DOCUMENT RESUME

ED 351 437 CE 060 325

AUTHOR Dick, James C.; And Others
TITLE Design of a Model Management Information System (MIS) for California's Regional Occupational Centers and Programs. Final Report.
INSTITUTION California Educational Research Cooperative, Riverside.
SPONS AGENCY California Association of Regional Occupational Centers and Programs.
PUB DATE Oct 91
NOTE 184p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC08 Plus Postage.
DESCRIPTORS Computer Oriented Programs; Computer Software Evaluation; *Data Processing; Decision Making; Information Management; Literature Reviews; *Management Information Systems; Models; Program Development; Program Implementation; Regional Schools; Secondary Education; *Vocational Education; *Vocational Schools
IDENTIFIERS California; Regional Occupational Centers

ABSTRACT

The management information system (MIS) development project for California's Regional Occupational Centers and Programs (ROC/Ps) was conducted in 3 phases over a 12-month period. Phase I involved a literature review and field study to match MIS design features and development strategy with existing conditions in ROC/Ps. A decision support system was chosen because of the need for integrated and interpreted data reported by local ROC/P managers. A middle-out or prototyping approach was selected due to the extreme diversity of ROC/Ps. Phase II included development and pilot testing of MIS model software at 12 pilot sites. Findings indicated the following: the software was relatively free of bugs, technical documentation was clear and easy to follow, current data aggregations were problematic, data preparation and input time was slow and cumbersome, top manager involvement was lower than optimum, and conceptual understanding was difficult. In Phase III, participants were interviewed and findings were analyzed and reported. Participants expressed enthusiastic interest in implementation. The most common criticism was the labor-intensive nature of the initial data input. Suggested improvements were less restrictive fields and changes to user interface. A suggested use for the system was a base of program evaluation data. (Appendixes include a 96-item bibliography, interview forms, and supporting documents, such as lists of data and information needs, review of existing information systems, computer model, and software benefits.) (YLB)

Design of a Model Management Information System (MIS)

for California's Regional Occupational Centers and Programs

Final Report

by

James C. Dick
Douglas E. Mitchell
Jeffrey B. Hecht

October, 1991

CALIFORNIA EDUCATIONAL RESEARCH COOPERATIVE
UNIVERSITY OF CALIFORNIA, RIVERSIDE

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Design of a Model Management Information System (MIS)

for California's Regional Occupational Centers and Programs

Final Report

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In contract with the
California Association of Regional Occupational Centers and Programs

Preface

This is the final report of the research effort conducted by California Educational Research Cooperative in contract with California Association of Regional Occupational Centers and Programs (CAROC/P). This report is the major written product of the project. Two other documents which have been produced under separate cover are:

1. Design of a Model Management Information System (MIS) for California's Regional Occupational Centers and Programs: **Supporting Documents**

This is a collection of 10 supporting documents pertinent to the st[illegible] but not vital enough to be included as appendices in the final report.

2. Regional Occupational Centers and Programs - Decision Support System (ROCP-DSS) **Instruction Manual**

This is a manual which accompanies the proto-type software program that was developed and tested during the study. It is referenced under "Dick, J. (1991)" in the Bibliography.

Copies of both of these documents are available through CERC at:

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Executive Summary

The Problem

The California Association of Regional Occupational Centers and Programs (CAROC/P), one of the largest providers of public vocational education in the state of California, has recognized the need for improved information usage in planning, developing, managing, and evaluating vocational education programs throughout California. Technological advances in the last decade have sharply reduced the cost of information management while dramatically improving the reliability and sophistication of analysis and interpretation. While making local management information systems (MIS) cost effective, however, these new technologies also made the job of information system design with the needs and interests of seventy different ROC/Ps and the state of California subtle and complex.

California's Regional Occupational Centers and Programs are sharply divergent in size, governance, resources, and local goal priorities. As a result ROC/Ps vary significantly from one another in:

1. specific management problems needing attention
2. types of information needed to inform management decisions
3. current capacities to generate and analyze needed information
4. resources available for MIS development and operation
5. readiness to incorporate new technologies and utilize advanced information analysis techniques.

Finding a technology and a development strategy to bridge this wide diversity is a major challenge to MIS development for CAROC/P.

In addition to the complexities of local capacity and needs, CAROC/P MIS development confronts an inherent tension between uses of information management vs. accountability. To be used for management purposes, an information system must identify ways of linking changes in program operation and resource utilization with student outcomes and overall program support. Managers need to understand contextual constraints to be able to explain deviations from expectations and to take corrective action. By contrast, when used for accountability purposes an information system is simpler and more static. Accountability systems focus on quantifying operations and comparing outcomes. They can ignore contextual constraints while management support systems cannot. Developing a system which balances the needs of local managers for context-sensitive details with the needs of state level leaders for uniform and accurate summary report information is an essential element in an overall CAROC/P - MIS development strategy.

CAROC/P has had an evolving interest in improved information usage. A history of instability in funding and support has coalesced ROC/Ps into an association with the common goal of maintaining their institutional vitality. In the fall of 1988, CAROC/P, in cooperation with the state, invested in a major cost/effects study. This study recommended that the organization pursue the development of a statewide management information system (MIS).

The Project

In August of 1990, the CAROC/P board contracted with the California Educational Research Cooperative (CERC), a research unit of the School of Education, University of California, Riverside, to undertake development and testing of a management information system (MIS) for ROC/Ps in California. A steering committee made up of representatives from CAROC/P and the California Department of Education set the focus of the project on the design and testing of a model system directly supporting course-level management and also providing a base from which state level reports can be generated.

The MIS development project was conducted in three phases over a twelve-month period. Phase I involved a review of literature and a field study to appropriately match MIS design features and development strategy with existing conditions in ROC/Ps. Phase II included the development and pilot testing of MIS model software. Phase III involved data collection, analysis, and reporting of study findings.

The MIS Piloted

A prototyping strategy was selected for MIS development rather than the more common hierarchical strategies because of the extreme diversity of ROC/Ps. Prototyping begins with the quick creation of a small, workable, modular system which is focussed on a particular problem or set of problems. It is implemented next to existing systems. Users provide feedback to the designers on the fit of the system features to their situation. Designers incorporate changes into subsequent versions of the model which are further tested and critiqued. This iterative cycle continues with refinements and expansions of the system as long as the development is beneficial to the users and/or cost effective for the supporting agency. In this case the prototyping approach allowed the system to focus on the management problems and decisions common to all ROC/Ps and avoided the conflicts and costs associated with constructing a system at the level of daily operations. Requiring uniformity of operations at the local level was suspended in the short term until consensus could be reached on the management decision priorities.

A decision modeling design was taken rather than a standardized data analysis design because of the need for flexible data analysis in local ROC/Ps. The lack of clarity on the priorities of different program quality indicators in ROC/Ps called for a system which could model the relative importance of various measures. By allowing local managers to model data analysis after their own unique decision making patterns and priorities, the system becomes a tool for shaping and documenting decisions. For the prototype MIS development, standardization of data analysis was de-emphasized in favor of flexibility and adaptability to local differences.

A Decision Support System (DSS) rather than a operations control system was developed because of the need for integrated and interpreted data reporting by local ROC/P managers. The type of DSS most appropriate to the conditions in ROC/Ps is an analysis information system which integrates and analyzes data on costs, enrollments, retention, attendance, ADA revenues, labor market, completions, placements, quality of instruction, student and employer feedback, and other measures of course quality. The piloted system facilitates operational management and strategic planning related to ROC/P programs. It also helps ROC/P management to quickly identify programs needing attention, target interventions, and provide documentation to demonstrate program quality and justify management decisions. The DSS developed for CAROC/P serves as a tool to improve local management and increase local motivation to collect valid and reliable data. In its piloted format, the system de-emphasizes external control through standardized reporting of quality indicators. When local management has achieved a level of confidence in using information to support decisions and when consensus has been reached on common indicators of merit, the establishment of ancillary reporting functions to develop statewide analysis of overall ROC/P productivity will become feasible and valuable. In the long run, the capacity of the prototype MIS to share and report common information will be virtually unlimited.

Conclusions

Uses of the System

The system has four major functions and ten primary benefits as illustrated in the following table:

Functions	Benefits
A. Information Organization	1. Integrates data from many sources
	2. Sorts available data based on multiple weighted variables
B. Information Analysis	3. Refines data definitions
	4. Establishes local standards
	5. Clarifies priorities
C. Decision Support	6. Localizes management control
	7. Monitors accounting and reporting
D. Communication	8. Informs of conditions
	9. Motivates to action
	10. Justifies decisions

The MIS Improves Information Organization

Many ROC/Ps have separate information systems for finance, attendance, personnel, courses, and students. The model MIS does not replace these, but it integrates data from each into a single database describing the characteristics and operations of all sections operated by the ROC/P. By establishing the course-section as the universal unit of analysis, the prototype MIS makes a wide variety of analyses possible. The system sorts sections in ranked order to show relative performance on any operational characteristics of interest to local managers. Managers need only to glance at reports to see which sections are performing at or above expectations and which are not. Another organizational feature of the prototype system is that it reports results using uncomplicated plus (+), minus (-), and neutral (o) symbols rather than overloading reports with numbers. Reports show quickly which aspects of section performance need attention.

The MIS Enhances Data Analysis

Important universal performance measures, such as labor market and instructional quality, can be derived from combinations of several indicators. The prototype MIS helps ROC/P managers refine their data definitions by merging multiple measures.

ROC/Ps are required by law to establish quality standards for their courses. This function is facilitated in the model by allowing users to set two break points for each measure or detail defined in the system. These break points establish a positive, a neutral, and a negative range. Since these are locally determined, they can be used for local goal setting and motivational purposes.

The developed system recognizes that program performance can only be adequately determined when multiple indicators are used. Management needs, priorities and options are brought into focus by generating course performance profiles based on multiple indicators and locally-determined success criteria. The prototype MIS has a system for weighting details so the relative importance of different indicators can be clarified through "what if" modeling.

The MIS Supports Improved Decision Making

Like other educational and social service agencies, ROC/Ps require sophisticated management information systems in order to significantly improve management decisions. Only by putting a powerful management tool into the hands of local managers can information analysis be helpful enough to offset data management costs. Properly used, the prototype MIS provides feedback to managers to help them guide both interventions and commendations. It gives clear indication of where the attention of the manager is needed and how serious any given problem might be, relative to other problems. It shows when goals and objectives have been achieved, and when sections or courses need to be terminated.

Future versions of the prototype MIS will be equipped with a reporting module making it possible to share data between ROC/Ps and report summary data directly to the state. Local managers will be able to monitor accounting and reporting since the information reported will have already been used to support basic management functions. The model system may eventually replace the current processes for course approval, biennial course quality review, and compliance reviews.

The MIS Improves Communication with Key Constituencies

Both internal and external communication in ROC/Ps is limited by a lack of integration and interpretation of data. The prototype MIS provides flexible control of data reporting, and uses a simplified format which is easy to understand. These reports have value at all levels of the organization to describe current conditions and motivate action to improve program operations. Additionally the reports benefit managers by justifying the decisions they make, especially those in sensitive areas. The reports are a powerful tool for communicating both the strengths and the weaknesses of the organization.

Limitations of the Pilot Version

Some limitations of the current test version of the program are obvious. The most conspicuous is that all data must be collected and transformed outside the program itself. At this point, the system is designed exclusively as an engine for data analysis and reporting. Data collection and storage functions remain with each ROC/P to manage using procedures used in the past. A production version of the software would have a much more sophisticated electronic interface with existing data systems which would automatically import data and transform it appropriately.

Need for Manager Development and Technical Support

The level of manager involvement and conceptual understanding in the first round of model testing was lower than needed for long term implementation of a fully developed MIS. Many ROC/P managers assumed that the prototype system was intended to improve data processing efficiency rather than support management decision making activities. Since the DSS model was not designed as a transaction processing tool to improve clerical efficiency, those who treated it as such were disappointed and usually did not understand the system's power as a management tool. Clearly a major hurdle to a broad-based understanding and acceptance of the DSS model for ROC/Ps is an education of managers to the fundamental differences between transaction processing systems and management information systems.

Recommendations

Further System Development

Among the first additions to subsequent versions of the DSS software must be modules that allow menu-driven user control over electronic transfer of data into the system. The overhead costs of data entry must be reduced significantly if the DSS is to be regularly used by ROC/P managers. A second priority in DSS revision is the added capability of calculating new details from existing details and of automatically aggregating and disaggregating data in various ways. A third priority addition is the capacity of the DSS to store historical data and perform trend analyses and reporting. Other suggested additions to a second version include:

1. capability to suggest solutions to problems found
2. opportunity to interactively insert memos into reports
3. more section and course code fields on which to select
4. more cut-off points in details for greater case discrimination
5. a module for generating the state required reports

Technical improvements suggested include:

1. allow changes of the colors for monochrome screens
2. use function keys to shortcut some of the processes
3. allow for customized data viewing and reporting
4. provide more on-line help

Implementation Support

Full implementation of a production version of the MIS model will need substantial support to be a success. First of all, the association should pursue a second round of pilot testing with the added improvements as listed in an above section. Along with the testing of system improvements a substantial staff development effort is needed to train ROC/P managers in information-based management decision making. Included in such an effort would be the development of promotional and training materials, on-site management consulting, and support for regular training sessions.

Following the pilot testing of a second version of the ROCP-DSS, and the preliminary training of ROC/P managers, a production version of the DSS should be developed for distribution and implementation in all ROC/Ps statewide. The implementation process will require training support in the use of the system for management improvement. In-house technical consultants will also be needed to assist in installing the system and in creating customized local linkages to existing transaction processing systems.

To realize the full potential of the system for networking and sharing information statewide, resources must be made available to facilitate (a) the sharing of decision models and (b) the standardization of data element definitions and data collection protocols. Once the consensus has been built at the local level as to the most appropriate types of data to distribute publicly, the electronic system for linking all ROC/Ps to one another and to the state office of education can be designed and put into place.

State Policy Framework and Support

To state policy leaders we offer the following recommendations:

1. Take the long view of developing local capacity for improved information-based ROC/P management rather than the short view of developing accuracy in data reporting.

2. Encourage and facilitate local consensus building on data definition and collection protocols. Make it attractive for local ROC/P managers to use information for management purposes.

3. Create a state level capacity for re-analysis of local models to learn how local managers model their own decisions and how local context variations cause managers in apparently similar decisions to make different decisions.

4. Examine state policy and regulations for ways to increase the accommodation to local variations. Allow local managers to adjust programs to local needs so that local information will become more valuable. Valued information is much more likely to be valid and reliable information.

Acknowledgements

We are indebted to the Research Committee of the California Association of Regional Occupational Centers and Programs for the leadership and foresight to commission this study. Like every quality research project, this study required enormous support from a wide variety of individuals and groups. Directors and staff members in several ROC/P willingly took time to explain their information systems to the researchers. CAROC/P staff members throughout the state collected management information documents and participated in workshops to define key data elements for use in the pilot versions of the MIS model. Pilot site office staff patiently endured the frustrations of pilot testing a new software product. We want to extend a hearty thanks to all these individuals who informally devoted of their time and energies to make this project a success. We also want to recognize those who contributed to this study formally.

The project advisory committee deserves special thanks for the thoughtful direction provided: Darrell Opp, research committee chair and president elect of the CAROC/P; Ted Zimmerman, project manager and consultant to CAROC/P; John Van Zant, chair of the action committee on labor market issues; Bill DePew, chair of the action committee on information systems; Gordon Ray, chair of action committee on legislation finance action; Laurel Adler, president of CAROC/P; Dick Adams, former president of CAROC/P; Roland Boldt, director of program fiscal and compliance services, career-vocation preparation division, state office of education; Chris Almieda, program manager of the industrial technology unit, state office of education; Berlin Parker, representative of the industrial technology unit, state office of education.

The directors of the pilot sites deserve commendation for volunteering to invest time and resources to the testing of the MIS model: Fresno Metro ROC/P, Bud Steuart & Bill Schultz; Kern High School District ROC, Cecil Brisco; North Orange County ROP, Tom Kurtz & Bill Depew; Riverside County ROP, Rick Collins & Pat Ainsworth; Sacramento County ROP, David Montague; San Diego County ROP, Dick Adams; Tri-Cities ROP, JC Low & Bud Davis; Baldy View ROP, Larry Weigel; Harbor Occupational Center, Al Platt; Mission Valley ROP, Ed King; North Santa Clara County ROP, Ron Guyer; Tri-County ROP, David Divini.

We would also like to thank the CERC technical support staff who provided assistance in conducting the literature review, proofreading, and producting the final report: Kananayakal Rajan, Tripp Doepner, Jane Zykowski, Susan Hill, Shirley Hall, and Kristen Cornett.

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Chapter One 1

- Introduction -

This project, Design of a Model Management Information System (MIS) for California's Regional Occupational Centers and Programs, had five goals:

1. Determine the nature of the MIS needed in ROC/Ps
2. Establish an MIS development strategy
3. Design a model system
4. Pilot test the model in several sites
5. Evaluate the model and report on its utility

Particular attention was given to addressing the wide variation among ROC/P managers in identifying and defining course level management information needs. The expected outcome of the project was a model MIS capable of analyzing ROC/P programs on such variables as student enrollment, program quality indicators, labor market demand, and program outcomes like placement rates. Specific design elements were developed through involvement and input of state level staff, ROC/P site managers, and experienced researchers.

Background and Setting for the Study

For over a quarter of a century Regional Occupational Centers and Programs (ROC/Ps) have been the chief providers of state funded job training for high school juniors and seniors. ROC/Ps also provide adults with original job training, skills upgrading, and/or retraining. The unique mission of ROC/Ps is to provide vocational and technical training to prepare students for:

> an increasingly technological society in which generalized training and skills are insufficient to prepare high school students and graduates, and out-of-school youth and adults for the many employment opportunities which require special or technical training and skills. (State of California, Cal Ed Code, Section 52300)

During the decade of the 1980's several factors contributed to the need for a management information system in California's ROC/Ps. Fluctuations in the state funding allocated to ROC/Ps, caps placed on revenues, increased accountability reporting requirements, and changed high school graduation requirements all impacted ROC/P management (Mitchell & Hecht, 1989). These policy changes, increased corporate and public interest in vocational training dramatically and increased the complexity of the task of managing ROC/Ps. By the late 1980s ROC/Ps were serving fewer high school students, attracting more adults, and modifying their training programs to contain costs in a rapidly changing high-cost workplace.

The California Department of Education and the California Association of Regional Occupational Centers and Programs (CAROC/P) have been cooperatively seeking to clarify the management needs and develop meaningful solutions. In 1987 a research project was funded by the state for CAROC/P to evaluate and demonstrate the cost effectiveness of ROC/P programs. The findings from this study, conducted by the California Educational Research Cooperative (CERC) confirmed that ROC/P revenues have fluctuated dramatically and have gradually decreased over the past 20 years. The study also demonstrated that the program outcome data intended to document ROC/P performance are neither common, useful, nor reliable (Mitchell & Hecht, 1989).

Without commonly defined and reliably collected data, any attempt at the analysis of program effectiveness is subject to error and open to criticism. Statewide data are needed for making sound policy decisions. Locally specific program quality measures are needed for making intelligent program improvement decisions. Existing information systems are unable to provide useable data for either state or local purposes. As a result, the ROC/P cost effects study report recommended that the state and CAROC/P collaborate on the development of a Management Information System which could address the needs for accurate and reliable data at both the local and the state levels (Mitchell & Hecht, 1989)

Scope of the Project Activities

In 1990, the California Department of Education (CDE) funded this project to research, design, and test a model Management Information System (MIS) for ROC/Ps. The California Association of ROC/Ps again subcontracted with CERC to research and develop a model management information system which could be implemented on a state-wide basis. The research was facilitated by an advisory committee formed to provide direction and guidance.

The study was undertaken in three phases over the twelve month period between September 1, 1990, and August 31, 1991. In Phase I a review of the literature on information system development was undertaken to identify possible approaches to take. A field study was then conducted to determine the nature of needs and conditions in ROC/Ps which would help to direct the design and development process. In Phase II a model MIS with supporting documentation was developed and pilot tested in twelve selected sites across the state. In Phase III participants in the pilot study were interviewed and findings were analyzed and reported. Recommendations for further development and implementation are presented in the Executive Summary preceding this report.

Chapter Two 2

- Phase I - A Literature Review on MIS -

A substantial body of theoretical and empirical literature on Management Information Systems has been produced within the last twenty years. With the rapid growth of the computer industry, the study of automated information systems has expanded in a number of directions. Information system analysis has found its way into such diverse fields of study as sociology, electrical engineering, cognitive psychology, and organizational behavior (Ahituv & Neumann, 1990). This body of literature was reviewed to provide an understanding of the definition of management information systems and to identify the optional approaches to information system development.

Appropriate matching of information system design features and development strategies to the situation where the system is to be implemented requires a thorough understanding of all three - design features, development strategies, and situation conditions. The literature review in this chapter clarifies optional design features and development strategies, the field research described in chapter three identifies the prevailing conditions in ROC/Ps which pertain to the selection of design features and development approaches.

