory-group size. When representatives are used, they must accept responsibility for facilitating understanding of information-system proposals and for developing concensus recommendations regarding proposals prior to final advisory-committee discussion. This additional step adds to the time necessary to process a decision and raises the possibility of less complete understanding and acceptance of final staff decisions than if each institution were represented at the table. If the advisory process is to remain credible, agency staff will have to accept these limitations and recognize the constraints they place on the process.

The advisory committee should meet at least twice a year (to evaluate the previous year's data-collection activities and state-agency uses, to consider staff-recommended changes in the data set, and to consider changes in data-collection instruments and schedule and editing requirements) and as many more times as necessary to consider other recommendations related to the developmental plan and schedule for the overall effort.

It may also be important to turn over to a technical task force the task of specifying new data elements and other more technical considerations, but care must be taken to be sure that the work of the technical task force is thoroughly discussed and understood by the advisory committee before it is implemented. This may slow the process, but it also serves to develop the all-important sense of involvement in the process and acceptance of the data set.

Another important attribute of the advisory process is an annual calendar (based upon an annual cycle) for identifying new data requirements, making changes in the data base, collecting data, and making data available. The schedule for the advisory committee should follow the cycle, with sufficient lead time for effective advisory input before decisions need to be finalized.

Since most such developmental efforts take more than one year anyway, such a sequence of steps allows the advisory network to see the requirement developing (thus no surprises) and the agency staff to be reasonably sure that the data requirement will remain unchanged long enough to justify its addition to the data base. Obviously, not even the best process will rule out the need for special surveys with little advance notice (for example, legislative requests) where there is perhaps time for only a telephone call or quickly called meeting to obtain institutional input.

The establishment of an advisory committee is not, in itself, sufficient to assure adequate participation. Successful participative processes also include regular contacts with the executive officers of all institutions involved in the data-collection effort and effective and continuing liaison with the information-system staff and other staff persons on each campus who will be responsible for providing the data. Preliminary contacts with the external state-agency representatives are also an important complement to the work of the advisory committee.

To repeat an earlier point, the objective of the advisory process is to create a sense of partnership regarding the data-collection activity and, especially, regarding how the data will be used. The partnership must involve data providers and data users alike, so that the direction and scope of the system is at least commonly understood and, preferably, generally accepted among all interested parties.

The Importance of Documentation

Since not all people interested in the information system will be directly involved in the advisory committee, documentation of the agency's plans and of the deliberations of the advisory committee becomes an important part of the implementing procedure. Advisory-committee minutes can serve the documentation process, but a separate newsletter written primarily for institutional and agency executive officers is preferable. Beginning with the initial information-base plan and data-set recommendations, efforts must be made to provide a record of the decision flow and alternatives considered to as wide an audience of potential data providers and users of the information system as possible. Documentation should present a clear picture of the connection

between state-level uses of information and the specific data elements necessary to support those uses, with descriptive information regarding analytical approaches and alternatives considered. Similarly, alternative software and other data-base support systems should be considered on a time-table sufficient to allow the choices to become general knowledge before the final decisions are made. There is one word of caution: this process can be overdone. Some states have spent years talking and writing position papers, unnecessarily delaying the decisions needed to get on with the job.

The Need for Orientation and Training Services

One important responsibility of the information-system staff is maintenance of user services, including basic orientation activities and analytical support to agency and nonagency staff with access to the system. In addition to published information, such as a user's newsletter, a capability for introducing and training such staff in accessing and working with the data base pays dividends in reduced amounts of systems-office staff time needed to do the same analysis.

An ongoing program of staff training activities for the information-system staff is also important. A combination of one-on-one training by the information-system manager supplemented by vendor and other technical workshops allows development of the staff skills needed for a particular system in a more predictable (and usually less expensive) way than can be achieved by hiring new staff.

Finally, periodic procedural-review sessions on-site with data providers allow for more candid, thorough discussion of data-reporting problems, state-level needs, and pending changes than is possible by memo or telephone. Institutional turnover can have as significant an impact on the quality of the data-reporting relationship as can state-agency turnover. On-site visits, once a year if feasible, also provide an opportunity for orientation of new institutional staff to the procedural requirements associated with the state system.