Definition and Components of an MIS

Management information systems, and the acronym MIS, have been given many different meanings. One of the more comprehensive definitions is provided by Murdick (1980, p. 11):

> The system which monitors and retrieves data from the environment, which captures data from transactions and operations within the firm, and which filters, organizes, and selects data and presents them as information to managers is called the management information system

It is important to distinguish between Transaction Processing Systems (TPS) and Management Information Systems (MIS). TPSs capture, store, and report data. MISs go further, they organize and transform data into information; for generating management reports in the form of:

1. summary periodic reports to monitor organizational performance
2. operational exception reports to highlight potential problems or identify new opportunities
3. strategic planning and control reports to analyze decision options (Murdick, 1980).

High level management information systems are sometimes called Decision Support Systems (DSS) (Alter, 1976). This label highlights the managerial role of the system and focusses attention on the difference between DSS and lower level Transaction Processing Systems (TPS) which are primarily concerned with the techniques and procedures for data storage and retrieval. The differences between transaction processing systems and decision support systems are described in Figure 2.1.

Comparison of purposes, uses, and characteristics of Transaction Processing Systems (TPS) and Decision Support Systems (DSS)

	Transaction processing systems	Decision support systems
Purposes	Transaction processing Record keeping Business reporting	Decision making Decision implementation
Uses	Obtain pre-specified aggregations of data in forms of standard reports	Retrieve isolated data items; Use as mechanism for ad hoc analysis of data files; Obtain pre-specified aggregations of data in the forms of standard reports; Estimate consequences of proposed decisions; Propose and Make decisions
Characteristics	Passive clerical activities; Oriented toward mechanical efficiency; Focus on past; Emphasis on consistency	Active line, staff, and management activities; Oriented toward overall effectiveness; Focus on present and future; Emphasis on flexibility and ad hoc utilization

(adapted from Alter, 1976:98)

Figure 2.1
Comparison of TPS and DSS

The key operational terms for a TPS are efficiency, reliability, and consistency. To be useful the TPS must keep both hardware and staff uses to a minimum and still move data rapidly and reliably from input to report formats. The criteria for evaluating a DSS is quite different. To be valuable, <u>a DSS must be capable of combining data creatively and flexibly and extracting operational parameters that improve management control systems.</u>

Some analysts distinguish communication support systems from decision support and transaction processing systems as different elements of a comprehensive information management system (Kozar, 1989) Figure 2.2 outlines the contents of these three different types of information systems.

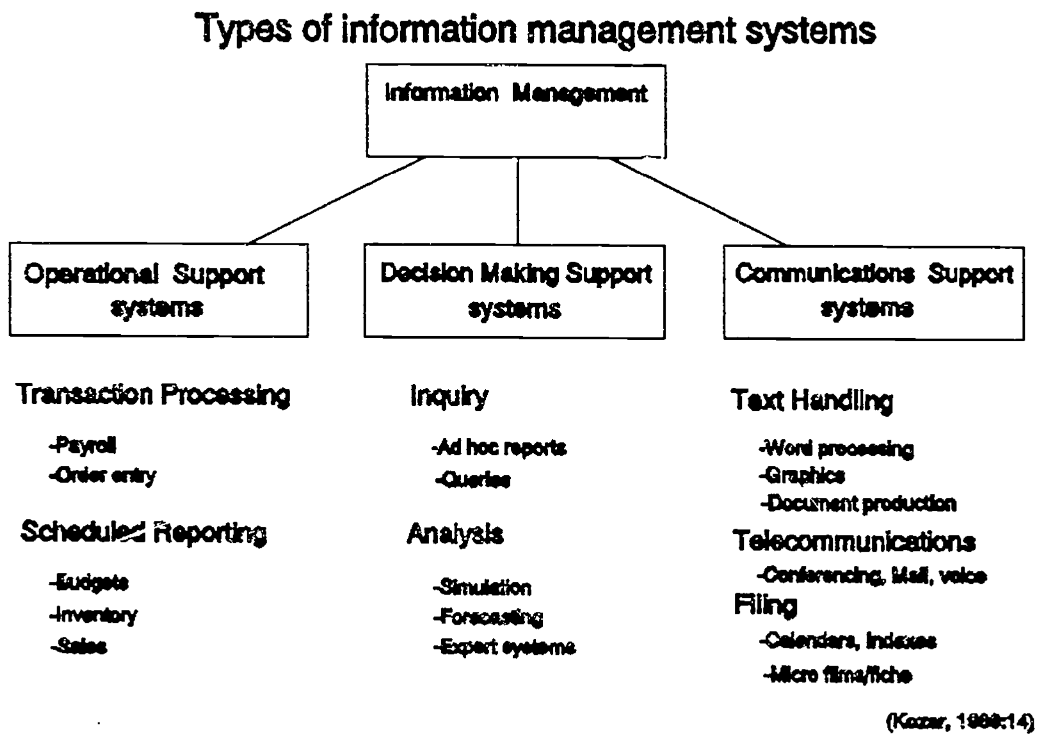


Figure 2.2
Types of Information Systems

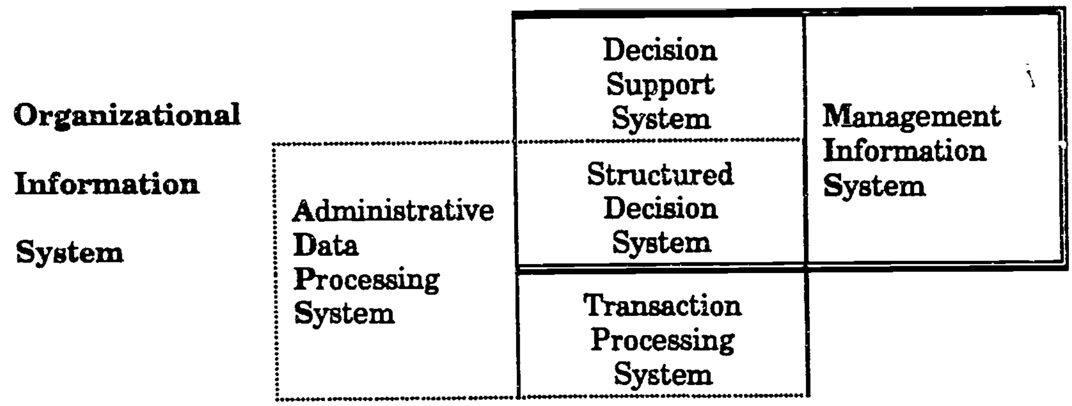
Before the technology explosion of the 1980s, virtually all efforts at MIS development concentrated on transaction processing. This emphasis was made necessary by the high cost of electronic data processing hardware and the limited availability of trained staff capable of operating it efficiently. Reporting of data of necessity, emphasized development of list oriented transaction records. These systems, usually designed around several subsystem data bases, are expensive to integrate and generally take a long time to design and install properly. Kozar (1989) notes an increasing shift toward the development of decision making support and communications systems in recent years. These more recent systems are designed to:

- meet immediate needs of managers for information
- respond to time pressures to solve problems
- focus on specific problems (often short lived)
- require some pre-analysis or manipulation of data
- incorporate data from a variety of sources

Decision making support systems tend to be less elaborate in design than transaction processing systems. Involvement of organization members in identifying the goals of the system and the immediacy of the data analysis problem precludes long software and data collection development times. It is often useful to quickly develop prototypes when designing decision making support systems (Kozar, 1989).

As noted by Ahituv and Neumann (1990) there is a substantial overlap between decision support and transaction processing system functions. They label the data storage and retrieval as well as the operations control associated with automated data manipulations as administrative data processing. Figure 2.3 illustrates how these authors reserve the term MIS for the systems that include information analysis and automated control of structured decisions.

A Physical Structure of
Information Systems
in Organizations



(Ahituv & Neumann, 1990:131)

Figure 2.3
Structure of Systems in Organizations

They conclude by defining an MIS as:

> an information system that makes some managerial decisions and provides managers at all levels of an organization with the information needed for making other decisions (Ahituv & Neumann, 1990, p. 133).

Relation of Decision Support to Management

Managers differ in their needs for information. This difference is related to the types of decisions made at different levels in an organization. Top level managers must solve problems which have little structure and for which the data needs are poorly defined as illustrated in Figure 2.4.

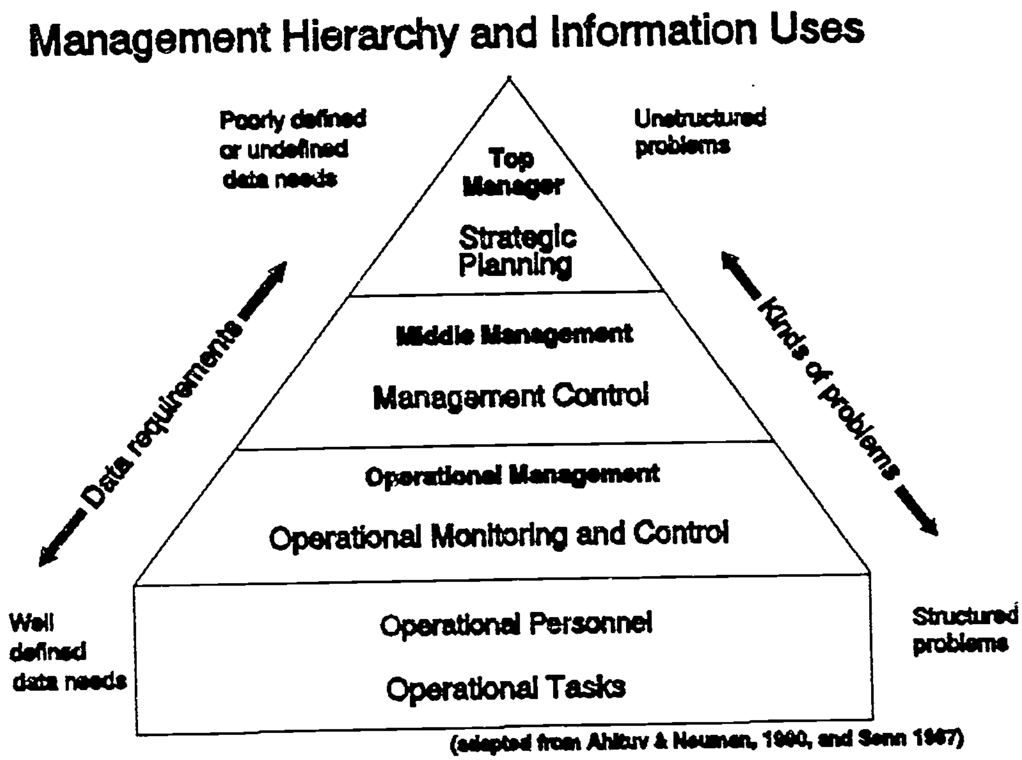


Figure 2.4
Management Hierarchy and Information Uses

Managerial decisions can be classified into the three levels:

1. Strategic planning -- Deciding on objectives of the organization, on changes, on the resources needed, and on the policies that are to govern the acquisition, use, and disposition of these resources.

2. Management control -- Assuring that resources are obtained and used effectively and efficiently to accomplish the organization's objectives.

3. Operational control -- Assuring that specific tasks are carried out effectively and efficiently (Ahituv & Neumann, 1990, pp. 111-112).

Another way of representing information needs at different levels of management is by information types. Top managers have a relatively low need for detailed factual reports on the internal working of the organization. They have a much higher need for summarized status reports on the relative health of the organization as well as external intelligence related to the impact of the organization on its constituents. Figure 2.5. illustrates the relative need for different information types at different management levels.

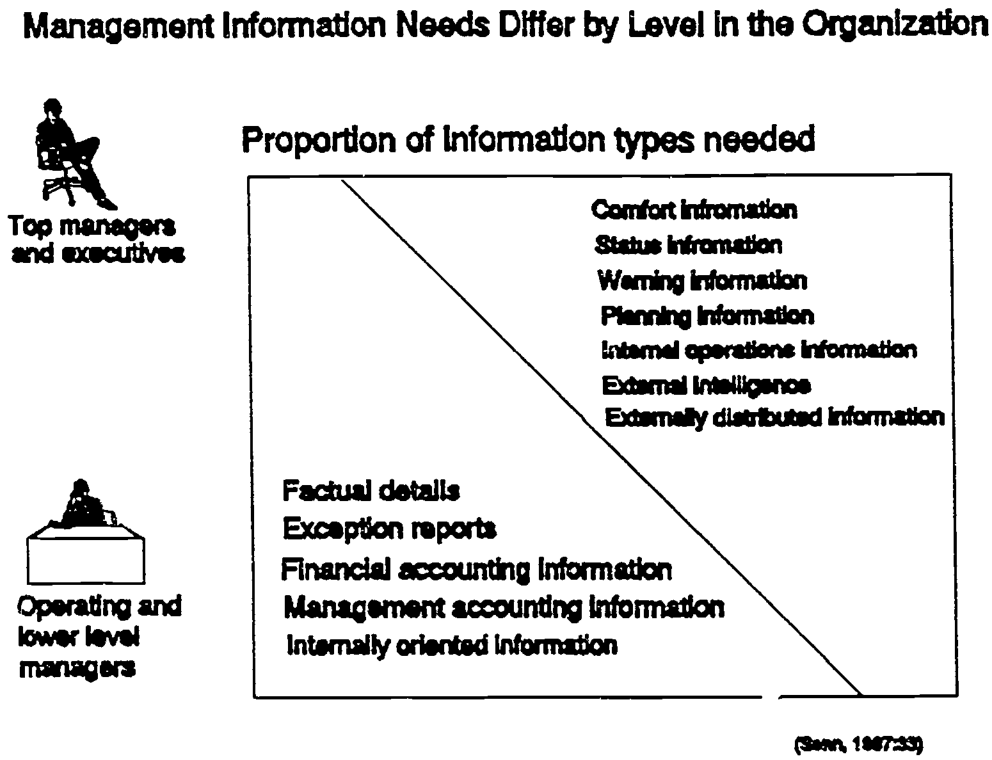


Figure 2.5
Management Information Needs

Types of Decision Support Systems

Different types of decision support systems can be designed to meet different management information needs. The type of system depends on the nature of decisions being made, the nature of the organization, and available information processing capabilities. Alter (1977) examined a large number of decision support systems and found significant design and functional differences. He advanced a taxonomy of decision support systems which distinguished systems on several key characteristics. Figure 2.6 shows seven types of systems by orientation, action, type and function.

A Taxonomy of Decision Support Systems

Orientation	Action	Type	Function
Data Oriented	Data Retrieval	**File Drawer Systems**	allow immediate access to data items.
	Data Analysis	**Data Analysis Systems**	allow the manipulation of data by means of operators tailored to the task and setting or operators of a general nature.
		Analysis Information Systems	provide access to a series of data bases and small modules with ability to integrate and analyze data.
Model Oriented	Simulation	**Accounting Models**	calculate the consequences of planned actions based on accounting definitions.
		Representational Models	estimate the consequences of actions based on models which are partially non-definitional.
	Suggestion	**Optimization Models**	provide guidelines for actions by generating the optimal solutions consistent with a series of constraints.
		Suggestion Models	perform mechanical work leading to a specific suggested decision for a fairly structured task.

(Alter, 1977:41-42)

Figure 2.6
A Taxonomy of Decision Support Systems

A file drawer system provides on-line access to an existing electronic data base. In an ROC/P setting such as system would allow a manager to access up-to-date reports like the enrollment status of any given class. Such a system keeps administrators efficiently informed with current information pertinent to organizational operations.

A data analysis system is slightly more complex in that it screens data before reporting it. Summaries, graphical representation of numbers, and sorted lists are typical outputs of data analysis systems. This type of system also keeps the manager informed of operational conditions, especially problems and exceptions.

Analysis information systems are designed to integrate, screen, and interpret information. They extract relevant information from existing electronic data processing systems, combine it with information from other internal or external sources, and perform various sorts, calculations, or analyses on the data before reporting it. They are often rather flexible in that managers can select the information to include in the analysis and can manipulate the reporting to match their changing information needs. In ROC/Ps an analysis information system might combine data relative to course costs, completions, placements, and job market to produce a profile of course quality. Such reporting capabilities are useful to top level managers for strategic planning and for middle managers and program supervisors for appropriately targeting their inservice and intervention efforts.

Accounting models function primarily as planning tools to simulate or project the consequences of a particular decision or action. These models work particularly well with budget planning and other cost analysis management decisions which lend themselves to clearly defined data relationships and specific numerical formulas. They are useful to business managers for planning budgets and analyzing the cost benefits of certain decisions.

Representational models function similarly to accounting models in simulating the outcomes of a particular action. These models differ from accounting models in that the analysis is based, at least partially, on relationships which are not clearly defined. Representational models often have a secondary function of helping to clarify the nature of the relationship between various forces influencing decisions or outcomes. Such a model applied to ROC/Ps may be used to clarify the relationship of various quality indicators such as labor market, cost, or placements to the decision of the ROC/P director on course retention or termination.

Optimization models are based on complex mathematical treatments of data which have as an end output recommendations for how to best reach goals such as maximizing income or minimizing cost. Optimization models are often seen as a "way of viewing tradeoffs, the importance of constraints, and so on." (Alter, 1977, p. 48).

Suggestion models are much more structured than optimization models. They function to perform complicated calculations which lead to the best or the right answer to a problem situation. The output of such models is a "specific recommendation for action" (Alter, 1977, p. 49). They serve to supplement or replace some of the routine but complex thinking and calculations which a manager would otherwise have to do in making a decision. Another name for a suggestion model is an expert system.

Strategies for Information System Development

Just as there are many different types of management information systems, there are multiple strategies for designing and developing information systems. A careful analysis of development strategies suggested in the literature provides a sound basis for approaching MIS development for CAROC/P. At least four different appropriate strategies to system development can be identified (Ahituv and Neumann, 1990). They are: (1) bottom-up, (2) evolutionary or modular, (2) top-down, and (4) middle-out or proto-typing. These approaches can be illustrated in relation to the order in which they place emphasis on the different components of a system.

Information System Components.

The goal of system development is a complete and comprehensive information system including transaction processing, structured decision control and unstructured decision support systems. Figure 2.7 illustrates these major components of a system. The transaction processing system (TPS) supports operational staff and emphasizes data processing efficiency. The structured decision system (SDS) takes information from the TPS, controls routine decisions and generates standard reports needed by managers. A decision support system (DSS) provides executive management with information needed to solve planning or policy problems. A DSS assists with decisions that are ill-structured or require a broad range of information and inputs.

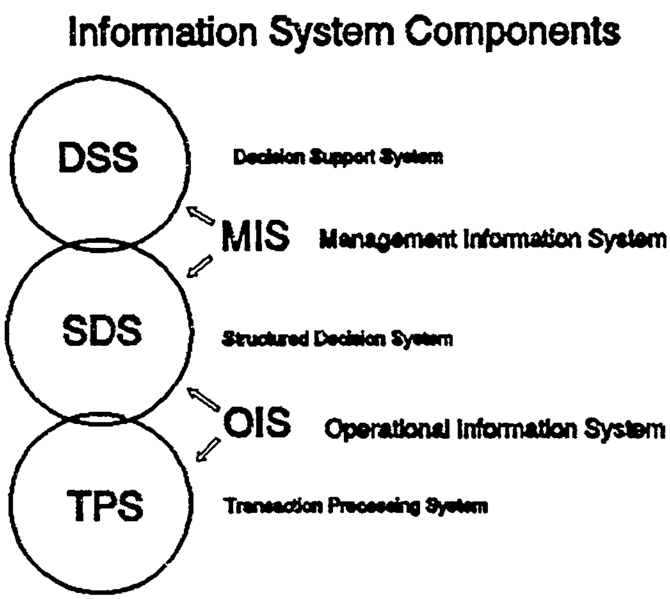


Figure 2.7
Information System Components

Bottom-up Development

A bottom-up strategy of information system development is based on the premise that data must first be captured, confined, defined, and organized before it can be turned into information that is useful for management. Transaction processing is the primary focus of bottom-up development strategies as illustrated in Figure 2.8. Proponents of this approach suggest that the TPS is the tool through which the SDS and DSS are made to work. They argue that until data storage and retrieval are fully in place the more advanced applications can not be pursued. When using this strategy much less effort is expended on understanding the global framework of the

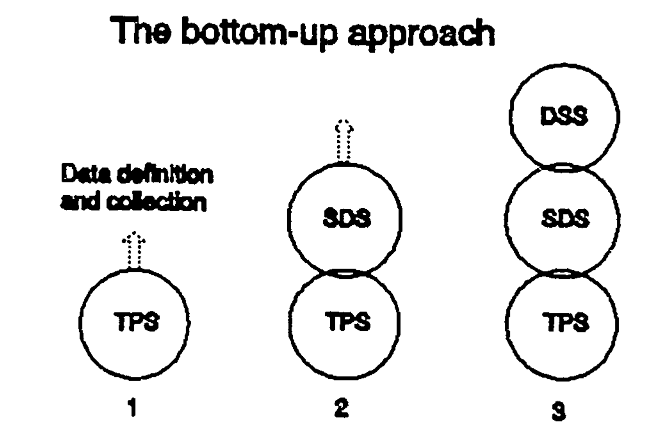


Figure 3.8

information system than on the more descriptive analysis of the flow of operational information within the organization. The bottom-up approach is driven primarily by the efficiency of data processing. Most textbooks on information system design describe some form of this approach. (see Doukidis, Land, & Miller, 1989; Couger, Colter, and Knapp, 1982; Kozar, 1989; Matthews, 1981; Murdick, 1980) By virtue of the historical growth of electronic data processing technology from simple data storage and retrieval technologies to complex analysis programming the bottom-up approach paralleling this historical development is the most common in reality (Hopple, 1988).

An example of the bottom-up development approach within California's ROC/Ps is the system developed for San Diego County ROP. According to a consultant from the computing corporation with which the ROP contracted, the firm responded to the needs of the ROP to improve the efficiency of its operations. Over a period of four or five years the firm built a data system which significantly automated the transaction processing functions. Only in recent years have several important structured decision control and unstructured decision support elements been added to the system.

The bottom-up approach is most appropriate when efficient data processing and uniform definition of data elements are the high priority outcomes of the system. A bottom-up design strategy requires a high commitment on the part of all involved to the standardization of data and data manipulation processes. This is usually achieved when the data definitions and data uses are already clearly established.

The disadvantages of the bottom-up approach are that the creation of well a structured data base can often become an end in itself and can distract from a decision maker perspective. Management applications often appear as after-thoughts which are tacked on to a TPS. By failing to estimate management information requirements in advance, designers often fail to optimize integration in later stages of system development. Also as the management needs grow and change the TPS may have to be redesigned to accommodate changes which were not adequately anticipated in the beginning. Another problem which is particularly evident in the bottom-up approach is that top managers are often only indirectly affected by initial stages of system development and are thus not integrally involved in the planning and development. When the time for DSS development arrives managers who have been uninvolved in prior developments may have a tendency to defer to the system designers for a DSS which can be designed within the limited parameters of the TPS.

Evolutionary Development

The evolutionary approach, also known as the modular approach to information system development is based on the premise that organizations and their information needs are in a constant state of flux. Rather than attempting to design and develop a comprehensive, integrated system, those who choose this approach build only specific subsystems on an as-needed basis. These subsystems are often self-contained, and are only integrated with other subsystems when necessary as illustrated in Figure 2.9. An example of this approach in ROC/Ps is the development of the "Socrates" attendance system. This system was developed to meet a specific need in ROC/Ps. It was designed to function as both a TPS and in some ways as an SDS. It was not, however, integrated with financial information subsystems. Further details are provided in Supporting Document #8 (see preface).

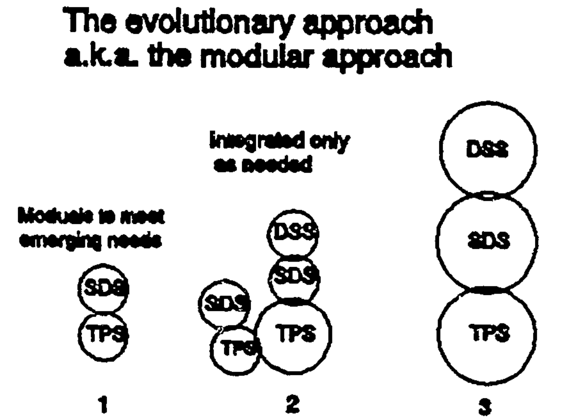


Figure 3.9

The advantages of the evolutionary approach is that it is one of the least intrusive of the approaches to system development in that it meets an immediate need and is focussed on a specific type of information. Because the modules of such a system tend to be smaller and independent, the system as a whole may be better able to adapt to changes in the information needs of the organization. Given the fluctuations in funding and the changes in reporting requirements for ROC/Ps in the last ten to fifteen years (Mitchell & Hecht, 1989) it is not surprising that most ROC/Ps have adopted more of an evolutionary or modular approach to their information system development.

The primary disadvantage of the evolutionary approach is that system integration is particularly difficult at later stages of development -- just when such integration becomes most important. The lack of integration between subsystem modules precludes support for complex managerial decisions. Ahituv and Neumann (1990) also suggest that the evolutionary approach is an extreme form of the bottom-up approach and thus shares many of its disadvantages.

<u>Top-down Development</u>

The top-down development strategy illustrated in Figure 2.10 is based on the premise that the system exists to serve the needs of the management. It presumes that the system development can not begin before the complete management needs for data have been fully described. While the actual physical development of the system may not begin with the decision support, these applications are purposefully integrated into the original system design.

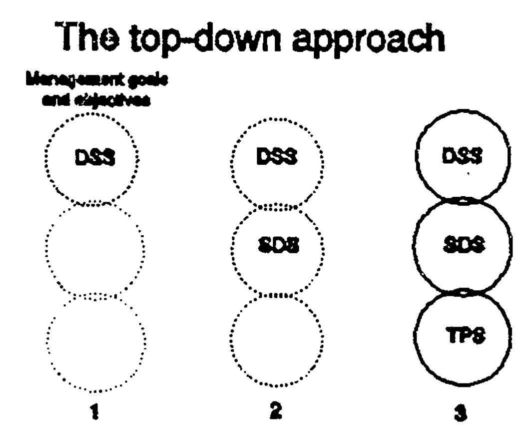


Figure 3.10

The top-down approach is most appropriate when a great deal of importance is attached to the use of information for management. It works well when the various data sources are already well integrated. It generally requires an extended period of time for studying and documenting management information needs prior to development.

Systems developed with the top-down approach sometimes die of their own weight as more and more data needs are added to the system design before any development actually takes place. An example of this problem is the information system developed for the community colleges in the state of California (Hamre & Holsclaw, 1989). The system was designed to be comprehensive enough to meet everyone's management information needs, but implementation has been particularly difficult because the system is so huge and cumbersome. In the real world, the immediate needs for detailed information and efficiency of processing often preclude a very thorough-going top-down approach to system design.

Middle-out Development

The middle-out, or proto-typing approach, is a new strategy made possible by recent technology developments. As hardware and software have increased in sophistication, the time required to program computers for complex analysis functions has been significantly shortened. Routines which only a few years ago took months of programmer time to develop are now available by selection from a menu in generic software packages (Fisher, 1991).

These changes make it possible to design proto-typical information systems and subsystems relatively quickly.

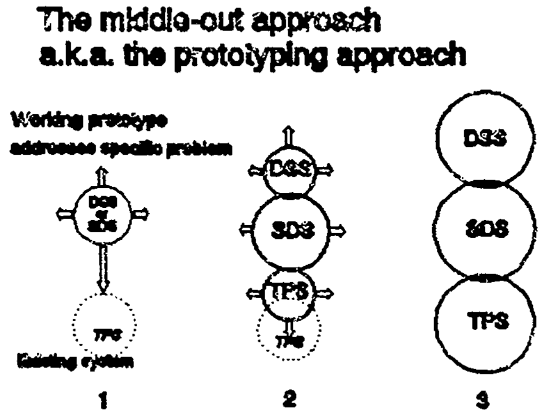


Figure 3.11

The proto-typing process involves piloting a system, providing feedback to the system designers, modifying the system for a better fit, and trying it again. This approach is similar to the evolutionary approach but it tends to begin with the development of decision oriented modules rather than with improved transaction processing. It often presumes the existence of at least some sort of TPS upon which it builds, but may even start in an environment which is not at all automated. The focus of the middle-out approach is on solving a key management problem central to the organization's success. Once the targeted problem is adequately solved by the proto-type system, the system can be expanded to encompass other management areas or another module can be added as illustrated in Figure 2.11. This strategy is particularly useful in environments which are unstable or where the nature of the information needed is not immediately clear.

There are several advantages to the proto-typing approach. First of all it makes information immediately useable for management decision making and thus has a much higher chance of being accepted and promoted by top managers. Since top management acceptance and involvement are key factors in information system success (Alter, 1976; Hill, 1987) this characteristic may be particularly valuable in situations where resistance is likely or expected. Proto-typing not only quickly solves a real problem, but it "provides feedback on the structuring of the problem and on the use of the technique" (Ahituv & Neur ann, 1990, p. 246). Proto-typing is an inexpensive way to explore both the nature of a problem and the possible design of a systematic solution. This is particularly useful in situations where it is not clear whether to invest heavily in em development. Proto-typing, with its modular nature, also has the dvantage of being able to tie into existing TPS systems. This feature is advantageous in situations where many different TPSs are already in place. A prototype can be designed to test the possibility of integrating data from several non-integrated TPSs. The modular nature of the proto-typing approach gives it the advantages of the evolutionary approach in being more responsive to changes in data needs.

The disadvantage of the proto-typing approach to information system development is that it does not directly address transaction processing issues. It either presumes an existing TPS or expects management enthusiasm for the value of the DSS to drive the development of data collection and transaction processing systems. Proto-typing may not be the most efficient in a stable environment where the nature of the problem is clear and the information needs for both operation and management are already well defined, and where few changes in information needs are expected.

Summary and implications of literature review

The primary objective of this project was to design an appropriate model MIS for California's ROC/Ps. This literature review clarified the optional design features and developmental strategies and raised the following questions to be answered by the field study:

1. Do ROC/Ps need primarily a
   a. transaction processing system (TPS),
   b. structured decision control system (SDS), or
   c. decision support system (DSS)?

2. If a DSS is needed by ROC/Ps, what types of decisions most need support? Which type of DSS would best support these decisions?

3. Which development strategy would be most appropriate for the type of system needed and the prevailing conditions ROC/Ps

Chapter Three 3

- Field Study to Determine MIS Needs -

Phase I of this project was largely exploratory. The findings of the previous research clearly highlighted the need for a management information system for California's ROC/Ps, (Mitchell & Hecht, 1989). The literature review had identified different types of information systems and several optional development strategies available. Further field analysis of the dynamics of the situation in ROC/Ps was necessary to determine both the type of system needed and the most appropriate development strategy to pursue. This chapter describes this field study of conditions in ROC/Ps.

The advisory committee, made up of representatives from the state department of education, the CAROC/P association, local ROC/Ps, and the research team from the University of California, met early in the project to define the project parameters. In the first advisory meeting, held on August 2, 1990, the committee discussed the goals, defined the scope and clarified the focus of the study, and identified the appropriate sources of feedback for the exploratory phase. Table 3.1 outlines these parameters of the field study phase of the project.

Table 3.1
Parameters of Phase I of the MIS Project

PARAMETER	DESCRIPTION
Goals	Clarify the nature of the problem and identify characteristics of an appropriate MIS model.
Focus	Information needs for effective local management.
Scope	Limited to the life cycle of a course.
Methods	Naturalistic qualitative analysis: discussion, brainstorming, unstructured interviews, observation.
Sources of Feedback Information	Advisory committee, ROC/P managers, special interest groups, MIS software currently in use, and site visits in representative ROC/Ps.

In discussing the primary goals of the project in the advisory committee it became apparent that the needs and interests of the groups represented were somewhat different. The representatives from the state department of education were interested in answers to the questions:

1. Who is being served?
2. What programs are offered?
3. What are the expected outcomes and accomplishments?
4. What are the associated costs?
5. What are the sources of income?

These questions implied a reporting system which would capture largely descriptive data.

Representatives from the association of ROC/Ps defined the problem much more in terms of the needs for data at the local and association level. Their descriptions of the ideal system included not only a comprehensive data collection and storage system at each local site, but also an electronic network linking sites with each other. The system should allow local managers to identify the strengths and weaknesses of their programs and share selected information among other ROC/Ps. Individual ROC/Ps could benefit from shared information, and the association could access summary information from all sites with which to validate ROC/P effectiveness statewide.

The identified goal of the project was to design and pilot test a model MIS for ROC/Ps which would begin to meet local, association, and state level information needs. Committee members agreed that the ideal MIS would serve both as a management support tool for local managers and as a data base from which to report to the association and the state. The primary **focus** of the MIS should be to **improve the effectiveness of local management**. If the MIS did not meet immediate needs on the local level, it would be neglected or subverted and thus become ineffective in providing the state with accurate data. The primary **goal of phase I** was therefore to **identify the information needs and prevailing conditions in local ROC/Ps** and match these with the most appropriate system design features and development strategy for a model system.

In narrowing the **scope** to a task which could be accomplished by a small research team in twelve months the MIS model was limited by committee action to data related to the **life cycle of a course**. The life cycle includes planning, implementation, operations, and evaluation phases. The unit of analysis selected was the course or the section, as opposed to the broader aggregate of the site or the smaller unit of the student.

The **methodology** chosen for the first phase of the study was a **qualitative analysis**, including group discussions, brainstorming sessions, unstructured interviews, and on-site observations. The **sources of feedback** information for the first phase of the study included the advisory committee, ROC/P leadership and representatives of special interest groups, individual managers and staff in selected sites, and existing information processing software currently in use. The following sections describe the both the major feedback sources and data gathering procedures as well as the insights and the implications for MIS design and development.

Advisory Committee Input

Following the initial meeting, the advisory committee was convened three times during the first phase to review progress and set study directions. On September 20, committee members helped to plan and coordinate a brainstorming session for ROC/P directors attending the annual leadership Forum. In this planning meeting it became clear that the value of the session with the directors was to get local managers support of the system as a powerful force for the progress and development of an MIS. The MIS was to be designed with characteristics immediately appealing to local managers.

On November 7, the advisory committee discussed the definition of data elements and explained the politicized nature of the process for defining data elements for state reports. They suggested that the research team design a system in which data definitions could easily be modified. They also recommended that the researchers avoid getting the system into the complexities of confronting state policies and established data definitions. It was clear from these conversations that the MIS was not primarily about defining data elements. The implication of this insight was that the MIS must be designed in a way which would support local management decisions rather than impose data definitions. The wish of the committee was for a decision support system rather than a transaction processing system.

On November 30, the advisory committee discussed the perception on the part of several ROC/P managers that the MIS was being developed as an evaluation tool for use by the state. The committee directed the research team to make all possible efforts to alleviate this misconception through the MIS documentation and design features and suggested that a one-page executive summary of the project be drafted (see appendix B). The executive summary should emphasize the value of the MIS to directors as a decision-making tool. The insights from the advisory committee are summarized in Table 3.2.

Table 3.2
Summary of Insights from the Advisory Committee

INSIGHT	IMPLICATION
The MIS must meet local needs to be accepted by ROC/Ps.	The MIS design must respond to locally felt management needs.
The MIS is not primarily about defining data elements.	The MIS should be more of a decision support tool for managers.

Input from ROC/P Directors and Management Groups

During the course of Phase I, **four** different group sessions were scheduled for the purpose of acquiring input on the MIS data elements and features:

1. ROC/P Directors at the Leadership Forum in September 1990.
2. Representatives in southern California from various aspects of ROC/P management including finance, attendance, legislation, handbook, small schools, labor markets, public relations, curriculum, adult education and special needs populations in October 1990.
3. Representatives in northern California from similar management groups to #2 above in October 1990.
4. ROC/P business officials at the Vocational Education Conference in November 1990.

In each of these sessions the participants were given a brief overview of the MIS project and asked to contribute to the brainstorming and generation of a list of the data elements which managers would utilize in the defined phases of a course life cycle; planning, implementation, operations, and evaluation.

The brainstorming sessions were especially fruitful in yielding lists of the data needs of ROC/P managers. In all three of the different types of groups broad themes and areas of data needs emerged rather quickly. Consensus was high on the need for data which could serve the following functions: (a) confirm labor markets, (b) validate curriculum, (c) verify links to business, industry, and higher education, (d) show cost efficiency, and document (e) instructional quality and (f) service to students (see document 2 in Supporting

Documents for further detail). The information needed by ROC/P leadership and by other management groups associated with ROC/Ps was clearly characterized as **management decision information** as opposed to *simple reporting and control information*. The insight arising from the group meetings is summarized in Table 3.3.

Table 3.3
Summary of Insights from Group Sessions

INSIGHT	IMPLICATION
ROC/P leadership and others expressed needs for management information rather than mere report and control information.	The MIS should function more for management decision support than for transaction processing and reporting.

Input from Managers and Staff in Sites Visited

Eleven individual ROC/P sites were visited during Phase I of the study in order to document current practices, clarify the issues which would help define the model MIS. The rationale for selecting sites to visit was based on the three factors of (a) exemplary management techniques in at least one of the four areas of planning, implementation, operation, or evaluation, (b) representation of the range of ROC/P types - county operated, joint powers, and single district, and (c) representation of the four regions of the state. Table 3.4 shows the distribution of ROC/Ps by governance type and by region with the sites visited.

Table 3.4
Distribution of ROC/Ps by Region
and by Governance Type with
Sites Visited in Phase I

Type	Region	Central	Northern	Coastal	Southern	Totals
County Operated	total	6	15	10	8	39
	visited		*2*		*2*	*4*
Joint Powers	total	4	2	8	11	25
	visited			*2*	*3*	*5*
Single District	total	1	0	0	5	6
	visited	*1*			*1*	*2*
Totals	total	11	17	18	24	70
	visited	*1*	*2*	*2*	*6*	*11*

Prior to site visits ROC/Ps were asked to collect samples of a complete set of data-related documents. On site visits CERC researchers collected the requested data documents, toured ROC/P offices and facilities, and discussed data management priorities and practices with directors and other management team members. The analysis of data gathered through these visits was divided into three main subdivisions with a related question:

1. The state of existing information systems - **What do ROC/Ps have?**
2. Priorities for data collection - **What do ROC/P managers want?**
3. Relationship of data to management - **How do managers use data?**

Observations on each of these three questions are detailed in the sections that follow.

Observations on the What Systems ROC/Ps Have

The major finding in regard to existing information systems is that there is no uniform system of transaction processing among the 70 ROC/Ps. A review of several existing transaction processing systems brought to light the fact that the time and costs associated with the development of a standardized collection and storage system for all ROC/Ps would be prohibitive in the near term. The high end systems in place in the largest ROC/Ps are far too expensive and complex to be attractive to the smaller ROC/Ps and a PC-based system for transaction processing is limited to the small and medium sized ROC/Ps. Clearly the type of system needed was a decision support system which could be designed independently from existing transaction processing systems, but would be able to draw on information produced within these systems. A primary question arising from this determination was one of the most appropriate format.

ROC/Ps vary widely in the extent to which automated information systems are in place, but all of the ROC/Ps visited have at least part of their operation computerized. In all the visited sites office personnel were equipped with personal desktop computers. Most sites had some connection to mainframe computers, usually in a county or district office. The lowest common denominator of automation for all the visited ROC/Ps was an MS-DOS IBM compatible desk-top personal computer (PC). The implication being, that a PC-based MIS could be made immediately available to virtually all ROC/P directors with minimal investment.

One of the areas explored to determine the state of existing information systems was an analysis of which types of information were in some computerized format. In all visited cases, some form of financial accounting was electronically mediated. In a majority of the sites accounting functions were performed on a mainframe computer. Attendance accounting systems were the second most prevalent automated systems found in the ROC/Ps visited. Two of these are reviewed in Supporting Document #8 (see preface) and found to be focussed primarily on data collection, storage, and retrieval, with less attention given to program quality evaluation/analysis or management decision support. Other information systems in the ROC/Ps included systems for course catalog production, for personnel management, and for equipment inventory control. In most cases where these systems were available, they were separate from one another both physically (in different computers) and organizationally (operated by different individuals). One of the greatest information needs, both observed and expressed by ROC/P managers was that of information integration. Managers wanted to be able to look at information from a variety of sources on a common summary printout. The model MIS needed to integrate information from existing systems and elsewhere into a common analysis and reporting format which would support management decision making. This finding suggested that an "information analysis" type decision support system would be the most appropriate design. Table 3.5 summarizes the insights gained from observations about existing information systems in ROC/Ps.

Table 3.5
Summary of Insights from Site Visits on
The State of Existing Information Systems

INSIGHT	IMPLICATION
No uniform transaction processing system exists in ROC/Ps, nor is TPS development a feasible option.	The MIS must be able to use information generated through existing TPSs.
Most ROC/P managers have access to a personal computer.	A PC-based MIS would be the most quick and economical to install.
Most ROC/Ps have multiple, non-integrated information systems.	An information analysis DSS would integrate diverse data systems.

Observations on What ROC/P Managers Want

Interviews with individual ROC/P managers confirmed the importance of many of the data categories which had been identified in the group sessions, however significant differences in priorities were evident from site to site. In one site the cost analysis data was of primary importance to the manager who had a rather elaborate reporting system which compared costs with ADA revenues generated on a monthly basis. In at least three other sites, managers said that measures of cost efficiency or cost effectiveness were not considered when evaluating the relative quality of their courses. They felt that cost alone was not the best index for course comparison.

In at least one site a great deal of emphasis was placed on the extent to which advisory committees were involved in course analysis and improvement. Forms and other data gathering processes had been established to quantify the activities of these committees. In another ROP placements were a chief indicator of course quality. A database of businesses and industries which had any relationship to the ROP was actively maintained. Lists of graduate placements in local businesses were generated as feedback to instructors.

In at least one large ROP a significant emphasis was placed on student opinion data collected in the follow-up. Former students were asked whether or not they had met their goals in the course and whether they would recommend the course to a friend. In yet another site, an important measure of program success was a comparison of high school graduation rates among ROC/P students and non-ROC/P students.