V.

ASSESSING INFORMATION NEEDS GENERALLY

Successful assessment of agency information needs depends as much on a clear understanding of agency purpose, structure, and analytical approaches as it does on any other single factor. Each state agency has a describable form and approach, and no two are exactly alike. Also, few have seen the need to develop a written or graphic description (beyond the typical organization chart) of the current and anticipated agency agenda and related processes. Yet information systems exist to fuel those organizational processes; an important initial step in information-system planning therefore is the description of data-using activities in a framework designed to closely relate data needs to the agency's organizational plan, whatever form it takes. In addition to its value as an organizational framework for the information-system planning process, this step serves to involve agency leadership in the design activity at the very beginning, where such involvement pays the greatest dividends.

Three possible frameworks are discussed here. They are an issues framework, a functional framework, and a structural framework. Each has its strengths and drawbacks. Each involves some form of specification of the agency's major decision responsibilities and related work agenda.

A Postsecondary-Education Issues Framework

The State-Level Information Base project selected an issues framework to identify and organize the reference data set contained in the document Selection of Data to Address Postsecondary-Education Planning Issues. The document contains a more complete description of the issues selected and the resulting framework.

Use of an issues framework has the advantage of relating information-base planning decisions, including data selection, to the state-level issues that are the analytical focus of the agency. An issues framework has an additional advantage to the project in that issues tend to be more common among states than either agency functions or organization structures. However, many staff analysts see an issues framework as at least one level of abstraction beyond what they usually address when setting work plans and priorities. This drawback can be moderated by the use of a matrix similar to figure 3.

Figure 3

An Issues/Data-Requirements Matrix

ISSUES	Issues Described	Required (or Planned) Decisions	Intended Analytical Approach	Data Requirements
1.				
2.				
3.				
4.				

Obviously, the more experienced the state agency is in maintaining an information system, the less elaborate the matrix needs to be. But the logical sequence from identification of the major issues facing the agency through specification of decision requirements and analytical approaches plays a key role in establishing and updating an efficiently sized data base.

The four issues that serve as the framework for the State-Level Information Base project documents follow:

1. Determining the extent of need and demand for postsecondary education in a state, including the needs of students and the needs of the state's society as a whole

   - Demographic characteristics of postsecondary-education participants
   - Demographic characteristics of state population
   - Demographic characteristics and educational objectives of high-school seniors
   - Number of applicants to postsecondary education
   - Number of characteristics of first-time entering students

- Elementary- and secondary-school enrollments
- Students enrolled in programs of particular state manpower planning interests
- Employment conditions and areas of labor power shortage
- Outcomes/impact of postsecondary education as indicators in postsecondary-education needs assessment

2. The nature and location of programs necessary to respond to identified needs and demands for postsecondary education
   - Inventory of existing institutions and their characteristics
   - Inventory of existing programs
   - Program enrollments
   - Program completers
   - Program quality or effectiveness
3. Characteristics of the availability and use of resources
   - Data on financial resources
   - Data on personnel resources
   - Data on facility resources
4. Analysis of alternative policies for financing postsecondary education
   - The amounts and sources of state and local revenues
   - Postsecondary education's share of major state and local appropriations
   - Levels of appropriation by program, with special reference to student-financial-aid funds

While this set of issues is intended to be comprehensive enough to serve all states, it is not intended to be descriptive enough to serve as the agenda for any particular state. Also, the support data suggested above are illustrative and should not be considered as a recommendation to any state for maintaining particular data. Each agency needs to conduct the analysis within its own planning environment.

A Functional Framework

Many state agencies prefer to develop data requirements around the major functions served by the agency, for example, long-range planning, budget development and justification, program review, and so forth. A functional approach has the advantage of being less abstract (more closely related to actual work plans and priorities) than the issues framework. The main drawback of the functional approach is the tendency to use it to justify a fully developed function (and related data requirements) as an end in itself, inadequately related to the issues or decisions to be served by the function.