These differences in the priority of data collection needs expressed by different managers led to the three conclusions summarized in Table 3.6.

Table 3.6
Summary of Insights from Site Visits on
Priorities for Data Collection

INSIGHT	IMPLICATION
Course quality measures are collected from a variety of sources.	The MIS should integrate multiple course quality measures.
ROC/P managers assign different priorities to different data.	The MIS should allow for variable weighting of a wide range of data.
Little consensus exists on the relative importance of different quality indicators.	The MIS should function as a "representational" system to model appropriate priorities.

Observations on How Data Are Used

A primary goal of the MIS model was to improve the use of information by local ROC/P managers. To understand how the MIS could best achieve this goal it was necessary to document prevailing conditions which prevent the optimum use of information by managers. Four conditions were found to be impeding the effective use of course information by ROC/P managers:

1. The course review process was approached negatively
2. Quality documentation was limited to too few indicators
3. Information was often available but not interpreted
4. Quality indicators were aggregated unevenly

The fact that the **course review process** is largely a control mechanism to prevent misuse and abuse of state vocational education funds contributes negatively to the use of course quality information by local ROC/P managers. The Ed. Code § 52302.3 specifying how ROC/P courses are to be evaluated addresses three major criteria: (1) non-duplication, (2) labor market demand, and (3) completions/placements. The avoidance of unnecessary duplication of training from one agency to another has apparently been a major concern of the state legislature, judging from the frequency with which it is addressed in the code and the level of detail with which it is described. The intent of the legislature on this point is clearly one of preventing inefficient use of taxpayer moneys through the establishment and operation of duplicate training programs.

The second most prominent legislated criteria for course evaluation is that of a documented **labor market demand.** The governing bodies of ROC/Ps are enjoined by the code to work with local advisory committees, Private Industry Councils, the Employment Development Department, and the California Occupational Information Coordinating Committee in documenting labor market demand. The involvement of multiple agencies in developing protocols, the use of different coding systems for training programs and jobs, and the different levels of aggregation between labor market statistics and ROC/P courses have all contributed to a state of confusion as to how to apply this criteria in course evaluation. As with the non-duplication criteria, labor market documentation is intended as a control mechanism to prevent the use of taxpayer money for programs which do not prepare students for jobs.

The code on course review also specifies that a course is to be of demonstrated effectiveness as measured by the **employment and completion** success of its students. While these two indicators of course effects are probably among the more measurable and reportable, they are by no means sufficient to document the value and quality of a course. They serve only as warnings to prevent the funding of programs which are not retaining students or which do not prepare students for job placement.

The mandated course review process is characterized by negative control measures - indicators which warn that a problem exists and which mandate the consequence of course termination if the problem persists. Unfortunately the code provides little indication on how to positively select for the most effective courses based on things like the quality of instruction, stability of the connection between the training program and industry, or positive effects of training on the lives of students. Management by termination of low end exceptions may minimize inefficient and undesirable ROC/P programs, but it does not promote highly efficient and powerful programs. It only promotes compliance-oriented data collection at the local level.

The selection of ROC/P training programs on the basis of excellence can only be stimulated when indicators of excellence are used to compare courses with one another. While the control measures specified by the education code may be a necessary protection against problems, they are far from sufficient to promote excellence in vocational programming. ROC/P managers must be given the tools by which a positive analysis of program quality can be locally controlled. The MIS model should serve as just such an analysis tool.

A second condition mitigating against the use of information by local managers is an **inability to combine multiple variables** in program quality assessment. Many ROC/P managers saw state mandated measures of course quality as overly simplistic and reductionist in nature. The quality of an entire program cannot be determined by one or two indicators. Since no single measure can accurately portray the quality or worth of a course, using only one or two measures in the high stakes decision of program termination is seen as grossly unfair. The more inferential the measure, the worse the inequity. This problem of placing too high of stakes on a few inferential measures of quality was portrayed through three examples in discussions with ROC/P managers.

1. When **completions** are the only measure of program quality, the tendency is to select for programs which are attractive and "fun" for students. Some training programs may have high attendance and completion rates, but may not be teaching students anything of substance. Reliance on completion rates alone could mask programs which amount to high-cost day care.

2. When student **placement** in jobs becomes the sole measure of program quality, the incentive is to design programs which move students quickly and surely into placements. Some training programs may have high placements only because the jobs are those which students would have gotten without the training. A program in hamburger flipping illustrates an over-reliance on placement data. High placement rates may belie the fact that students may have just as easily gotten the job without training.

3. If the **cost per student** is the sole measure of the quality of a vocational program, the incentive is to select for programs with the lowest possible cost and to fill all classes to their capacity. While cost efficiency is certainly a valuable goal in the administration of vocational training programs, training for more complex and higher paying jobs may well cost more than the training for the most simple and lowest paying jobs. Selection of training programs on cost alone will promote cheap programs which may be inadequate to address the need for workers in tomorrow's high-tech workplace. It also

disregards the responsibility of public vocational education to provide training for many levels of job complexity.

Program quality is only achieved when the full range of quality measures are integrated into the selection process. The MIS should be a tool which will allow for more comprehensive and "fair" depictions and/or comparisons of courses. It should allow for combined reporting of a large number of quality indicators which all contribute to a course section quality profile.

A third major problem in utilizing data for management is one of data overload - having **too much data** and not enough time or energy to interpret it all. The decision making process, while it requires a rich variety of inputs, is not simply a case of generating a critical mass of evidence. The more data with which a manager is confronted, the more the need for pre-analysis and interpretation of the data. If the MIS is to function as a support for managers it should provide pre-analysis and interpretation of data.

ROC/Ps are expected to be flexible and responsive to the changes in the labor market and student pool. This flexibility is achieved by being able to adjust programs quickly. A majority of the quick management interventions are targeted at the section level. A major problem arises when the **data are not all aggregated at the section level**. When cost information is aggregated only at the program level it is impossible to tell when a section is costing too much to run. If attendance information is aggregated only at the course level it is not possible to tell if all sections are pulling their equal weight in bringing in revenues. If personnel information is not section specific it is not possible to determine whether staff placement is at its most efficient. These and other major management decisions require that program quality indicators be collected and reported at the section level. The MIS model must highlight this need for section specific data collection and analysis.

A summary of the insights and implications gathered through observations of the conditions precluding or preventing optimum data use for management in ROC/Ps is presented in Table 3.7.

Table 3.7
Summary of Insights from Site Visits on
The Relationship of Data to Management

INSIGHT	IMPLICATION
Management by negative controls does not stimulate information use.	The MIS should provide a positive course quality analysis.
Course quality documentation cannot be achieved with only one or two indicators.	The MIS should allow for the combination of multiple indicators in establishing a quality profile.
The more data confronting a manager, the greater the need for pre-analysis and interpretation.	The MIS should pre-analyze data and provide reporting which is easy for managers to interpret.
Data aggregation at the section level affords the greatest support to managers in course management.	The MIS should focus all measures of course quality at the section level.

Summary of Findings in Phase I

Phase I of this project consisted of a literature review on the topic of MIS design and development as well as a field study to determine the conditions prevailing in ROC/Ps and the nature of the MIS needed. Two major decisions came out of Phase I of the study:

1. the type of system to design
2. the development strategy to pursue.

The Type of MIS Design

The type of MIS most needed and most feasible for developing in ROC/Ps was a decision support system (DSS). The specific type of DSS most appropriate to the conditions and needs in ROC/Ps was an analysis information system which integrates data from disparate sources into coherent analysis reports. Such a system facilitates both operational management and strategic planning related to ROC/P courses. It integrates and analyzes data on costs, enrollments, retention, attendance, ADA revenues, labor market, completions, placements, quality of instruction, student and employer feedback, and other measures of course quality. It helps local ROC/P management to (a) quickly identify those programs which most need their attention, (b) specifically target their interventions, and (c) pr ide documentation to both demonstrate the high quality of their programs and justify their management decisions.

The MIS also function as a representational system. The lack of clarity in the values and priorities of different indicators of course and program quality in ROC/Ps called for a system which would help to clarify the relative importance of various quality measures. A system of weighted details allows managers to model their decision making by rearranging weighting priorities until the sorted report reflects the ranking order they would have intuited. The representational model empowers local managers to become users and controllers of information. It helps managers model the best mix of variables to include in the sensitive choices inherent in program selection and evaluation.

The Best MIS Development Strategy

Given the conditions and the needs clarified in Phase I, the selection of the most appropriate development strategy was clear. Selection was made from among four options which were prominent in the literature - bottom-up, evolutionary, top-down, and middle-out. Because of the great diversity of data element definitions and electronic capabilities among ROC/Ps, a bottom-up approach is too expensive to develop and implement on a state-wide basis, and is not likely to increase the effectiveness with which ROC/P programs are managed. An evolutionary or modular approach does not sufficiently address the expressed need for integration of information from a variety of sources for management use. A top-down approach is too time consuming to develop, and the changing nature of the data requirements in ROC/Ps would make the system obsolete before it could be completely designed. **A middle-out or**

proto-typing approach is the most appropriate strategy for system development because it:

1. focusses on a particular management problem,
2. can be quickly designed and implemented for pilot testing
3. is flexible to changing data needs
4. helps to further clarify the problem
5. leads to the best long-term solution.

A focus on the **decisions** regarding **sections** helps the system transcend the diversity of size, governance, and data use between the various ROC/Ps.

Chapter Four 4

- Phase II: Design and Testing of the MIS Model -

Design of the MIS Model

Phase II of the project was the developmental phase in which the findings from Phase I were synthesized into the first version of a model management information system. This chapter describes the various aspects of the design and testing process. In the first section the steps of the development process are outlined. A description of the MIS model from the perspective of the user is provided in the second section. The third and fourth sections include details on the selection of pilot test sites and the procedures followed in the pilot testing process. The final section is a summary of the observations made during the pilot testing.

MIS Model Design and Development Process

The advisory committee and the research team, after careful analysis of the existing situation in ROC/Ps around the state and review of the possible options outlined in the current literature on information systems elected to design an MIS which would function both as an analysis information decision support system and as a representational model. As an analysis information DSS the system integrates information about courses from several different sources to produce analyzed reports. As a representational model the system helps to clarify the values and priorities of local managers in the decisions they make about course retention, suspension, and termination. In reviewing the options for system development and implementation, it was decided that the middle-out, or proto-typing approach would best fit the situation.

The proto-typing approach to system development begins with the quick creation of a small, workable, modular system which is focussed on a particular problem or set of problems. It is implemented next to existing systems. The users provide feedback to the designers on the fit of the system features to their situation. Designers incorporate changes into subsequent versions of the model which are further tested and critiqued. This reiterative cycle continues with refinements and expansions of the system as long as the development is beneficial to the users and/or cost effective for the supporting agency.

The strategy used to design the proto-type model was that of decision analysis. Decision analysis was particularly suited to the situation with ROC/Ps because decisions about courses were much more uniform across ROC/Ps than were data elements or data collection protocols. A focus on decisions was the most logical way to achieve a common system among such a diverse group of organizations as the ROC/Ps. The decision analysis strategy is comprised of five major steps leading up to pilot testing (Tran, 1986):

1. Define the decision areas on which to focus
2. Identify key decisions which contribute to effective management
3. Classify the decisions and the information which supports them
4. Develop a decision model
5. Suggest data to be used in the pilot test

Each of these steps to the decision analysis strategy for prototype design is briefly described in the following paragraphs. Supporting materials can be found in the Supporting Documents publication (see preface).

1. Define Decision Areas. Early in the study the advisory committee had narrowed the focus to **the management information needs of local managers** and limited the scope to the **life cycle of a course**. A course was defined as an approved curricular unit characterized by listed objectives and competencies to be achieved within a given instructional framework in a specified amount of time. The life cycle of a course was defined from the perspective of ROC/P managers as the four stages of planning, implementation, operation, and evaluation. The decision areas were therefore confined to those decisions made regarding a course from its beginning to its termination.

2. Identify Key Decisions. A flowchart of key decisions was developed in which the data needs and sources for each decision were plotted. This flow chart was printed in Supporting Documents #5 (see preface). The decisions in

this chart were phrased in terms of a question to be answered. For example, "Is the labor market demand sufficiently strong that we can expect placement of graduates into the jobs for which they are being trained?" An analysis of the decisions outlined in the flowchart revealed that the majority were concerned with **documenting course quality.**

3. Classify Decisions. The information needed to support management decisions regarding course quality were classified into **four major domains** or possible sources of feedback.

a. ROC/P managers and instructors,

b. students and graduates of ROC/P courses,

c. high schools and colleges

d. employers of ROC/P graduates.

Within each cell made from the overlapping of the four domain circles on one another are subcategories of information about course quality. For example, at the intersection of students and ROC/P management is found the category of instructional quality, showing that feedback on instructional quality is jointly determined by the students and the ROC/P administration. These domains of course quality measurement and analysis are illustrated in Supporting Documents #6 (see preface). More specific examples of the information needs related to these domains are listed in Supporting Documents #7 (see preface).

4. Develop Decision Model. A computer model for decision support was developed in response to the guidelines developed in phase I of the study and based on a model for problem solving forwarded by Carkhuff and Anthony

(1981). At the core of Carkhuff and Anthony's model is a sorting function. **Course sections are sorted in rank order** from best to worst depending on a positive, neutral, or negative rating on multiple weighted factors. The system is flexible in a number of ways. An unlimited number of details may be defined to measure different aspects of section quality. Detail standards which define the ranges for the positive, neutral, or negative ratings of values can be modified interactively on screen. Weights can be assigned to the different details included in a given report. These weights determine the impact of each detail on the section's relative rank score. These weights can also be easily manipulated until they approximate the intuitive relative values that managers assign to different measures of course quality. A technical description of the computer model is provided in Supporting Documents #9 (see preface).

5. Suggest Data to Use. The advisory committee met in February, 1991, to discuss possible detail data to require in the pilot test of the model. From the diagram of domains of course quality, three indicators were selected:

1. "**Direct Cost per ADA**" defined as all the direct costs for a section divided by the total ADA the section generated.

2. "**Percent of Attendees Certified**" defined as the total number of students certified divided by the total number attending.

3. "**Percent of Positive Exits**" and was defined as the total number of students who either continued in school, got a job, or joined the military divided by the total number attending.

Suggested parameters for these details are found in Appendix A - a worksheet for detail definition.

The MIS Model Software - A Decision Support System (DSS)

The software for the ROCP-DSS was designed to be user-friendly. It is largely menu-driven. Users select from a menu to move around within the modules of the program. The Main Menu screen showing the File Maintenance menu is illustrated in Figure 4.1.

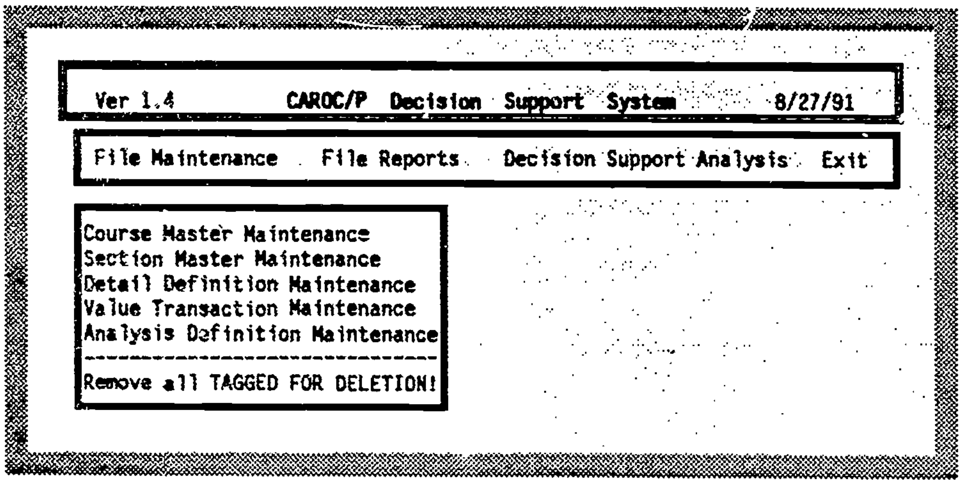


Figure 4.1
DSS Main Menu Screen

The first five steps in the use of the system are listed as optional maintenance modules in the file maintenance menu. Full program use involves six steps:

1. Create a database of course numbers and titles
2. Create a related database of course sections
3. Define details or measures of section quality
4. Enter values for each detail on all sections
5. Define analysis report formats
6. Run analysis reports and repeat step 5 as needed

The ROCP-DSS Manual (Dick, 1991) describes the various menus and procedures in greater detail.

The major function for which the DSS exists, running an analysis report, is only possible when the first five steps have been successfully completed. Once the databases for courses, sections, details, values, and analysis reports are in place the real power of the system becomes evident. Modifications can be made to the reports immediately prior to printing. This feature allows for asking and answering "What if" questions by changing detail weights and other parameters. This feature is particularly important in giving the DSS the distinction of functioning as a representational model. If managers "play around" with the mix of the details and weights for their reports until the sections sort in the "right" order, then the report actually begins to represent the internal management intuitions of ROC/P managers. The implications of the use of such a representational model as a research tool for the study of management decision making process can not be understated. The DSS is designed primarily as a management assistance tool however. A brief review of what the report looks like and how it can be used will illustrate the value of the DSS for this purpose.

Interpreting and Using the Analysis Report

The decision support analysis report is printed in two sections. Samples of both parts of the analysis report are shown in Figure 4.2. The first is a sorted listing of all the sections included in the analysis. The list includes a matrix of sections by details showing the relationship of each section to the standards which have been set on each detail. For example a plus sign shows that the value for a detail is within a defined positive range.

CAROC/P Decision Support System
05/17/91 Analysis Report: DEMO 14:33:39
Page 1

Course Section	Prog Locn	Course Title / Section Title	SADA	CERT	POSX	Rel Rnk
12000	Auto	Automotive Repair				
1	KHS	Miller - Brakes	+	+	+	200
33344	Auto	Tire and Wheel				
4	XHS	Chavez - T & W	o	+	-	120
12000	Auto	Automotive Repair				
2	ROC	Jones - Engines	o	o	o	100
45678	Auto	Auto Body				
1	HS	Hicks - Auto Paint	-	-	-	00

CAROC/P Decision Support System
05/17/91 Analysis Report: DEMO 14:33:39
Page 2

Report Summary

Report Parameters

Code: DEMO
Title: Demonstration Analysis Report
Description: Three required details with demo data
Program: Auto
Location: ALL

Detl	Title	Low Accept	D	High Accept	Wgt	Pct
$ADA	Cost per ADA	1800.00	<	2500.00	20	40
CERT	% Certifications	50.00	>	80.00	20	40
POSX	% Positive exits	40.00	>	70.00	10	20

Statistical Summary

Detl	Min Value	25%	Avg Value	75%	Max Value
$ADA	$549.00	$984.00	$1143.00	$1808.00	$2984.00
CERT	35%	64%	78%	85%	100%
POSX	42%	49%	52%	64%	99%

Figure 4.2
Sample DSS Analysis Report

The second part of the report is shown as page 2 in Figure 4.2. It is called the Report Summary and includes descriptive information on the detail parameters such as relative weights and the low and high accept values which define range limits for positive, neutral, and negative. The summary also includes statistics about the values on each detail such as the minimum, mean, and maximum values and the approximate values at the 25th and 75th percentiles.

The analysis reports can be used in a number of different ways in the support of management decisions. Several suggested uses of the reports include the following:

1. Assisting managers in making decisions to retain, suspend, or drop courses/sections.
2. Justifying course/section decisions to superintendents or boards.
3. Providing feedback to mid-level managers to help focus interventions and instructor inservices.
4. Providing feedback to instructors on the relative quality of their class sections.
5. Providing report data to be shared among the other ROPs in the association.
6. Developing a database from which state reports are generated.
7. Supplementing or replacing the course quality review process.

The audience for analysis report information is by no means restricted to the ROC/P manager, as can be seen from the preceding list. Individuals at all levels in the organization can benefit from a comparative quality analysis of course sections. The ROCP-DSS Instruction Manual provides a much more detailed description of system use and benefits (Dick, 1991).

Pilot Testing of the MIS Model

When the first version of the MIS model software was available in late March, 1991, it was shipped, along with the manual to twelve officially selected pilot test sites. The pilot sites were given from three to four months in which to evaluate the software for its usefulness and applicability to their situation. During this time the sites were monitored periodically for their progress in implementing the pilot test. In the next sections three major topics are covered regarding the pilot testing: the **selection of pilot sites**, the **procedures** followed during the pilot test, and **observations** made regarding implementation of the software by the pilot sites during the testing phase.

Selection of the Pilot Test Sites

The selection of ROC/Ps to participate as pilot test sites was based on four criterion:

1. a willingness to participate as a pilot site,
2. governance type representation,
3. geographical region representation,
4. size representation.

Each of the selection criteria is described in greater detail in the following paragraphs.

Willingness to participate.

A willingness to participate as a pilot test site was an important criterion in the selection of sites for two reasons. Given the limited time and resources available for the study, the research team did not want to take on the extra burden of working with unwilling players. In addition, a process of self-selection was expected to more accurately reflect the voluntary adoption patterns expected in later implementation. The managers of ROC/Ps were surveyed for their willingness to be involved in the MIS study. Twenty ROC/P managers expressed a willingness to serve as pilot test sites. These willing sites adequately represented the other three criteria of governance type, regional distribution, and relative size.

Representation of Governance Types.

Three different governance types of ROC/Ps exist:

1. single district
2. joint powers agreement (JPA)
3. county office operated

At present the county operated ROC/Ps are the most prevalent, with thirty-nine in operation around the state. Two of these have a specifically designated training center (ROC). Of the twenty-five joint powers ROC/Ps, only five are ROCs or ROC/Ps. Only six single district ROC/Ps exist in the state, three large urban districts in the Los Angeles area, and three geographically large and isolated districts. Two single district operations have a training center.

The steering committee selected six county operated, four joint powers, and two single district ROC/Ps as part of the pilot study to insure a representation of all three types. In addition the team stipulated that at least one of each of the three types sampled would be an operation with a designated training Center. Figure 4.3 shows a comparative count of the ROC/Ps by governance type along with a relative count of the sample by governance type.

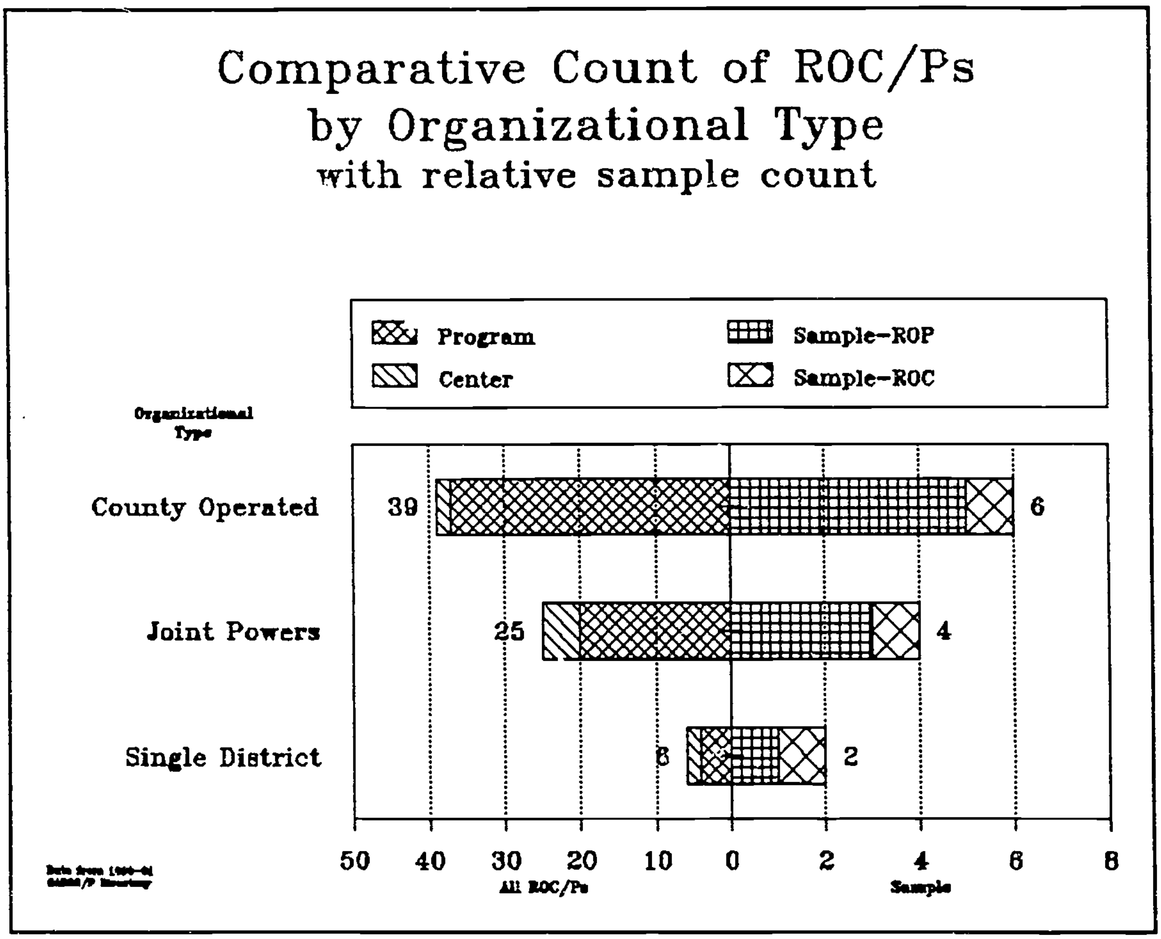


Figure 4.3
ROC/Ps and Pilot Sites by Governance Type

Representation of the Four Regions. ROC/Ps are unevenly distributed in the four state regions. The central region has the fewest ROC/Ps, only eleven, but with the full range of governance types. The northern region has seventeen ROPs, all but two of which are county operated. The coastal region has eighteen ROC/Ps, ten of which are county operated. The remaining eight are JPA. The southern region has the greatest number of operations with twenty-four ROC/Ps. The majority in the south are JPA ROPs. Most of the single district ROC/Ps are a part of the southern region. Figure 4.4 shows the distribution of ROC/Ps by region and by type.

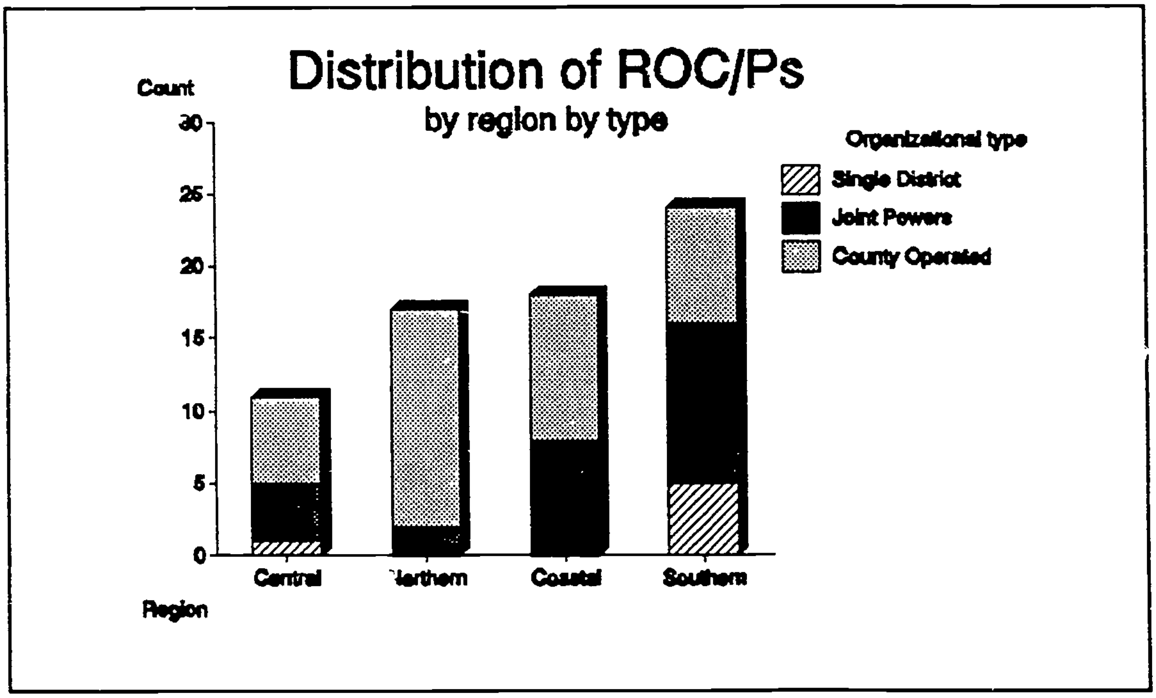


Figure 4.4
ROC/Ps by Region and Type

At least two sites per region were selected to participate in the pilot test. Four additional sites were selected from the southern region because of its greater numbers and because of the proximity of these sites to the research headquarters in Riverside.

Representation of Size. The nine largest ROC/Ps represent only about thirteen percent of all ROC/Ps in the state, but account for over fifty percent of the ADA generated by all ROC/Ps. In selecting a sample to represent the different sizes of ROC/Ps, it was important to include large and small as well as several in the mid range on size. Four of the of the top nine largest ROC/Ps and a representative sample of the mid to small sized ROC/Ps were included in the sample. Several urban ROPs which represent a rather small geographical area and several rural ROPs which span large areas were also involved. At least one ROC which operates like a technical high school was also included in the study. The least well represented size of ROC/Ps was the smallest (fewer than 600 ADA). This was not an oversight on the part of the committee, but was done with the thought that the system could be more easily scaled down to fit the smaller ROC/Ps than it could be scaled up to fit larger ones. The primary target group was therefore the mid to large sized ROC/Ps. Figure 4.5 shows the distribution of ROC/Ps by size of ADA along with the distribution of the pilot sample.

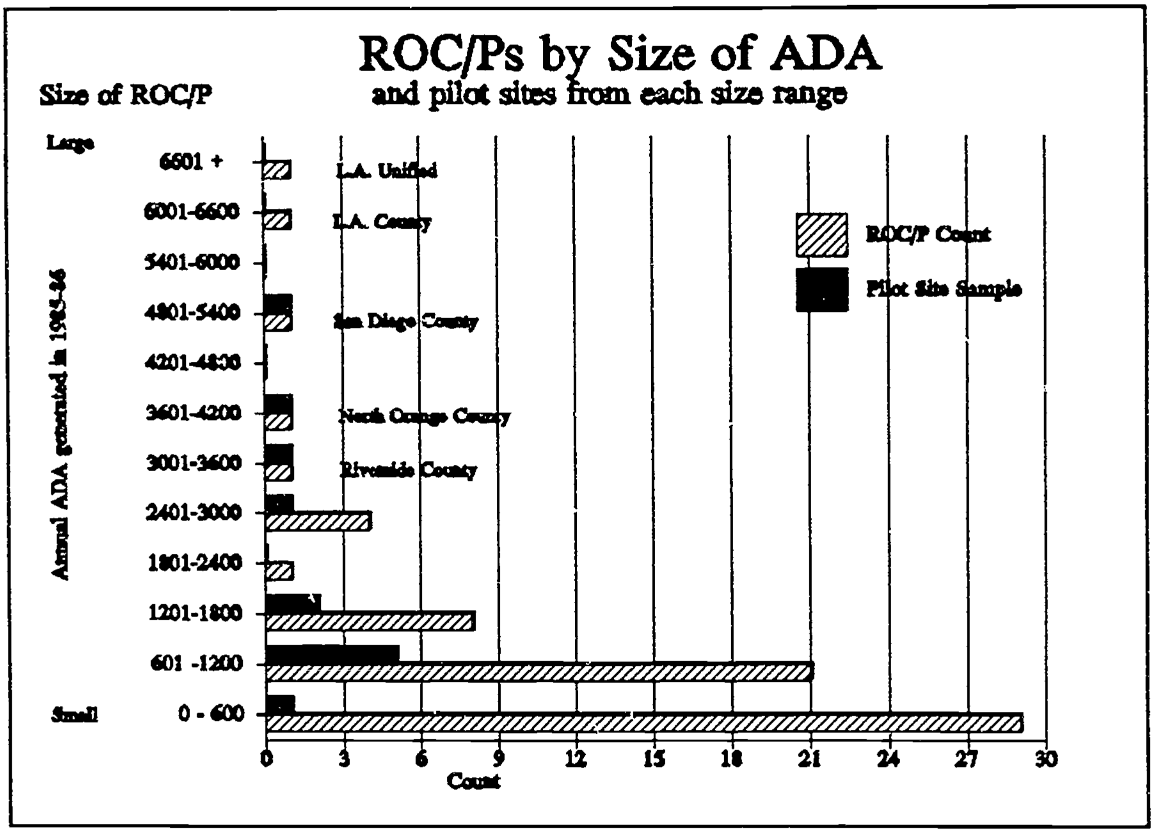


Figure 4.5
ROC/Ps and Pilot Sites by Size

Pilot Testing Procedures

The twelve pilot sites were originally divided into two groups, those which were likely to need technical assistance from the researchers and those able to implement the MIS model using in-house resources. This distinction was made primarily to alleviate the time and travel pressure from the research team and to encourage the pilot sites to work independently. All of the twelve sites were otherwise treated in basically the same manner throughout the testing process. The procedures included notification of selection as pilot site, distribution of software and documentation, calls to verify receipt of software and to notify of the availability of assistance, site visits to assist with technical and/or conceptual difficulties as needed, and scheduling of final debriefing interviews. Each of these procedures is explained in greater detail in the following paragraphs.

Pilot Sites Notified. After the February meeting of the advisory committee, in which the twelve pilot sites had been recommended, the selected sites were notified. The MIS project manager, a former ROC/P manager, contacted each of the twelve pilot site managers personally to welcome them into the study as a pilot test site. Once the formal introductions had been made, the responsibility for carrying out the pilot testing was left to the member of the research team in charge of field contacts.

Software and Documentation Distributed. On March 19 the available software package was loaded onto IBM compatible personal computers in two of the test sites. On March 28 it was loaded onto a computer in a third site. In all three of these first sites the software loading was done or supervised by the field researcher. Convinced that the loading operation was simple enough and well documented in the manual and that the program was working as intended, the research team mailed the software and manual to the remaining nine sites on April 3.

An updated version of the software (v. 1.3), including the completed analysis reporting module, was distributed on disks by May 15. In the last week of May the Manual chapter covering the analysis report module was distributed. As feedback on the software program began coming in from the pilot test sites several modifications were made to the software program. Several cumbersome aspects of the program were streamlined, a few new features were added to increase both program efficiency and reporting power. The disk with this update (v. 1.4) was mailed on Friday, June 14. Version 1.4 is the latest reiteration of the program at the time of this report's printing.

Phone Contacts Established. Within a week of first mailing the MIS model software and manual the field researcher contacted each site to confirm receipt of the mailing. Researchers established a schedule for contacting each pilot site at regular two-week intervals to monitor progress. All sites were notified in the first week of May about a workshop on use of the MIS model to be conducted at the May 9th Vocational Education convention in Oakland. At the end of May and into the first week of June all pilot sites were contacted to confirm the receipt of the analysis module of the software and the corresponding chapter inserts for the manual.

Trouble-shooting Site Visits Conducted. The researcher made site visits to eight of the twelve pilot test sites during the course of the pilot test period. In some cases these visits involved basic technical assistance in data entry and report generation. In other cases the discussion was much more on a conceptual level with the researcher explaining the utility of the program to the managers at a site. All eight site visits took place between May 20 and June 14. In each of three county sites, the researcher worked either alone or with a secretary/registrar to make data transformations and/or enter the data in to the MIS model database. Once the database was filled with values, the researcher assisted the secretary in defining several different analysis reports.

Four site visits consisting mostly of conceptual discussion and demonstration of the software. All three of these sites were large urban ROPs, two county operated, and one JPA. In two of these sites the researcher spent time inservicing secretaries and/or data persons on the program. In neither case were managers participating in the inservice. In another large ROP the researcher met with a team of higher level managers to demonstrate the program and discuss issues regarding its use. The fourth site which received conceptual help had two data processing personnel who had already experimented substantially with the software and wanted to clarify some conceptual and technical difficulties during the site visit.

Summary of Observations from the Pilot Test

Observations during the pilot testing phase of the study led to inferences regarding both the technical and conceptual implementation of the DSS software. The following list is a summary of these observations. Each item is explained in further detail in subsequent paragraphs and revisited in the summary chapter.

Technical implementation

1. The software was relatively free of "bugs"
2. Technical documentation was clear and easy to follow
3. Current data aggregations were problematic
4. Data preparation and input time was slow and cumbersome

Conceptual implementation

5. Top-manager involvement was lower than optimum
6. Conceptual understanding was difficult - more training needed

Initial observations on the technical implementation of the MIS model software were that it was surprisingly fool-proof and **free of software bugs**. Other than the few problems related in an earlier section, most of which were addressed and corrected in update version 1.4 of the software, the program seemed to run just as intended and the **documentation was clear** enough to be followed by any but the most computer phobic among ROC/P managers and office staff.

A common problem encountered in DSS implementation was that the actual numeric values associated with the suggested details were not readily available in the **format or the aggregation** called for by the software. Both the completion and placement data were frequently aggregated only at the program or course level rather than at the section level. Costs per ADA were in some cases not already precalculated, so long-hand division was needed to transform the raw data into the correct format for the values fields. To the extent that ROC/Ps collect data only to satisfy state requirements for broad summary data, they miss the usefulness of the data for fine tuned local management decision support. Collecting summary data exclusively for reporting carries with it little motivation to keep the data accurate and reliable. The DSS software brought this problem into clear focus in several sites. ROC/Ps need to be made aware of the need to collect as much data as possible at the section level early in the implementation process. Future versions of the software needs to incorporate routines for aggregating and desegregating certain types of data automatically.

The data collection, transformation, and entry processes necessary for DSS use were found to be particularly **time consuming and tedious**. The definition of analysis reports was rather difficult to conceptualize without having seen a completed report. Certainly the limitations of the current test version of the program are obvious, not the least of which is the fact that all the data must be collected and transformed outside the program itself. A major point of focus for a production model of the software would be a much more sophisticated electronic interface with existing data systems which would automatically import existing data and transform it appropriately.

The implementation of the software proceeded most quickly in sites where the **managers in charge** were computer literate enough to be able to **conceptually grasp the utility** of the MIS model software, understand the necessary tasks involved from a quick perusal of the documentation, and had computer literate staff with whom to collaborate. A primary component of delayed or non-implementation seems to have been a manager who delegated responsibility without a personal interest and follow-through. In general the participation of managers was lower than expected.

Part of the problem of non-involvement of managers was the difficulty in conceptually understanding the major function and uses of the model. Reorganizing the documentation based on a more careful task analysis may be one way to increase future understanding and implementation. The software manual should provide separate instructions for <u>technical staff</u> who will be loading the software and configuring it for use in the office, <u>clerical staff</u> who will be entering and updating the course and value data, and for <u>managers</u> who must define details and analysis reports. Also, a clear presentation of the outcomes and benefits of using the software should be incorporated into **training materials** and sessions mounted to both precede and to complement the implementation process.

Chapter Five 5

- Phase III: Data Collection, Analysis, and Findings -

Phase III of the project involved three basic processes, **data collection**, **analysis** of the data, and presentation of the **findings**. The data collection process was through a structured interview. The analysis process involved sorting interview responses and observations into categories, rating various aspects of the implementation, and deciding on the relative importance of various pieces of data. The findings were divided into three categories, the <u>implementation process</u> and it's success, <u>evaluations of the MIS model characteristics</u> including criticisms, suggestions for improvements, and commendations, and the perceived <u>uses of the system</u>.

The original pilot site sample included twelve ROC/Ps. Three additional ROC/Ps requested and received copies of the DSS software at the time of distribution. One of these additional sites, a joint powers ROC/P, participated with sufficient interest to be included in the final debriefing interviews and analysis. The total n for the data presented in this chapter was thirteen.

Data Collection: Debriefing Interview

Pilot sites were asked to generate three different analysis reports using the DSS software, fill out course and section difference forms for each of the courses and sections sampled, and download electronic copies of the data files created. Each site was also expected to participate in a 2-3 hour structured debriefing interview with the researchers.

A six page form was developed for debriefing interviews (Appendix B). The interview instrument was designed to capture three different kinds of information: **descriptive** information about the pilot sites, **narrative** information about the process and extent of MIS model implementation, and **appraisal** information related to the problems and possibilities of the MIS model software. Descriptive information about the pilot sites included data on administrative structure, relative size, service area characteristics, technical capabilities, personal and office characteristics relative to information use, and the ways in which different data elements (details) were defined. Narrative information about the implementation was collected from each individual who participated in any aspect of the pilot test. Narrative data was categorized under the headings of personnel involvements in the pilot test, analysis reports generated, and interpretation of reports. Appraisal information was collected throughout the interview with questions about the inhibiting and enabling factors to implementation, but was specifically addressed in a section on the future uses of the DSS software.

Analysis: Extent of Implementation

Implementation of the software was conducted on a completely voluntary basis by the pilot sites. It was expected that the levels of implementation would differ from site to site. To establish the level of implementation achieved by the different sites, three independent measures were developed for analyzing the debriefing interview data. These measures assessed (1) the extent to which the **prescribed tasked** had been completed, (2) the level of **involvement** of the ROC/P director or an upper level manager in key processes, and (3) the level of **conceptual** understanding of the system by the director or manager at the debriefing interview.

1. Completion of Prescribed Tasks. The first measure of implementation assessed the extent to which the prescribed tasks of software testing had been successfully completed. The sites were rated on a five point scale on the three major technical aspects of conducting the pilot test:
(a) creating a sample database of courses and sections, (b) defining details and analysis reports, and (c) producing analysis reports. The highest available score on task completion was twenty. One pilot site received a score of twenty. Six sites received scores ranging from twelve to eighteen. Three sites had accomplished less than the minimum tasks described in the software manual for pilot testing. The remaining two sites which had not entered course and section data into the system received scores of zero.