A Structural Framework

Development of data requirements based upon the stated needs of separate organizational units suffers from a lack of an integrative, agencywide focus and an inadequate relationship to overall agency purposes. If all agency staff share a common sense of agency purposes and supporting activities, then this drawback may be moderated. More often it leads to data "wish lists" that must then be reduced to a necessary set in what can become a dysfunctional, confrontive process.

A further drawback is the extent to which agency functions are typically split among organizational units. The most common solution to the duplication that can result is identification of functional leaders working with interunit staff teams (an approach that argues more for a functional than a structural approach).

Other Considerations in Adopting a Framework for Information-System Planning

The use of specific decisions or the agency agenda are frequently suggested as additional frameworks. They are not developed here, since the concepts they imply are already incorporated in the Required (or Planned) Decisions and Intended Analytical Approach columns of the three matrixes suggested above.

Most data bases are organized around file structures that reflect data types (student, course, staff). While such an organization is consistent with the organizational concept behind a common data base serving common purposes, it is not useful as a way of helping data users identify new data requirements. Duplicative "wish lists" and a scattered connection between agency purposes and data collection quickly result.

The remainder of the process for identifying and selecting specific data elements involves a review of new data requirements against the existing data set; identifying those that can be served by combining or adapting existing data elements; and, finally, by specifying new data elements and data-collection instruments that will be used to gather them. This part of the process will also become less elaborate as the agency gains experience with the relationship between the uses of (needs for) data and the data-base definition process. More will be said about that part of the sequence in the following chapter.

Regardless of the framework used, it is important that adequate rigor be exercised in identifying agency data requirements. Two things work together to encourage excessive statements of data requirements. First is the growing dialogue nationally about data requirements associated with such broad state responsibilities as budget and program review. The second is the tendency of any analyst to request data that might upgrade the quality of analysis beyond what is possible from existing data.

Neither tendency is a serious problem, provided that all proposals for new or revised data collection are tested against statements (provided by the same staff that propose the data requirements) of the specific analytical objectives or external state-agency requirements the data are intended to support. Selecting or revising an approach to budget or program review is usually developed within a separate institutional advisory structure. So it is reasonable to expect agency staff to limit their data demands to those related to the analytic approaches as discussed in those separate deliberations. Also, agency staff have an obligation to negotiate external agency data requirements with the objective of satisfying as many such requirements from existing data sources as possible. Any new requirements that remain after the negotiation can then be built into the data-base updating process.

Past experiences in developing state-level information systems reveal that an agency should not expect to determine all its data needs at once. Rather, a reasonable set of data should be determined and new data added as need d. Fortunately, most new requirements will be for new arrangements (such as ratios) of presently collected data elements. This is, essentially, the reason for a data-base approach to data collection.

Other General Considerations in Assessment of Agency Information Needs

Several other matters that need to be addressed in the preliminary stages of the agency's assessment of its information needs include the importance of interstate exchange of data in support of agency activities, the extent to which the agency is willing to collect data on an ad hoc versus a recurring basis, and the discipline with which the agency will attempt to limit its data collection to data requirements versus "nice to have" data.

Interstate exchange of information receives its impetus from the practice of many state agencies of using benchmark or comparison states in certain staff analyses. The use of interstate comparisons is especially prevalent in the analysis of instructional program costs and other work related to the development of budget formula factors. The typical exchange agreement involves less than 10 states and is based upon conventions necessary to translate each state's own data and definitions into a common format adequate to serve the stated purposes of the exchange. Because each such agreement has its own objectives and conventions, the potential for a more generalized exchange is limited. Even within the task of analyzing budget formula factors, too many subtle differences of approach exist to support the development of a single nationwide exchange set.

Even if agreement could be reached about the comparison information needed to form an exchange set, few states will want to modify internal definitions (often achieved at considerable internal political costs) in order to support it. This problem can be moderated somewhat by also exchanging state-specific definitions so that they can be converted into a comparable format. The difficulties associated with achieving interstate comparability should serve as a reminder to state-agency staff of the difficulties faced by institutions as they attempt to report institution-specific data in state-required formats.