2. Involvement of Manager. Besides the technical inspection of the software, an important objective of the pilot testing process was the analysis of its usefulness as a management tool. To fairly test the system's usefulness as a tool for ROC/P managers it was necessary that managers to be fully engaged in the pilot test process. The software manual specified that managers should be involved in three aspects of the pilot testing process: (a) the definition of details, (b) the definition of analysis reports, and (c) the reviewing of printed analysis reports with and eye to needed modifications. A simple scoring system was established to rate the extent of involvement of ROC/P directors and/or other top level managers. The maximum available score on the measure of involvement of an executive manager was ten. Three sites received scores of ten. One site received a score of eight. All of the other sites received scores of five or less. In half of the sites the top level manager had not been involved in any of the three key aspects of model use.

3. Conceptual Understanding of the System. Since a major objective of the pilot testing of the DSS software was to determine its value to ROC/P managers as a management tool, it was necessary that at least some of the managers of the Pilot test sites have a fairly clear conceptual grasp of the nature of the system. Without a conceptual understanding of the system it would be impossible to make fair judgements about its value to them. The answers to three of the questions in the debriefing interview form were analyzed and scored to establish a numerical indication of the extent of

conceptual understanding of the system by managers and directors. The three questions assessed the ability of the managers to (a) generate additional details appropriate to the system, (b) suggest possible uses and applications of the system and its reports, (c) describe changes to the system which would enhance its usefulness as a management tool. The scoring was on a range of zero to five for each of the three categories for a maximum of 15 points.

Although none of the sites received the top score of fifteen points, eight of them had scores of ten or more. High conceptual understanding scores even in sites with low task completion and low manager involvement indicated that these were not necessarily prerequisite to a tolerable conceptual understanding of the system by a manager.

Findings I: Factors Related to Implementation

In the following paragraphs several factors, including the governance and administrative structure, size, technical capabilities, level of assistance from the researcher, and the administrative level of the main person involved in the pilot testing are examined for their relationships to the different measures of pilot test implementation: (1) task completion, (2) manager involvement, and (3) conceptual understanding.

Factors Related to Task Completion. None of the factors of governance, location, or level of person conducting the pilot test were apparently related to the level of task completion. The factors of size, commitment of director to the pilot, computer configurations, and staff size all had some bearing on task completion. Pilot sites with more staff and computer resources generally had higher task completion levels. The top five sites in terms of task completion were medium sized (between 500 and 2000 ADA). Sites with high task completion seemed to take the pilot test more seriously. The top five sites each entered more than 40 courses each into the system for pilot testing. The remaining sites had each entered samples of fewer than 30 courses for testing.

Factors Related to Director or Manager Involvement. Governance, numbers of office staff, and the computer literacy of the director all seemed to play a role in the extent of manager involvement in the pilot test. Managers in the joint powers ROC/Ps were much more likely to be involved in defining details and analysis reports than were managers in the county operated ROC/Ps. This difference was explained with an analysis of the difference in the numbers of office staff. JPA offices averaged significantly fewer office staff than county operated offices. Size may have also been a significant factor. In the three largest sites, with more than nine administrative staff and more than thirty classified office staff, manager involvement was the lowest. In the smallest offices, with one to three administrators and fewer than five classified staff managers were only slightly more involved. The four sites characterized by the greatest manager involvement all had three to six administrative staff and five to eleven classified staff. The computer literacy of the manager was another important factor in manager involvement. All of the more involved managers were computer literate and used a PC regularly in their work or at home. Of the three sites with the least involvement of a manager, two of the site directors were admittedly computer illiterate.

Factors Related to a Manager's Conceptual Understanding of the Model. The three factors clearly related to manager's level of conceptual understanding were (a) the level of their involvement with implementation, (b) their level of their exposure to training, and (b) their relation to the chief executive of the ROC/P. In all cases where a manager had been highly involved in the pilot test conceptual understanding was high. Others with high conceptual scores had spent extensive time exposed to the training of the researchers. This finding suggests that managers become familiar with the system either through involvement with the software or through exposure to training.

The other factor closely related to understanding was the position of the person most responsible for conducting the pilot test. In the top ranked site the top manager took direct responsibility for the pilot test. In all twelve of the other sites, the task of pilot testing had been delegated to someone under the ROC/P director. In the high ranking cases the manager responsible for the pilot test worked closely with the executive director as part of a top management team. In the lowest ranking cases the responsibility for pilot testing had been delegated to secretarial, data processing, or clerical staff. Since the DSS model was not designed as a transaction processing tool to improve the clerical efficiency of an ROC/P office, those who treated it as such failed to understand the power of the DSS as a management tool. Clearly a major hurdle to a broad-based understanding and acceptance of the DSS model for ROC/Ps is an education of managers to the fundamental differences between transaction processing systems and management information systems.

Findings II: Evaluation of the DSS Model Characteristics

The evaluation feedback from the pilot sites regarding the DSS model characteristics was divided into three categories:

1. criticisms
2. suggestions for improvements
3. positive features of the system

Criticisms of the DSS Model

When asked if they would use the system in its current state only two of the pilot sites responded with an outright no. Both cases were large operations (over 4000 ADA). One was a site in which a large, comprehensive information system had only recently been put into place and was already producing reports similar to those generated by the DSS. The other was a site in which the management was in search of an information system for transaction processing and record keeping. In both cases, the persons who reviewed the DSS model had expectations that it was going to function as a transaction processing system for data storage and retrieval. This expectation was evident from the following comment:

- The DSS provides inadequate support for year-to-year planning, and no support for on-going operations. The system does not contain the information necessary to generate appropriate management information reports.

The belief that information systems should be developed from the bottom up was most evident in these two sites which said they would not use the DSS in its current form. The system evaluators disagreed with the basic premise in the DSS approach that it is possible to separate data collection and storage from data analysis and reporting as evidenced in statements like:

- There are literally thousands of details that must be recorded, tracked, reported, and analyzed just to operate an ROP. An effective MIS must first manage these details. An effective MIS must become the repository for the ROP's operational information, with the paper files used as supporting documents.

Another criticism of the DSS was that the reports could expose individuals or the ROC/P to unfair comparisons or unwanted scrutiny. Several sites expressed concerns along these lines.

- My most serious reservation is that the state would lock into one or more details for unfair comparisons of ROPs.

- I'm afraid of very negative and defensive reactions to the DSS. The reports may create alienation among the different managers in the office.

- The reaction of several members of our management team to the analysis report was one of caution. They were afraid of letting the reports get into the wrong hands. Specifically they did not want board members to see the reports.

- You are likely to meet the greatest resistance to the DSS among the business and attendance accounting personnel (if they feel the importance of their data is being diluted by other data, or if they find that they are losing control over the interpretation of data).

These comments indicate a need for a better system of program quality analysis in ROC/Ps. An important ingredient in the establishment of such a system must be localized control. Unless and until local manager can discover the strengths and weaknesses of their programs in a setting where they have both the opportunity and the power to make corrections and improvements, they will be continue to be resistant to the use of information which could be used in connection with sanctions or negative comparisons. A major step in the promotion and development of the DSS for ROC/Ps is to give local managers a fair amount of time to experiment with the system without having to make their findings public. Without this time and privacy cushion it is unlikely that the system will ever get beyond an automated report generator.

By far the most common criticism of the model was labor intensive nature of the initial data input. This criticism was partly related to the expectation that the system was going to function as a transaction processing system in making data processing more efficient. It was also legitimate criticism of a calculated weakness of the first prototype. With the give time and resources for developing a model, efficiency of data collection was sacrificed in favor of eloquence of data analysis. At least one site made significant progress in overcoming the problem of slow data entry by doing a direct electronic transfer of course and section data. In further developments of the model the data input efficiency would be overcome through electronic linkages to existing transaction processing systems.

Suggestions for Improving the DSS

Several sites noted the problem of strict field definition as hampering the direct transfer of course and section data and suggested that using **less restrictive fields for program, course, section, and location codes** would solve this problem:

- Allow ROPs to enter their own program, course, section, and location codes. Make the fields for these less restrictive in size and type

- Course number fields should allow alpha characters, not just numeric.

Another site suggested changes in the order of data entry as a possible way to simplify the process.

- It could save time and energy if the sections were defined at the same time as the courses.

Clearly, among the first additions to subsequent versions of the DSS software must be modules which will make the **electronic transfer of data** into the system a matter of selecting from a menu. The overhead costs of data entry must be cut significantly if the DSS is to be a tool which will be regularly used by ROC/P managers.

Several suggestions were given on ways to improve the user interface of the DSS software. Technical fixes suggested were to **allow for changes of**

the screen color combinations so the program could be modified to work on monochrome monitors, and to **use function keys to shortcut some of the processes**. Other improvements of the user interface included suggestions to **speed up the process for search and update of data records**, to provide more **automatic checks of data accuracy**, and to **allow for viewing and reporting the data in different ways**.

- Simplify the procedure for changing or updating values data and provide feedback that data has been changed.

- Would like a quick way to access individual records using find commands or english term queries.

- Need a screen which prompts whether the direction is accurate - to be sure the positive and negative signs are appropriately labeled.

- A production system should be mouse driven and more interactive. It should have validation screens for checking the accuracy of raw data.

- We would like more optional screens and ways of viewing the data such as a browse mode or an on-screen review of an individual section profile with the raw data for all details.

- Vary the look of the printouts. They all look too much the same.

Other suggestions for system improvements had more to do with the function of the system. Several reviewers pointed to a need for the system to be able to **calculate new details from existing details**, or to **aggregate or disaggregate data** which applied to courses or sections.

- Provide the capability to automatically calculate a new detail from two or more existing details.

- Provide a way to deal with changes that deal with more than one section such as when a teacher salary goes up and impacts the cost of several sections.

An even more complex process requested by those testing the system was that of **trend analysis and reporting.**

- Provide for tracking of change over time - trend analysis.
- Consider a 3-5 year trend analysis with exception reporting - for example to show those with 4 out of 5 years below standard.

Some of the reviewers felt that the system should provide more **on-line help** and more thorough explanations of the benefits of the system.

- The manual for a final system will need substantially more information on how to define details and why, and how to use reports.

One or two of the sites even proposed that the system could eventually become an expert system which could **suggest solutions to problems** it found.

- Eventually the system could have help screens which would suggest possible interventions to problems which have been identified.

In using the system as a course evaluation tool one site pointed out the importance of using positive terminology, while another site suggested that the system should be more **interactive with opportunity to insert memos** and include these in reports as a way to conduct a course by course improvement.

- We would avoid the use of the terms evaluation and termination. They have negative connotations. We would suggest terms such as "quality building" and "partnerships for program improvement."

- It would be nice to be able to insert comments (justifications) next to certain low detail values on some courses or sections. These could be combined with a summary of actions to be taken or suggested interventions in a printed report which would profile an individual section or course.

Other suggestions on how to improve the system included the **addition of more section and course code fields** on which to select for analysis, the addition of **more high and low accept fields** in details for greater discrimination between cases, and addition of **a module for automatically generating the state required reports**. These suggested improvements are summarized in the recommendations chapter which follows.

Positive Features of the DSS Model

One of the major questions which was being tested in the pilot phase of the project was whether or not the DSS model could be successfully implemented in a variety of different settings. The positive feedback from the pilot test sites affirming the perceived value of the system provided convincing evidence that the model was indeed useable in very different ROC/Ps. Eight of the ten sites which had produced reports using the system responded that they could benefit from implementing the system as it was. Several were enthusiastic in their evaluation of the ease with which the system could be understood and used.

- In general we found the documentation useful and clear. The format was appropriate and easy to follow.

- The manual was simple to read and right to the point. It left out the jargon typical of software manuals.

- I found the DSS software well constructed, well thought out, and hard to screw up. With very little formal inservice I was able to figure it out.

- The DSS is a great software program. The manual is excellent. It has great potential as a management tool.

- The usability of the system is excellent if the data can be efficiently entered.

Of the many features of the program, one of the favorites among managers was the user interface. Managers liked the fact that they could interact with the data and define so many of the parameters on which the data were being analyzed. For some it was an eye-opening experience to be in a position to manipulate their course data.

- We liked the general approach: a system built on a microcomputer with an easy to use end-user interface. We rarely referred to the documentation for operational issues; it was clear how to enter and modify data.

- We have had a system for course evaluation which does much of the same things as the DSS. The DSS has a couple of advantages over our system. It is nice to be able to work with data on a PC. The DSS is much more flexible in that we can easily define new details and easily modify the weights.

- Being able to interact with data on the computer has helped me realize the value of seeing the data and being able to work with it.

- It was a good idea to provide managers with the options for changing the parameters of data reporting. I especially like the ability to weight and add more details and to change the parameters to understand the relationships between details.

- I think the DSS is going to be a terrific tool. It will be very useful to me. I like the way I can build additional details into the analysis. I'm pleased that you guys could develop something like this in such a short time. It takes into consideration the differences between different ROC/Ps and yet provides a generic tool that all can use.

In addition to the feature of user interface, the reviewers appreciated the system for its power in supporting the decision making process, particularly the fact that it could help them pull together information from a variety of sources.

- The DSS reports provide a good guide for course planning decisions.

- The DSS has the potential of putting things into perspective. It also helps avoid biases and subjectivity in decision making.

- This is a potentially very valuable system. If the DSS were a high priority, it would improve the position of all the managers in this ROP. We would work a lot smarter. We now spend a lot of time doing dumb stuff.

- In the past our databases have been in different places, it was impossible to make the kind of comparisons that the DSS does. With the DSS we will be able to follow up problem areas instantly instead of waiting until all the data is in from different sources.

One of the assumptions behind the choice to begin the development of an MIS with a decision support system was that a DSS would drive the data collection process with positive and intrinsic motivators. The research literature suggested that this would be the case, but we had no way of knowing how soon to expect that this would happen, or if it would even be evidenced within the short time available for pilot testing of the first prototype of the DSS. The feedback from three or four of the cases confirmed that a decision support approach to system development can and does generate intrinsic motivation for data collection and standard setting.

- The DSS helps to focus the priorities and standards and helps to drive data collection. Just talking about pilot testing of the DSS has already changed the thinking a bit in this ROP.

- I would like to have a year to work on the implementation of the DSS. That way I could plan ahead and collect section specific data to include in the report at the end of the year.

- I will be a much better user of the DSS in the future because I will be able to use more details and experiment until I get the weights right. I will also be able to develop information to add to the system.

- The discussions of the DSS even prior to pilot implementation have emphasized the weakness of our current data to support decisions and prompted a decision to drop our current data collection system in favor of something better.

- The DSS could save us money by allowing us to look at costs in connection with quality and improve both the cost efficiency and the quality together.

- One of the positive features of the DSS is that it gets us thinking about standard setting.

These quotes from system reviewers provide strong affirmation that the DSS model can not only be implemented in a variety of different settings, but that it has the potential of revolutionizing the collection and use of data by the managers of ROC/Ps. Instead of simply collecting data because it is required for a report, ROC/Ps will be motivated to find more thorough and accurate ways to measure and document the positive effects of their programs and support management decisions.

Findings III: Uses of the System

To determine their views about the system's uses, reviewers were asked to volunteer uses for the system and its reports and then were asked to comment on a list of possible uses suggested by the developers. The findings resulting from this exercise are summarized in the following sections.

Uses Volunteered by System Reviewers at Pilot Sites

System reviewers at the pilot sites volunteered a list of uses similar too that suggested by the developers. The major use volunteered was to **provide a base of program evaluation data from which to draw in making decisions about courses.** This process was described in four sub-steps:

a. analyze cost benefit ratios and other measures of course quality

b. set target goals for improvement in various measurable areas

c. evaluate overall course quality with combined measures

d. conduct longitudinal evaluation of changes

As expected, the decisions identified as being informed or supported by the system included those in the areas of course development, budget planning, scheduling, and the mix of course offerings. The reports were seen as useful for informing and/or motivating advisory committees, boards, school districts, counselors, and instructors. ROC/P leadership also viewed the system as a possible alternative to the enacted requirements for:

a. course approval

a. biennial course quality review

b. compliance review.

In addition, several unique uses for the system were suggested:

- It seems like this system could be very useful for a comprehensive high school. But since they do not have the same strict requirements for accountability they may not see the need of it as much as we might in ROPs.
- The DSS would have more utility at the college or junior college level where the student clientele is more mature and stable.
- The DSS would eventually provide a great database for research.
- The DSS reports will assist with the application for funding.
- The DSS could be a great PR tool.

Responses to System Uses Suggested by Researchers

The researchers had suggested a list of seven possible uses for the system (see the last page of the debriefing interview form in Appendix B) and asked the pilot sites to comment on them. Responses on the seven possible uses varied from site to site. These responses are particularly instructive as to positive prospects and problems to expect in implementation and use of the system in the future. In the following sections responses to each suggested use of the system are briefly discussed.

1. Could the DSS be used for assisting managers in making decisions to retain, suspend, or drop courses/sections?

The response to this question of ROC/P managers who had reviewed the DSS software was overwhelmingly positive. Several of them emphasized their agreement with statements such as:

- Most definitely! This is the major reason for having the system.

The use of the DSS to support decisions is clearly one of its strongest selling points for ROC/P managers.

2. Could the DSS be used to justify course/section decisions to superintendents or ROP boards?

The majority of pilot sites responded positively to the use of the DSS to justify local management decision, but responses ranged from very positive to cautiously qualified. On the extreme positive end one manager stated that this was the most important use of the system. In another site the manager interviewed explained that such a use would not be the most politically astute in situations where the superintendent has a great deal of decision making power. One ROC/P director shed some light on the possible differences between ROC/Ps with different governance structures:

- Whether or not the DSS could be used to justify ROP management decisions would depend a lot on the political processes in the particular ROP office. JPA operations may have more leeway in decision making - the CEO has more control than the CEO in most county operations. It also depends on whether the ROP contracts everything out to districts or controls the operation of courses themselves. It also depends a lot on whether the superintendent was appointed or elected. Elected officials tend to wield a lot more power in the decision-making process.

In other pilot sites managers explained that because of their managerial autonomy, such a use of the system would not be applicable. The importance of using the DSS reports to defend local management decisions to other political entities may or may not be seen as a positive option to ROC/P managers, depending on their situation.

3. Could the DSS provide feedback to mid-level managers to help focus interventions and inservices?

All the responding sites saw the feedback to help focus interventions and inservices as a benefit of the DSS. The DSS is designed to support decisions related to the targeted improvement of course quality. This feature can certainly be used as a major selling point for the system to ROC/P managers.

4. Could the DSS provide feedback to instructors on the relative quality of their class sections?

Response to the possibility of using the DSS reports as direct feedback to instructors was mixed. Two managers were quite positive about keeping instructors informed on their relative status and on the measures by which the quality of their courses were being determined, especially on those measures over which the instructors had some control such as student attendance and student reviews of instructional quality. Most managers responded that they would use the DSS reports only on a selective basis with individual instructors. In one site the manager explained that the instructors had voted not to publicize any comparative data regarding their teaching. Clearly the use of the DSS reports as feedback to instructors would have to be approached with sensitivity on a site by site basis, depending on the needs and attitudes of those involved.

5. Could the DSS provide report data to share among the other ROC/Ps in the CAROC/P association?

On the possibility of using the DSS to generate information to share between ROPs, most of the responding sites saw it as a desirable goal, but one which would be difficult to achieve given the differences in data definition between ROPs. One site suggested that ROC/Ps could share via FAX machine on a number of variables they already had in common:

- The DSS could provide sharing between ROC/Ps on things like placement rates for different courses, connections with higher education, and rates of continuing students.

Another site was much less sure about the benefits of sharing data between sites. The concern of this manager had to do with misuse of aggregated data:

- Sharing data between ROPs is not something I can see you would want to do. Aggregations can screw up data quite badly. While compiled reports may be interesting, they are too easily misused.

The majority of pilot site managers suggested that data sharing would only be possible after the ROC/Ps could agree to common data definitions and collection protocols. The use of the DSS for sharing of common data among the ROC/Ps is an option which needs to be explored more carefully. A study of the common data elements which would be useful to know about other ROC/Ps should be included in the next phase of DSS development, so this use of the system could be facilitated.

6. Could the DSS be used as a database from which state reports are generated?

Responses on the use of the DSS as a system for generating state reports were mixed. Of the ten who responded, six saw this usage as a good possibility in the future once the DSS was in place in a number of sites and some thought had been given to common data elements which may be of interest to the state. Another three others said it would only be possible if consensus could be reached on state level data definitions. One pilot site manager answered with a flat "no".

7. Could the DSS be used to replace or supplement the course compliance review process?

In response to the question of how the DSS would relate to course compliance reviews four managers saw some possibilities for the DSS eventually replacing the CCR. One ROP manager suggested that using the

DSS for state reporting should be a low priority compared to the use of the DSS for self evaluation and course quality review.

- If I were the state I'd get behind this system one thousand percent. The state should mandate the use of the DSS and reduce the compliance reviews. They could simply send an auditor to check that careful self-evaluation is being done.