The point here is not to discourage development of interstate-exchange agreements, but to emphasize the significance of the decision to participate. It will take a special effort on the part of the state agency to convince data-providing institutions to adopt definitions different from those they have been using, so the value of interstate comparison data must be determined early and justified well.

Some mechanisms do exist to promote the exchange of experience and information among states. The federal emphasis on developing data standards is helpful. The National Center for Education Statistics/State Higher Education Executive Officers (NCES/SHEEO) Network is a nationwide example of an information-exchange activity. The Southern Regional Education Board and other regional compacts are additional examples. But the practicality and benefits of a specific data set to support general exchange among the states has not been established and is not a specific dimension of this project. The reference document Selection of Data to Address Planning Issues does include a recommended definition for each data element and, to the extent additional states adopt the project's definitions, the potential for exchange of data will be increased.

The decision between ad hoc (special surveys) and recurring data collection in support of agency-staff activities is made for the most part by the nature of the activities. Regular staff analytical requirements, such as those related to the budget cycle and various monitoring functions, are the primary focus of the state-level information-system activity addressed in this document. Special studies, while not the focus of this project, may also be supported by the information system, by rearranging data elements already included in the data base to meet the special requirements.

The use of special surveys is best justified when (1) the analysis requiring the data will not be repeated and cannot be modified to use existing data sources or (2) the analytical approach has not been refined and data is required to test options. In the first case, common sense argues against processing the requirement for addition to the permanent data set. In the second instance, the likelihood of frequent changes in data and definitions during the developmental process suggests delaying revisions in the data set until the developmental process is complete.

Special surveys that vary little from data available in the regular data set should be carefully negotiated with the analyst involved to see if the same staff results can be achieved with data already available. Repetitive

special surveys, involving little change in data collected from one to the next, should be processed through the advisory structure for addition to the regular data collection.

Nice to have is an indicator of undefined responsibilities or analytical approaches. It reflects an intention or preference on the part of the analyst for improving the scope of a particular analytical activity. A more appropriate sequence is for the analyst to first establish the proposed new approach on its own merits and then, when a decision to proceed has been made, to process the new data requirements through the regular advisory structure for addition to the regular data collection.

Most nice-to-have requirements will disappear somewhere in the process of justifying the need for or value of the new approach. Those that survive that process and the decision process for additions to the regular data-collection calendar are no longer nice to have, but rather are necessary.

VI.

SELECTING AND EVALUATING SPECIFIC DATA ELEMENTS

Establishing new data-collection requirements (with their accompanying burdens on data-providing institutions) is a difficult process at best. It is therefore important that the initial data set be comprehensive enough to avoid frequent changes and additions, especially during the time institutions are developing the routines necessary to support state-level requirements. This caution applies not only to the selection of data elements but to the establishment of definitions. Since, ideally, the institutions will be providing the state-required data from levels of aggregation captured within their own information system, changes in definitions can be even more of a nuisance than additions or changes in the number of specific data elements. Above all, the importance of advisory participation by the affected institutions must be emphasized.