Four other managers who responded to this question were favorable to the use of the DSS as a supplement to the CCR process. In the next round of refinements of the DSS, careful thought needs to be given to the elements of the CCR which can be defined as details to be included in the decision support system. As the use of the DSS for local decision support is expanded and refined, it may be found that many of the same elements included in the CCR are being covered by the use of the DSS. An eventual goal for the DSS should be to incorporate the elements of the CCR into the state reporting linkages.

Summary

The project was successful in identifying local ROC/P course-level management information needs and developing a proto-type decision support system to address many of these needs. The pilot test showed the system to be adaptable to a range of ROC/P settings representing different organizational structures, sizes, and technical capacities. A number of important uses were identified by the designers and by those who reviewed the system. Pilot site users and other ROC/P managers have expressed enthusiastic interest in the development and implementation of a production version of the model system.

Much remains to be done before the MIS model can become the backbone of local program management and statewide analysis that it deserves to be. The existing software is clearly developmental in character and will need additional work before it is ready for production use. Production ready software cannot be completed until local ROC/P managers have acquired considerably more experience with the decision support concept and have used it to analyze a much broader array of program details. Staff development and training work needs to be undertaken to enable local managers with limited computer expertise to become comfortable with the MIS approach incorporated into the existing software. Major development work needs to be done to link local MIS usage to the data and accountability needs of state level administrators and policy makers. Recommendations regarding the crucial development and implementation needs are included in the executive summary at the beginning of this report.

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Appendices

Appendix A - Detail Definition Worksheet

Detail Definition Worksheet

For Specifying Quality Measures and Performance Indicators

Detail Code	Title	Kind, Type	Minimum, Low Accept	Maximum, High Accept	Default Value, Direction, Weight
$ADA	Direct Cost Per ADA	A	$500.00	$10,000.00	$2,000.00
	Description	D	$1,800.00	$2,500.00	< (lower better)
	All direct costs for a section (Salary, Benefits, Supplies, Facility, Equipment) divided by the ADA generated by the section				35
CERT	Percent of Certifications	A	0%	100%	65%
	Description	P	50%	80%	> (higher better)
	Total number of students certificated by the end of the allotted time for a session divided by the total number attending				30
POSX	Percent of Positive Exits	E	0%	100%	50%
	Description	P	40%	70%	> (higher better)
	Total number of students in military, further study, or jobs within 3 months of the end of the session divided by all attendees				25
	Description				
	Description				
	Description				
	Description				
	Description				

Appendix B - Debriefing Interview Form

CAROC/P MIS PROJECT

ROCP-DSS Software Pilot DEBRIEFING INTERVIEW Form

I. PILOT SITE DESCRIPTION (one sheet per site)

Site Identifiers

Name:

Location:

Administrator:

Administrative Structure (Collect Organizational Chart)

Type: CO ☐ JPA ☐ SD ☐ Other ______________________

Numbers of:

Administrative Staff:

Classified Office Staff:

Instructors:

Relative Size

Longest Distance from ROP to site:

Numbers of:

Districts:

High Schools:

Instruction Sites:

Courses Offered:

Sections:

Students Served:

Annual ADA:

Base Revenue Limit:

Service Area Characteristics

Population Density: Rural Suburban Urban

Population Ethnicity:

Population Growth Rate:

Job Market Diversity:

Job Market Demand:

Extent of Transportation Provided to Students:

Other Factors:

Technical Capabilities in ROP Of

Personal Computers

Types:

Count:

Uses:

Modem:

History:

Person Contributing Data:

CAROC/P MIS PROJECT
ROCP-DSS Software Pilot DEBRIEFING INTERVIEW Form

II. PERSONNEL INVOLVEMENTS IN PILOT TEST (one sheet per person)

Task Involvement

TASKS	WHEN DONE How long did it take to do?	CIRCUMSTANCE	INTEREST Compared to regular tasks.	PRIORITY Compared to regular tasks.	ENABLERS What helped you do the task?
Load Software					
Study Manual					
Enter Courses and Sections					
Define Details					
Enter Details					
Collect/Calculate Values for Sections					
Enter Values					
Define and Enter Analysis Definitions					
Produce Reports					
Modify Parameters					
Read and Interpret reports					
Redo reports after studying					
Evaluate Software					
Other:					

Personal Characteristics

Job Title:

How Long at ROP:

Level of Computer Use:

How Involved with DSS Pilot:

Office Characteristics

Proximity to Director's Office:

Relationship to ROP Director:

Importance of Data to Director:

Director's Management Style:

III. DETAIL DEFINITIONS

DETAIL CODE / QUESTION	$ADA	CERT	POSX		
How is this detail defined?					
What formula is used?					
Where was data for Values found?					
How were the values data collected?					
What format were the data in?					
Who collected and calculated values?					
Were values available on the section level?					
How were the parameters defined?					
What does this detail measure?					
How important is this detail? Should it be required of all ROC/Ps?					
How easy was this detail to interpret?					

IV. ANALYSIS REPORTS GENERATED (Collect latest 3 reports)

Analysis Definitions

Who defined these analysis reports?

Decided which details to include?

Set the weights, high and low accepts?

Are these First, Second, or Third generation reports?

Report Exposure

Who has seen these reports?

What was the context? Internal External

What were the initial reactions?

Confirms what we know

Surprised

Puzzled

Confused

What discussions took place?

Tenor of discussion?

Impact of Analysis Reports

Were parameters evaluated or changed?

In what ways changed?

Why changed?

Is it right yet?

Were any management decisions influenced by the rep

If so, in what ways?

If not, why not?

V. INTERPRETATION OF REPORTS

Differences from Usual Reports

In what ways do the analysis reports differ from data reports already available?

- flexible
- multiple traits
- sorting capability
- data values hidden
- section specific

What advantages and/or disadvantages do you see from these report characteristics?

Report Interpretation

Does the section order on any of these reports seem

What does the Relative Rank Score mean?

What do the plus, minus and o symbols mean?

Which is more valuable to you, the rank ordering of the plus and minus symbols? Explain?

CAROC/P MIS PROJECT
ROCP-DSS Software Pilot DEBRIEFING INTERVIEW Form

VI. FUTURE USES OF THE DSS SOFTWARE

If the DSS software were to stay just as it is, would you implement the use of it on a regular basis?

If not, what changes could make you start use it on a regular basis?

If you plan to use the DSS, in what ways would you use the reports?

What would you change in the software to make it more user friendly and/or useful?

What details would you add to the ones you are already collecting?

What possibilities do you see for the use of th following?
Justify your answers:

Assisting managers in making decisions to retai courses/sections.

Justifying course/section decisions to superint

Providing feedback to mid-level managers to hel inservices.

Providing feedback to instructors on the relati sections.

Providing report data to be shared among the ot

As the database from which state reports are ge

Supplementing or replacing the course complianc

Other beneficial uses. Explain

Design of a Model Management Information System (MIS)

for California's Regional Occupational Centers and Programs

Supporting Documents

by

James C. Dick
Douglas E. Mitchell
Jeffrey B. Hecht

October, 1991

CALIFORNIA EDUCATIONAL RESEARCH COOPERATIVE

UNIVERSITY OF CALIFORNIA, RIVERSIDE

THE CALIFORNIA EDUCATIONAL RESEARCH COOPERATIVE

CERC is a unique partnership between county and local school systems and the School of Education at the University of California, Riverside. It is designed to serve as a research and development center for sponsoring county offices of education and local school districts--combining the professional experience and practical wisdom of practicing professionals with the theoretical interests and research talents of the UCR School of Education faculty.

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Design of a Model Management Information System (MIS)

for California's Regional Occupational Centers and Programs

Supporting Documents

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Design of a Model Management Information System (MIS)

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In contract with the
California Association of Regional Occupational Centers and Programs

Preface

This is a collection of documents and materials supporting the October 1991 CERC publication entitled Design of a Model Management Information System (MIS) for California's Regional Occupational Centers and Programs: Final Report. This collection was printed under separate cover from the final report document. The Final Report is available through CERC at:

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Supporting Documents

Table of Contents

Document 1

Mid-Project Executive Summary - February 1991

A Management Information System for California's Regional Occupational Centers and Programs

Mid-Project Executive Summary

A Research and Development Project Conducted on Behalf of CAROC/P by the California Educational Research Cooperative at the University of California in Riverside

RATIONALE

A Management Information System (MIS) is a systematic, planned way of using information to make good management decisions. A well designed MIS for California's Regional Occupational Programs and Centers (ROPs) will assist the local managers in effective decision making, and also provide the CAROC/P organization with a vehicle for collecting a statewide sample of uniformly defined data.

ROPs have found themselves in an isolated, reactive stance toward legislative changes. The CAROC/P organization would like to take a more proactive stance toward the governance of the ROPs. With the increased standardization of data resulting from a commonly shared MIS, the statewide organization would significantly strengthen its voice in state level policy decisions regarding the operation of ROPs.

TIME LINE

The MIS development project is scheduled for three phases: (1) MIS development, (2) MIS piloting, and (3) Data analysis/reporting. The first phase involves a literature review, visitation of 10-12 ROC/P sites, work sessions with ROP managers and other field representatives to outline MIS data elements and relationships, selection of several pilot sites, and development of the MIS and related materials. The second phase includes such tasks as orienting the pilot sites to the MIS, collecting data, analyzing and reporting the data to site managers, and evaluating the MIS for its contribution to management decision making. The third phase consists of collecting and analyzing the common data generated at the pilot sites, getting valuative feedback from participating individuals, making revisions in the MIS, and generating recommendations and reports. In all phases of the research and development effort input from field practitioners will be solicited.

The final outcome of the study will be a very basic working computerized decision support model, not a finished commercial product. The report with recommendations should provide the basis for the development of a more comprehensive commercially viable MIS which could used by ROPs across the state.

SCOPE

The MIS under development is limited in its scope to the evaluation of course related data, primarily addressing the questions of course quality. It will be extremely useful to managers in establishing valuative criteria, pinpointing problems, determining which corrective measures need to be taken, and deciding when to suspend or terminate courses.

The early phases of the research found that many of the ROPs have reasonably sophisticated data collection systems in place, so the proposed system does not attempt to replicate this. The proposed MIS is a top-end analysis and reporting system rather than a data collection system. The piloting of a such a top-end MIS serves several purposes:

1. It will demonstrate the extent to which ROP managers will make use of data in decision making -- illuminate the value of a full MIS to managers.
2. It will demonstrate the potential for state wide sampling of uniform analysis data -- suggest directions to take in the design of a state wide system.
3. It will allow the ROPs to assert the measures by which they want to be held accountable rather than waiting for the state to tell them -- take a proactive stance toward the current interest of the state legislature in accountability.

Document 2

List of data needs of ROC/P managers from CEO forum

CEO Brainstorming Session Summary

Setting for the CEO work session

The annual CEO Forum was held in Palo Alto, CA. September 21-22, 1990. An hour-long work session was conducted with the ROC/P CEOs present. The participants were divided into 5 groups and asked to identify and establish priorities on the issues and management decisions related to each of the stages in a course life cycle, (1) goal clarification, (2) needs assessment, (3) development, (4) operation, and (5) evaluation. The session served to raise the awareness of the CEO's of the MIS project, bring about a higher degree of buy-in than could have been accomplished through a monologue presentation, and verify the key issues thought to be central to the function of an MIS. An outline of the issues generated by each group is provided in the following five sections.

Group 1 - Goal Clarification

Mission and Functions of ROPs

The mission of ROC/Ps is to prepare youth and adults for entry level jobs; provide advanced training and up-grading skills to currently employed individuals, and to provide retraining. The statutes restrict the lower age limit of ROP recruits to high school students above the age of 16 or a junior in standing. Special needs individuals are not excluded, but are not particularly targeted for service by ROPs.

Accountability

ROPs are seen to be accountable in three ways:

1. Legislative
2. Regulatory
3. Socially

Group 2 - Needs Assessment

Priority Considerations and Questions

The group working on needs assessment outlined the following priority issues (numbered and bold) to consider when asking whether or not to offer a new course/program. The questions following each issue were generated by the researcher.

1. Labor market

a. Is there sufficient demand for individuals trained in the way we could realistically train the students whom we serve?
b. How many job openings of what type can be expected for every training period?
c. How willing are employees to hire our trainees or work with us on community classroom arrangements.?
d. Will this labor market last long enough to warrant the efforts of planning and starting a program?

2. Curriculum

a. Is curriculum available for the proposed course/program?
b. What time and labor efforts will be needed to develop curriculum which is appropriate to the labor needs and will meet state standards?

3. Monetary

a. Can we afford to add a new program at this time?
b. What are the likely start-up costs of the proposed course (curriculum development, materials, equipment)?
c. What are the on-going operations costs of such a program (instructor, facilities, supplies)?
d. What sources of income other than ADA are available to offset the costs of this course?
e. Can enough ADA income be generated to balance the costs of the course?
f. Will increased wage earning power of trainees justify the cost of training?
g. Will the likely placement rate of trainees justify training costs?

4. Student interest and availability

a. Is student interest high enough to expect to fill the class?
b. How many students can be expected to take the course?
c. What advertising efforts will be needed to assure adequate enrollment?
d. What will the advertising cost?
e. Which form of advertising is most effective?
f. What is the minimum number of students needed to break even on cost and income?
g. What is the maximum number of students the course can take given the facilities, equipment, materials, and instructor(s)?
h. Are students physically near to the training site(s)?
i. Is transportation necessary, feasible?

5. Articulation/Non-duplication

a. Will this course/program provide an appropriate step for students who plan to continue training in this field?
b. Will this course articulate with area colleges and universities?
c. Is this course an unnecessary duplication of similar courses offered elsewhere?
d. Where else could students get the same training?
e. Is the course filling a real need?
f. What related educational programs in the region are likely to be impacted by the addition of this course? In what ways?
g. Can we live with this impact?

6. Internal ROP needs and constraints

a. Do we have the necessary resources to begin and sustain this course (facilities, instructors, equipment, materials)?
b. Do we have the political support to begin this course?
c. Can we add to our enrollment without going significantly over our cap?
d. What effects will the addition of this course have on other courses/programs?
e. What effects will the course have on the administrative work load?
f. What steps are required to bring a new course from concept to complete integration with the whole program?
g. How long will this process take given the available human and other resources?
h. How much will it cost?

7. **External restrictions and constraints**
   a. Will this course meet government approval standards?
   b. Are there labor union standards which must be met for such a program? Can they be met?
   c. Are the expectations of potential employers within reasonable reach for this course?
   d. If not, can these expectations be modified to match realistic competency outcomes?
   e. Can our facilities meet state building safety codes?

Group 3 - Course Development

Areas of Consideration

State frameworks (curriculum)
Class size
Facilities
Equipment
Costs and monetary effects
Credentialed Teacher
Advisory Committee
Job Skills Analysis
Competencies
Articulation 2+2
Curriculum comparisons with other ROC/Ps
Type - Class only, Community class, Co-operative

Sequence of major tasks

1. Form an advisory committee with the following functions
   a. Job task analysis
   b. Job titles listing
   c. Competencies development and verification
   d. Articulation with higher programs
   e. Community classrooms and CVE coordination
   f. Equipment and facility recommendation
2. Match frameworks with quality indicators and competencies
3. Review other model programs
4. Evaluate Costs
5. Assure 2+2 Articulation

Group 4 - Course Operation and Monitoring

Seven top priority components

The following components were rank-ordered by the CEOs in group 4 on degree of importance in the task of managing a given course on a day-to-day basis. Questions and commentary were generated by the researcher.

1. **Attendance**
   - a. Do we have enough students to warrant offering this course?
   - b. Are enough students attending to generate the ADA needed to fund the offering of this course?
   - c. Does the level of attendance point to quality concerns in the curriculum or its delivery which need to be addressed?

2. **Costs**
   - a. What is the budgeted cost for this course?
   - b. How much ADA would have to be generated to cover the cost of offering this course?
   - c. How much of the budgeted costs for this course are fixed costs and how many are flexible costs?
   - d. Where could cost cutting be applied to this course?
   - e. Which costs will be covered by revenues other than ADA?

3. **Effects of Scheduling**
   - a. What is the best time for offering a course?
   - b. When will the most students be able to attend?
   - c. Is transportation needed? Available?

4. **Curriculum Relevance**
   - a. Have we designed the course to prepare for appropriate jobs?
   - b. Is this course preparing students for available jobs?
   - c. Are graduates of this course able to do the jobs well?

5. **Quality of Instruction**
   a. Is the instructor of this course properly qualified?
   b. If not, what needs to be done to qualify the instructor?
   c. Is the instructor competent? What needs improvement?
   d. Are students learning what they need to know for jobs?
   e. Are students happy with the quality of instruction?

6. **Facilities and Equipment**
   a. Do the facilities and equipment used in a course meet government standards?
   b. Are facilities and equipment appropriate to the course objectives - job titles toward which training is oriented?
   c. Is equipment inventoried, serviced, maintained properly?
   d. When is it appropriate to retire old equipment and purchase new?
   e. What are the appropriate equipment depreciation schedules to set? Are they clearly documented? Are depreciation costs accounted for in the total cost of a course?

7. **Student Follow-up Data**
   a. Do students like this course when they are done?
   b. Have students met their entrance goals at exit from course?
   c. Why do students leave this course?
   d. What can students who complete this course do?
   e. What do students do when they complete this course?
   f. Which course objectives are best met by this course? Skills attainment, placement, avoidance of dropout, personal satisfaction of students?

Group 5 - Course Evaluation/Termination

Outline of concerns and issues identified by CEOs

1. Completers/Leavers (needs to be redefined)
   a. Enrollment
   b. student needs and interests
   c. accessibility
   d. teacher availability
   e. graduation requirements
   f. counselors

2. Cost Effectiveness

3. Job Market Analysis
   a. Wages
   b. Future
   c. Placement

4. Advisory Committee

5. Public Perception
   a. Termination
   b. Observation

6. Curriculum Standards - Statewide
   a. Common competencies
   b. Standardized testing (competency based)

Document 3

Types and Examples of Information Needed by Top Managers

Types and Examples of Information Needed by Top Managers

Seven types of information are frequently needed by top-managers in an organization. This document lists definitions and examples of these information types reflecting the ROC/Ps in California.

Comfort information: keeps managers informed about current situations or achievement levels; allows the individual to know that performance is on track and in line with general expectations in an area of interest.

Examples:
Current enrollments by section
Actual ADA generated compared to expected ADA
Number of completers

Status information: also called progress information; keeps managers abreast of current problem and crisis as well as reporting advances to take advantage of opportunities that may disappear if not acted upon.

Examples:
Number of absences or drop outs
Status of advisory committee meetings
Progress on new course developments
Progress of other agencies on developing similar courses

Warning information: signals that changes are occurring, either in the form of emerging opportunities or as omens of trouble ahead that will affect the success of the firm, its products or services, or its long-term viability.

Examples:
Shifts in the labor market
Legislative changes in funding or reporting requirements
Unusually high or low completion or placement rates
Rapid increase in drop outs from a particular course
Increase in student interest in a course

Planning information: descriptions of major developments and programs due to begin in the future; includes assumptions on which plans are based or anticipated developments essential for the realization of the established plans.

Types and Examples of Information Needed by Top Managers (cont.)

Examples:

Labor market growth or decline
Entry of new labor market sectors
Entry of competitor - other training agency
Availability of qualified instructors

Internal operations information: key indicators of how the organization or individuals are performing; useful for reporting the overall health of an organization, subsidiary, division, or product. Areas in which actual performance does not match expectations are reported as exceptions.

Examples:

Biennial course quality review
Student satisfaction survey information
Follow-up information on placements
Revenue/expense reports

External intelligence: information, gossip, and opinions about activities in the environment of an organization; includes a broad range of areas such as competitor and industry changes, financial market movement, and political-economic fluctuations or expected shifts.

Examples:

Industry demands for new types of trained workers
Expert projections of economic behavior in next 6 months
Talk of actions in high school, community college, and adult ed.
The fall-out from legislation in vocational education
Student interest survey results - availability of students

Externally distributed information: information the chief executive wishes to review before its release to stockholders or distribute to the news media.