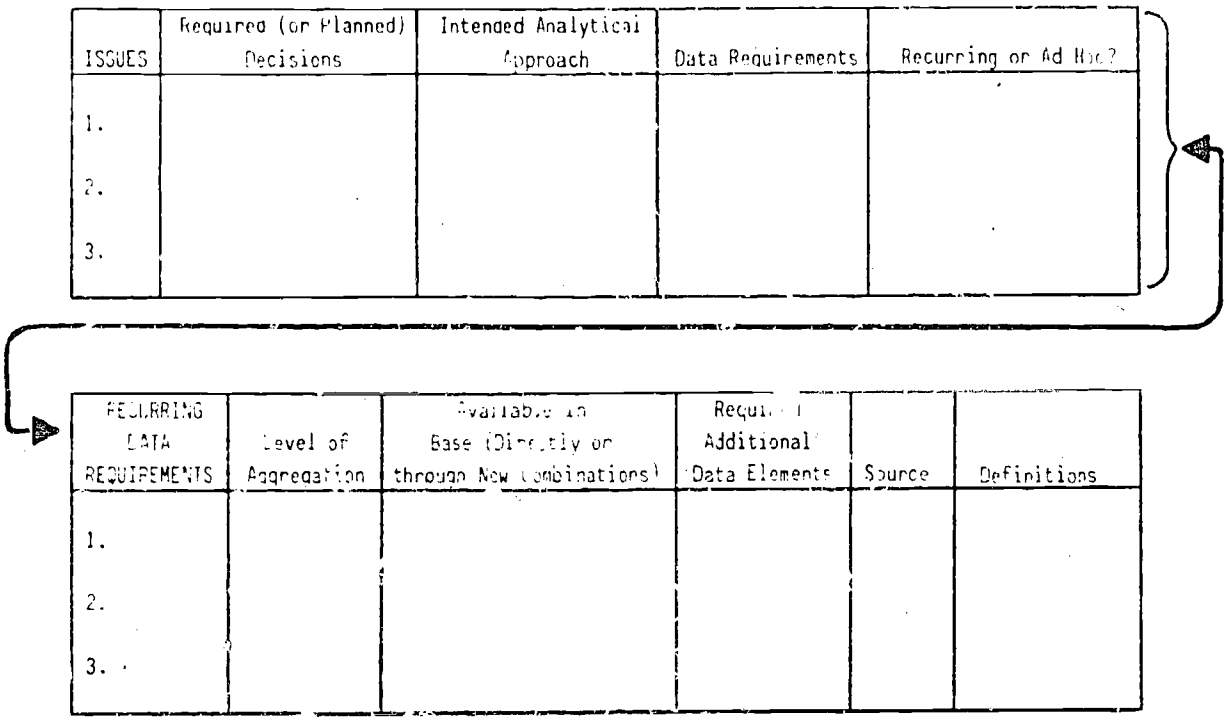
Completing the Link between General Data Needs and the Selection of Specific Data Elements

Chapter V discussed three possible frameworks through which an agency's general data needs can be determined. To complete the data-selection task, the statement of general data needs (as expressed by the data users in the agency) must be made specific enough to guide the data-base modification process. This is the crucial linking step between the data users and the information-system staff. The skillfulness with which this interface is handled can make or break the system.

A general picture of the remainder of the sequence is illustrated in figure 4 (the issues framework is used here as a reflection of the State-Level Information Base project experience; other frameworks could be used):

Figure 4

The Data-Justification Sequence



ISSUES	Required (or Planned) Decisions	Intended Analytical Approach	Data Requirements	Recurring or Ad Hoc?
1.				
2.				
3.				

RECURRING DATA REQUIREMENTS	Level of Aggregation	Available in Base (Directly or through New Combinations)	Required Additional Data Elements	Source	Definitions
1.					
2.					
3.					

Determining Appropriate Levels of Aggregation

Different levels of detail in data collection and maintenance will be determined by the differing levels of detail in the information required to support agency analytical responsibilities, all of which are directly or indirectly tied to differences among the issues addressed. One state agency may need to go no lower than broad postsecondary-education sectors (senior institutions, community colleges and vocational/technical institutions, independent higher-education and proprietary schools). Another may need to develop information on individual institutions, particularly in the public sector, or may need program-specific information. Rarely does a state coordinating agency require course-specific or individual-specific information on either students or faculty in order to support its planning activities, though a governing board may need such data to exercise its operational responsibilities.

As a general rule, a state agency should collect no greater detail than can be justified by the specific requirements of its analysis. To do otherwise

invites difficulties in reconciling detailed data among institutions--a time-consuming and frustrating activity--with no apparent return on the effort invested. For those state agencies with program-review responsibilities, it is reasonable to expect collection of at least some data at the program level. Most budget formulas use discipline-level cost information, while most of the trend and illustrative data required to support long-range planning documents can be developed at an institutional or sector level of aggregation. The point is that in addition to knowing its analytical requirements, the state agency should identify the lowest level of impact of its decisions, (program review to program level, budget formulas to two digit HEGIS level, master plan documentation and support only to the sector summary level) and relate its data collection to those levels of impact.

The temptation is to collect more detail so the agency can be responsive to more detailed questions as they develop in various executive and legislative review processes. There is no doubt that the ability to be responsive to detailed questions during legislative testimony pays dividends for the presenting agency, but the cost in terms of maintaining data at that level can be significant. If there is a discernable pattern to legislative and executive inquiries, it may be cost-effective to include the related data items in the data base. Otherwise, it is a part of the obligation of the state agency to negotiate responses to detailed questions through specific data surveys with an appropriate delay in response time.

Identifying Sources of Data and Definitions

The project data reference document, Selection of Data to Address Planning Needs, identifies the probable sources for much of the data it contains. Institutions are the primary source of the data in any state-level information base. Since few state information systems preceded their institutional counterparts, there is an inevitable need to negotiate adjustments in institutional definitions or to translate existing institutional data into the state framework. When the state agency is also the coordinator of the Higher Education General Information Survey, the task of definitional compatibility for some of the data required from institutions will be made somewhat easier. The HEGIS survey not only provides the potential for state summaries of basic postsecondary-education characteristics for possible use in support of state planning, but it also appears to provide potential for some interstate exchange of higher-education planning information. The State-Level Information Base project staff is working with the National Center for Education Statistics staff on the development of editing routines that will support the state agency's responsibility for coordinating HEGIS data collection.

The definitions included in Selection of Data to Address Planning Needs have been drawn from several previous NCHEMS efforts, including the Statewide Measures Inventory and the Data Element Dictionary. While they are not recommended as standard definitions for all states, they can further extend the interstate-exchange potential now present within the HEGIS set to the extent that they are adopted by a majority of states. The Selection of Data document also identifies external sources of data, including, among others, the U.S. Census Bureau and Department of Labor. These sources can be available

to state agencies whether or not they are built directly into the agency information system.

The decision regarding whether access is more satisfactory than incorporation into the information depends on a variety of other factors, including agency responsibilities, structure, and the design of the system. The more frequent the update requirement for the state-level comprehensive plan, the more likely some sources of external data should be maintained within the information base where they can be subject to the same computer access and analytical software capabilities as other sources of data.

Some Cautions

While definitional consistency among institutional sectors and among states is not a requirement for a successful information base, loss of that consistency creates some difficulties in aggregating the results of staff analysis for broad state-level purposes. In other words, it is possible to conduct most analyses on a sector-by-sector basis and reach separate conclusions about the impact of potential policy actions on the individual sectors. But it is usually an expectation of external legislative and executive reviewers that the recommendations for all sectors be reconcilable. The same reconciliation can also be a helpful prerequisite to applying (or at least explaining) a policy action consistently to all sectors.

The frequency with which individual data elements are used is an important consideration. It is an important evaluative task to periodically review all data collected, modifying the data set as necessary to stay abreast of emerging issues. A potential example in some states is the significant investment in facilities-analysis systems. The rapid growth of higher education and the strong federal commitment to higher-education construction in the late sixties and early seventies provided resources to state agencies for the development of facilities and analysis systems that were quite sophisticated and data intensive. Most state agencies continue to maintain detailed facilities data in their information base. Over the next three to four years, most state agencies should review that requirement and either significantly raise the level of aggregation at which data are maintained or consider discontinuing it altogether.

Changing facilities issues, such as deteriorating building quality, access considerations, and shifts in program emphases, will continue to be a part of state analytical agenda. The kind of data necessary to support these developing issues differs from that used during postsecondary education's growth period. Selection of Data to Address Planning Needs addresses facilities data by program and building quality. Data regarding access are currently the subject of a federal data-collection planning effort that is too preliminary to support project recommendations here.

Ironically, most incremental refinements in state-level information bases risk breaks in some significant historical series. While trend analysis is not the only form of analysis supporting state-level planning, it continues

to be a significant one. Legislatures as well as staff analysts find comfort in long-term historical series. An important step in defining specific data-set requirements is to make some provision for protecting the historical series or, if it must be broken, for providing a parallel series with a translative mechanism reconciling the two. There will be cases where it will be a better choice to forsake an improvement in the definition of a data element than to make the change and create an irreconcilable break in the historical series. The quality of data provided by reporting institutions and others improves as the same data collection is repeated. For these reasons, state agencies should avoid any but the most justified changes in the existing data set and should carefully schedule changeover to be as consistent as possible with existing reporting routines and other constraints facing institutional data providers. If dramatic or repeated changes are necessary in a data set, the state agency must accept its part of the responsibility for any loss in usefulness of the information that results.

VII.

ASSESSING RESOURCE REQUIREMENTS

Establishing and maintaining a state-level information base is an expensive enterprise, usually involving extensive additions to the ongoing budget requirements of the agency. The efficiencies involved in handling multiple data requests from a single data base are an important part of the argument for any information system, and central processing usually involves some financial economies of scale over a decentralized operation. Still, it is the benefits, not the cost savings, of an information base that best justify the activity.

Assessing the benefits of a state-level information base is complicated by the multiple purposes it serves and by multiple perspectives regarding its potential uses. An information base containing data for monitoring program productivity will have high value to the staff of a state agency responsible for review and discontinuation of programs, but will be seen by the affected institutions as having zero or negative value.

In any event, the effectiveness of the information system is closely related to the resources available to it. Inadequate resources can force information-system managers to shortcuts in the editing of data received, in the ability to respond to various analytical approaches of different staff sections (particularly in terms of computer-software capabilities), and in the ability to be timely. Failures in any one of these areas lead to inadequate performance. Inadequate performance, in turn, makes the costs associated with the state-level information base appear even less justified.

The importance of using all data collected is also key. Collecting data that will not be used is pointless. In fact, the result can significantly weaken the credibility of the entire effort.

The advice of the project on this subject is based largely on the experiences of the eight pilot-test states. Systems-Related Experiences , vides additional resource planning information. State-agency staff involved in the business of information-system planning are encouraged to consider the experiences of these eight states and to look at the experiences of other states as well. Considerable time and effort can be saved through the sharing of both good and bad decisions.

Staff Requirements

In assessing staff requirements, consideration must be given to three different kinds of staff skills. First, the project manager is the key to the success of the overall efforts. The manager provides the interface between management and technical staff and processes most feedback regarding suggestions for change and improvement in the system. While there is no prescriptive set of qualifications for the project leader, the position requires operations-research and systems-analysis backgrounds together with the personal skills necessary to work closely with agency staff in all functional units, with institutional staff represented on the advisory committee, and directly with institutional data providers. In addition to being technically able to properly plan and manage the effort, the project manager needs to be able to supervise the systems and programming staff that are necessary to complete the team. Successful state-level information-base activities are those led by someone able to quickly interpret management needs and to respond to them without the constraints of the resources available.

The task of systems analysis is most intensive during the period when the initial support system for the information base is being designed and developed and again during periods when major revisions are being made. The number of analysts needed to support the function depends on the size of the system being designed and maintained. Because of the relationship of systems needs to peaks in the developmental stages, many agencies contract for systems analysts rather than hire permanent staff who may later be underused when the major staff activity is routine maintenance of the information base. The systems-analysis staff also provides an important back-up to the capabilities of the project manager, increasing the manager's flexibility in being responsive to requests for alternative approaches to the organization and display of information. The need for programmers to support systems-analysis activities, especially in the early stages, is another important consideration.

The agency requirement for program and data-control clerks depends on the size of the information base being maintained. It also depends on the nature of the annual data-collection cycle. Cycles that are geared to peak data collection at two or three times during the year (the beginning of fall, winter, and spring quarters, for example) typically create staff overloads at those periods of time with resultant delays in the availability of processed data. While it is usually not practical for the agency to increase staff during those short periods of time, the peaks still occur. About the best an agency can do under such circumstances is to attempt to reschedule user demands to suit the limitations of the information-system staff.

The wide range of organizational structures, responsibilities, and styles among state postsecondary-education agencies (and among the pilot-test states) precludes development of a rigorous set of guidelines regarding the total number of staff required for systems of different sizes. But in general, the minimum for any agency is a project manager plus one full-time systems-analyst position and one FTE of programming time. The number of data-control clerks will vary from one part-time to several full-time, depending on the size and schedule of the flow of information into the system.

In the early stages of systems development, the project manager can serve as data-base administrator. As uses of the data base become more sophisticated and as the number of files grows, most agencies will need a full-time data-base administrator, charged with responsibility for maintaining and updating each of the files, including development of interfile and intersector analyses.

Computer Support

The extensiveness of the computer-support budget depends largely on the sophistication of the agency analytical agenda. The more sophisticated the analysis being contemplated and the larger the postsecondary-education community being analyzed, the more likely the agency will face a requirement to purchase or contract for computer support over which it has first priority in scheduling. On the other hand, a state agency without plans for sophisticated modeling or similar kinds of analyses or with a relatively small postsecondary-education community may cover its needs by contracting with other computer agencies or by working with the state computer network, when one exists. Successful pilot-test states have used computer-support capabilities ranging from in-house computers through contracts with major universities to contracts with outside computer companies. The further removed the computer is from the control of the analytical staff, the greater the risk of insufficient priority to assure timely and quality output. The cost trade-off between an in-house computer with underused capacity versus contractual services from a computer broker must take into account the differences in the quality and continuity of service that will be available to the analyst.

Computer costs should be relatively low during the developmental stages of the project, increasing as use of the system increases. On balance, most interested state agencies will find that their major expense is the number of staff necessary to maintain a responsive system.

Systems Support

Since this project does not propose a standard data base with implementing procedures, neither has it developed unique data-base management or access software to accompany state-level information-base activities. The experience of each of the state agencies with the software they have selected is captured in the project document Systems-Related Experiences in Eight Pilot-Test States. That document, supplemented by direct contact with some of the pilot-test state agencies, should provide each interested agency with the ability to evaluate many of the software products on the market to determine which ones are worth pursuing directly with the vendor.

Institutional Costs

It is clear that the costs to data-reporting institutions need to be better represented in state-level information-system decisions. However, the process for doing so is unclear. The New Jersey Department of Higher Education used a one-page survey to gather estimates of institutional direct costs for responding to the surveys through which the data for its information system are provided.

Each institution reported direct cost information in the following categories for each survey:

- Professional staff
- Computer-programming staff
- Data entry/operations staff
- Clerical and support staff
- Data-processing operations
- Materials
- Other

Direct costs were defined as those directly attributable to the specific task of providing the data requested on a particular form. Not included are indirect or overhead costs, hardware costs, or developmental costs for information systems already operating.

The method suggested for costing personnel costs was to determine hourly salary rates for all persons working on the data-collection forms (whether or not they are actually paid on an hourly rate) and then to multiply the hourly salary by the number of hours spent by each person in completing each form.

The New Jersey survey was first done for 1977-78 and will be repeated in 1978-79. It is difficult to draw conclusions on the basis of one year's data, but most felt the results at least represented the cost of institutional reporting, and many felt it did so accurately.

Some variation of the cost-survey method seems to be the most feasible approach to recognizing institutional costs in the information-system decision process. Other approaches, such as attempts at one-time cost analyses of institutional reporting or maintenance of separate records by reporting institutions, are more expensive to conduct with no apparent improvement in study results or impact on the state-level decision process.

The lack of good cost records regarding the experience of developing an information system hinders management's ability to acquire the resources needed to ensure that the benefits of the system outweigh the costs. Considering the attention given to the costs associated with management information systems, surprisingly few state postsecondary-education agencies maintain information-system cost records. Though it will mean a separate costing routine, some attempt should be made to capture at least direct costs by object of expenditure and purpose. Otherwise information costs become hidden costs, and trade-offs with other staff and function priorities cannot be described or defended as well as they need to be in a time of limited resources. Also, external agency demands for more or different information appear to be without cost.

Noble Deckard (1970), suggests one set of object-of-expenditure and expenditure-purpose categories:

- Objects of Expenditure
  - Systems analysts
  - Programmers
  - Computer time
  - Administrative services
- Expenditure Purposes
  - Organizational requirements analysis
  - System development and design
  - Equipment specifications
  - Systems programming and testing

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