Examples:

Semester reports of successful completions
Accumulated contributions from business and industry
Details of newly developed student services program
Reports of successful placement of workers into local business

Reference

Senn, J.A. (1987). Information systems in management (3rd ed). California: Wadsworth Publishing Company, p. 32-34

Document 4

Flowchart of course life cycle management decisions

Flowchart of Management Decisions in the Life Cycle of a Course

Planning Phase

SOURCES OF INTERNAL SUPPORT DATA	MANAGEMENT DECISIONS	SOURCES OF EXTERNAL SUPPORT DATA
	Is there sufficient local political support to launch the proposed course?	ROC/P Board and advisory committee input
Personnel cost records	Is there sufficient student interest in the proposed course to cover the cost of hiring an instructor?	Student interest surveys in high schools
Past placement rates for similar courses	Is the labor market demand enough to provide jobs for course graduates?	EDD projections, Advisory committees
Counts of completers	Does our mix of courses reflect the labor market needs in different fields?	EDD statistics
	Is this labor market already sufficiently served by existing training programs in the region?	Survey of programs offered in region (future AEI MIS)
	What equipment/supplies are essential to the success of this course?	Advisory committee input on job skills analysis and equipment needs
Personnel, Inventory, Facilities, and Transportation data	Do we have access to the basic components needed to run the course?	Possible new hire instructor(s), new or donated equipment
Projected costs for instructor, supplies, equipment, facilities	Do we have the funds needed to offer the proposed course? What is a reasonable investment to make in establishing this course? What are the likely benefits? (social, financial, political)	Possible sources of funding other than ADA allocation, records of similar courses elsewhere.
Expected life of the course. Past practice.	How should one-time startup costs be amortized?	Record of similar courses elsewhere

Flowchart of Management Decisions in the Life Cycle of a Course

Course Development Phase

SOURCES OF INTERNAL SUPPORT DATA	MANAGEMENT DECISIONS	SOURCES OF EXTERNAL SUPPORT DATA
	For which jobs will this course prepare its graduates?	Dict.of Occupational Titles, OES-CBEDS-CIP crosswalks
	What are the essential skills and knowledge needed for effective entry level employment?	Advisory committee input, employer survey
	Which skills and knowledge would qualify a student as "job ready?"	Advisory committee input, curriculum frameworks/guides
Course lists of achievable competencies	Do the competencies identified in course outlines match essential job skills?	Job skills analysis, OES-CIP crosswalk
Student demographic statistics and learning patterns	How many hours should it take to train the type of students we serve to a state of job readiness?	Information on similar courses offered elsewhere
Course description database	How well does this course articulate with other educational opportunities?	Related college course prerequisites
Facility size, available equipment, cost and training of instructor	How many students will the course serve? ideally? maximally, minimally?	
	Can the course meet state guidelines for approval?	VE 77 forms and process
Database of sponsorship agreements	How can regional businesses be involved in the support of the students in this course?	Chamber of commerce, labor and employment offices

Flowchart of Management Decisions in the Life Cycle of a Course

Implementation Phase

SOURCES OF INTERNAL SUPPORT DATA	MANAGEMENT DECISIONS	SOURCES OF EXTERNAL SUPPORT DATA
Survey of students' methods of discovery about the course	What is the most cost effective method of attracting good students? Which types of advertizing attract which students?	
Survey of student intent/expectations at outset of course	How can our students best be served by the course? What are student expectations from the course?	Student interest surveys in high schools
Past placement rates for similar courses, enrollment, student intent survey data	To what extent is this course likely to contribute to labor supply?	COICC data collection forms and procedures
Admissions database of student demographic data	Are the students who are attracted to this course representative of the normal population? Might our advertizing need to change to attract a more normal group?	Comparative high school student body descriptive statistics, local census data

Flowchart of Management Decisions in the Life Cycle of a Course

Operation Phase

SOURCES OF INTERNAL SUPPORT DATA	MANAGEMENT DECISIONS	SOURCES OF EXTERNAL SUPPORT DATA
Enrollment or attendance database, course descriptive data on ideal, min and max enrollments	Does the enrollment warrant continuation of the course offering? addition of sections?	
Budget, ideal and actual enrollments, attendance patterns	Does the ADA revenue generated cover most of the costs of the course.	
Attendance records and reports	Which students have chronic attendance problems? How can they be encouraged to attend with regularity?	
Supervisor evaluation spending records attendance patterns	How well is the instructor of this course doing?	
Observations, course outlines, completion rates	Does the curriculum taught in the course match the objectives in the course description?	
Course outlines, competency achievement rates	Are students learning the intended competencies in the time allotted?	CVE supervisor evaluations of student skills

Flowchart of Management Decisions in the Life Cycle of a Course

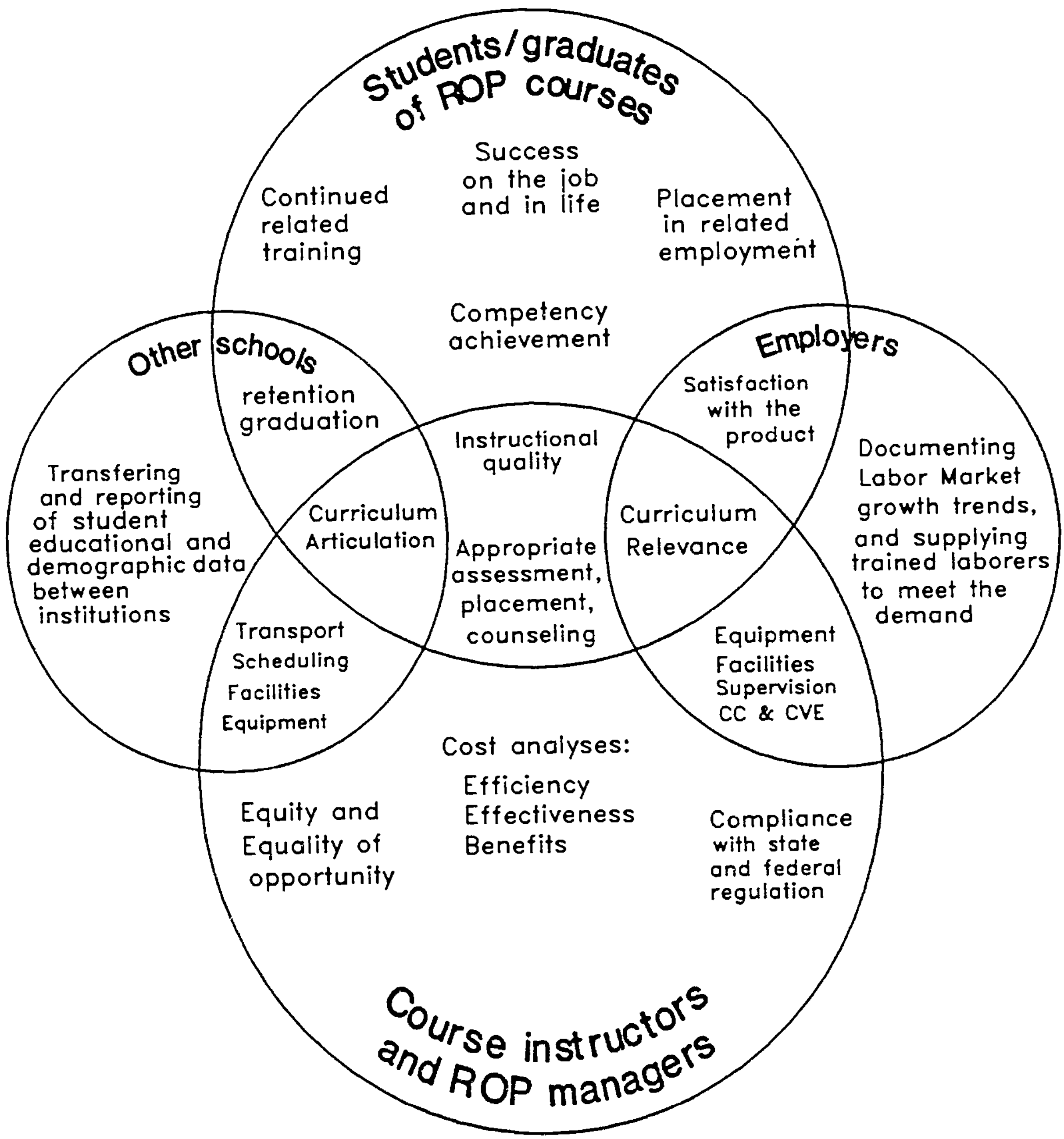
Evaluation Phase

SOURCES OF INTERNAL SUPPORT DATA	MANAGEMENT DECISIONS	SOURCES OF EXTERNAL SUPPORT DATA
Exit survey compared with entrance survey, follow-up survey	Is the course meeting the needs of the students who attend it?	
Course dropout rate, Dropout follow-up	How can dropout rates be minimized? What are the primary causes of dropping?	Dropout rates of comparable group in high schools
Achievement, completion, & dropout rates, course outline	Is the curriculum appropriately difficult and the instruction correctly paced for the students served?	Employer satisfaction surveys
Student intent and placement rates	Does the course provide sufficient links with employment for graduates seeking work after completion?	
Entrance survey of wages and follow-up survey of wages	To what extent does the training provided in the course increase the earning power of graduates?	EDD statistics on wages for various jobs
Follow-up data linked to intake survey data by individual student	How does the course affect the career goals and choices of the students who attend and complete the competencies?	
Student demographic data, completion and placement rates	What do the state and federal governments need to know about the effects of the course?	State and Federal reporting requirements
Compiled and analyzed data from many sources	How does the overall quality of this course compare with other courses offered by the ROC/P?	
Lists of employers of course graduates, employer surveys	Who are the primary employers of our graduates? How can we better serve them?	Advisory committee input

Document 5

Graphic figure showing the domains of course quality

Domains of Course Quality Measurement and Analysis



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Document 6

Table of information needs in the domains of quality

Course Quality Measurement Variables

Source of Data / Category of Analysis	Illustrative Measurement Variables: Variable Factors	Base Factor
ROP course instructors & managers		
Cost effectiveness	cost per certification, placement, etc	mean cost per *
Cost efficiency	course costs, cost per ADA, % covered	means, 90%-110%
Service to special needs students	services available, % special students	standards, norm distrib
Compliance with state regulations	forms (VE80, VE77, J780)	standard data procedures
Students & graduates of ROP		
Impact on career choice and success	% placements in related work or study	total enrolled in course
Students + ROP		
Competency achievement	% certified by course end	total enrolled in course
Instructional quality	student and supervisor ratings	rating scales
Employers (both actual and potential)		
Labor market demand	trends, predictions, local surveys	past predictions, time
Resource sharing agreements	$ value, counts, rating of quality	rating scale
Employers + ROP		
Equipment & facility quality	rated by instructor and advisory group	standards, rating scale
Employers + Students		
Client satisfaction level	student and employer rating survey	rating scale
Employers + ROP + Students		
Curriculum relevance	rating survey to different groups	rating scales
Other schools		
Student data transfer and reporting	rating of efficiency and accuracy	rating scale
Resource sharing agreements	rating of political/economic advantage	rating scale
Other schools + ROP		
Scheduling and transport	costs, efficiency, counts of students	means
Other schools + Students		
Attraction and retention	interest, retention rates, graduations	H.S. norms, means
Other schools + ROP + Students		
Curriculum articulation	2+2 agreements, dbase, student data	standards

Document 7

Review of existing information systems

Review of Two Existing Information Systems

Two different existing information systems were reviewed during Phase I of the MIS study, Solano Online's "Socrates" and San Diego County Office of Education's "Contracts Administration System." More than one third of the seventy ROC/Ps in the state use some form of the Socrates system. Several of the largest ROC/Ps are currently using or are in the development stages of programs similar to San Diego's Contracts Administration System. The following table provides a comparison of key characteristics of these two systems.

Characteristics of Two Existing Information Systems in ROC/Ps

Name	Contracts Administration System	Socrates
Development	5 years	12 years
Estimated per site cost to install	$400,000	$25,000
Hardware base	Mainframe Computer	Mini or Personal Computer
Functional areas	Admissions, Attendance, VE 80 Reports, Course Catalog, Contracts, Program Quality, Budgets	Admissions, Attendance, VE 80 Reports,
Size of ROP where operational	over 3000 ADA	600 to 2500 ADA

Both "Socrates" and "Contracts Administration System" and are examples of state-of-the-art information systems which have been specifically designed for ROC/Ps. The development approach followed in both cases was to analyze the data collection, storage and retrieval, and reporting practices and needs in existing ROC/Ps. The primary goal in the design of these systems was the efficiency of data manipulation. Both systems substantially increase the efficiency with which student enrollment, attendance, and completion data are captured, stored, and reported.

The implication for MIS development from the analysis of these existing software packages in the ROC/Ps was that the best way to solve the data problems identified does not lie in adding to or expanding the field of existing transaction processing systems. **What is needed in ROC/Ps is not primarily more efficient processing of information but more effective use of information for management purposes.** The MIS will function as an inexpensive generic decision support system which can linked to a number of different existing data collection systems (e.g. attendance, accounting, and inventory). Such a system will be easily implemented in a variety of different sites and will serve to equalize even the least automated sites at the point of effective management strategy.

Document 8

The computer model for the ROCP-DSS software

The Computer Model

The computer model was developed from the conceptualization created by the research team, using the weighting model forwarded by Robert R. Carkhuff and William A. Anthony (1981). In this conceptualization key factors involved in critical decisions are first identified. Each factor is defined as either a "positive", "middle", or "negative" scale depending on the particular value of a case on that factor. Particular cases (alternatives) are then collected, with their values on the several factors determined. These scales ("+", "o", "-") are weighted in accordance with the individual's perception of the worth of that factor in the overall decision making process. Finally, the alternatives are rank ordered according to their overall score based on the cumulative weightings of their scales.

The particular operational model was conceived on the premise that the unit of analysis was the course. It was recognized, however, that a single course could be taught at different times and locations by different instructors in different circumstances. Thus, it became the section that was the actual basic unit of analysis for the computer model. Since sections are implementations of individual courses the system would have to expect that courses would be created first, followed by specific section(s) for each course.

With sections in place, it would then be necessary to attach attributes to those sections. These attributes would carry the actual information about that section needed for the comparative analysis. Needless to say, attributes would be shared across many, if not all, sections at a given site. To accommodate this need a basic definition of each attribute (or detail, as it was called) became necessary. Specific quantitative information relative to each section (a value) could be attached to each of these details for each section after the details themselves had been defined.

A comparative analysis report could finally be produced once all values had been entered for all details attributed to each section. Such a report would need to know how to evaluate the value given to each detail for each section (when to rate a certain value as a "positive", "middle", or "negative" and how much relative weighting to give a particular detail in relationship to other details for any given report). Given these scoring of sections on one (or more) details a rank ordering of sections could be produced. There would have to be some way to report and save the parameters from each analysis report so that they might be easily reproduced in future runs.

Thus, the trial system needed to be able to accommodate several different, yet related, data files containing information on: courses, sections, details (the attribute definitions), values (the actual value of a detail for a particular section), and analyses (the mix and weighting of different details on particular sections for a given report). The system would have to allow for basic file maintenance functions: entry into these data files, updating (modifying) of existing information, and deleting of old information. In addition, it would have to accommodate reporting of the contents of each data file, and the production of the actual analysis report (the most complicated task of the system).

Development of the Trial System

It was decided to implement this model in an MS-DOS (IBM-PC or compatible) platform for distribution and testing in the field. This environment had previously been determined as the one most available to the greatest number of potential test sites. Dbase IV (Developer's Edition) was used as the development vehicle for the software written. It provided a standardized and easily modifiable environment for program evolution, and a run-time module making easy the distribution and installation of completed modules. To insure the minimum of field problems, several programming constraints were imposed throughout the development:

(1) All programming was to be done in a "modular" fashion, with sufficient internal documentation to enable later programmers to easily comprehend this implementation.
(2) Each module was to bear a module name, revision date and version number to aid in debugging and problem identification efforts.
(3) Menus and full-screen prompts, with "pull-down" assistance boxes, were to be used at as many points as feasible, standardizing and simplifying the user interface with the system.
(4) User entry points were to be tightly edited, to prevent erroneous data from being stored in any data file.

The imposition of these constraints lengthened program development time somewhat, but proved to significantly reduce problems once the trial system was implemented at the test sites.

The Data Files

Six different Dbase IV data files are used in the CAROC/P Decision Support System: COURSE, SECTION, DETAIL, VALUE, ANALYS, and REPDAT. The COURSE file is usually the first one encountered in the system. It contains the basic information about each course, and a four character field (PROGRAM) detailing which program the course is a part of. This field may be used for selecting only those courses belonging to a certain program during the analysis reporting procedure.

Structure for database: COURSE.DBF

Field	Field Name	Type	Width
1	COURSE	Numeric	8
2	TITLE	Character	30
3	DESCRIP	Character	60
4	PROGRAM	Character	4
** Total **			103

The COURSE data file maintains two standing indices. The first, under the tag name of COURSEC, is just an index of the course numbers. This index is useful for course look-ups in the file during routine maintenance activities. The second, under the tag of COURSEP, is an index of the file according to program. This index is useful when reporting according to only certain selected program codes.

The SECTION file is typically encountered next. After the user has entered one (or more) courses these courses must have one (or more) sections entered for each. Since values are associated with particular sections (not courses), it is essential that each course have at least one section.

Structure for database: SECTION.DBF

Field	Field Name	Type	Width
1	COURSE	Numeric	8
2	SECTION	Numeric	4
3	TITLE	Character	30
4	DESCRIP	Character	60
5	LOCATION	Character	4
** Total **			107

Sections are unique according to a combination of the course and section number. This combination forms the first index for the SECTION file, a twelve character string combining the course and section numbers under the tag SECTIONC. Like in the COURSE file, this tag is useful for locating particular section records during maintenance procedures. The section index tag, named SECTIONL, is an index of the section file according to location. The location code is a four character string the user can use to represent the physical location (or any other useful attribute) associated with each section. This code can be used at analysis reporting time for selecting only certain locations to report on.

Once courses and sections have been established in their respective data files the user next proceeds to create definitions for the details associated with the sections. This information is stored in the DETAIL data file.

Structure for database: DETAIL.DBF

Field	Field Name	Type	Width	Dec
1	DETAIL	Character	4	

2	TITLE	Character	20	
3	DESCRIP	Character	60	
4	KIND	Character	1	
5	TYPE	Character	1	
6	MINVALUE	Numeric	12	2
7	MAXVALUE	Numeric	12	2
8	DEFVALUE	Numeric	12	2
9	LOACCEPT	Numeric	12	2
10	HIACCEPT	Numeric	12	2
11	DIRECTON	Character	1	
12	DEFWEIGT	Numeric	3	
** Total **			151	

Each detail is stored in the DETAIL file under a unique four character code. The detail is described by giving it both a title and a short description. The user can indicate whether that detail is an actual value (A) or an estimated (E) value for that detail in the KIND field, while the TYPE field is used to remind the user whether the detail is a number (N), dollar value (D), or percent (P). These two fields are for memo purposes only, since the system does not enforce any special editing on particular values.

The CAROC/P Decision Support System has been programmed to only accept numeric values for details. While this does not always fit every situation, most values associated with a detail can be converted into a numeric equivalent for analysis. MINVALUE, MAXVALUE, and DEFVALUE are entered into the detail definition file to aid the editing process during actual value entry. MINVALUE represents the smallest numeric value allowed for this particular detail, while MAXVALUE is the largest allowed. DEFVALUE, a value that must fall between the two, is the default value assigned to that detail for all sections unless otherwise overridden by the user. Proper setting of these parameters insures that out-of-range values are not accidentally entered into the VALUE data file.

HIACCEPT, LOACCEPT, and DIRECTON all deal with the way the value is interpreted at analysis reporting time. HIACCEPT typically represents the highest acceptable value for the "middle" range, while LOACCEPT represents the lowest acceptable value. A section with an actual value for this detail greater than HIACCEPT is deemed to be a "positive" ("+"), while one with an actual value less than that of LOACCEPT is deemed to be a "negative" ("-"). The above is true when DIRECTON is set to a value of ">". Sometimes, however, "positive" is represented by lesser values, not greater ones. Changing DIRECTON to "<" reverses the interpretation of HIACCEPT and LOACCEPT so that an actual value below LOACCEPT is rated as "positive" while one greater than HIACCEPT is rated as "negative". The user is responsible for determining adequate ranges for both LOACCEPT and HIACCEPT, as well as the direction of interpretation (DIRECTON). Both LOACCEPT and

HIACCEPT must be within the ranges of MINVALUE and MAXVALUE, and HIACCEPT must be equal to or greater than LOACCEPT.

The final field in the DETAIL data file is DEFWEIGT, representing the default weight the user typically assigns to this detail at analysis reporting time. Like KIND and TYPE, this is a memo field, serving only to remind the user of this detail's intended use in an analysis. The DETAIL data file contains only a single index. Stored under the key of DETAILD, the detail code is used primarily for data file maintenance procedures. It is also accessed when analysis reports are defined.

After one (or more) details have been established the user next typically enters values for each section under each detail. While it is not absolutely necessary for every section to have a value for each detail (the system can function with that level of missing data), the CAROC/P Decision Support System will attempt to insure that each has at least the default. It does this by scanning the VALUE file each time the value maintenance program is invoked, insuring that every section has a corresponding detail entry for every detail. If a section-detail does not previously exist the system will automatically create one, using the detail's default value (DEFVALUE) as the value for that section-detail.

```
Structure for database: VALUE.DBF
Field  Field Name  Type        Width    Dec
    1  DETAIL      Character       4
    2  COURSE      Numeric         8
    3  SECTION     Numeric         4
    4  VALUE       Numeric        12      2
** Total **                       29
```

The combination of the DETAIL, and character representations of the COURSE and SECTION form a sixteen character string making each entry of detail for each course-section unique. Each of these entries contains a single numeric value, entered according to the specifications and constraints in the DETAIL file for that detail code.

The VALUE file contains two standing indices: VALUEC and VALUEN. Both use the same elements for the keys (given above), though the first is sensitive to detail-course-section order while the second is sensitive to course-section-detail order. By selecting these keys the user can alternate the presentation of records from this file, during the data entry procedure, to better accommodate the order of the data in its raw form.

After detail values have been entered for each section the user is ready to proceed to the creation of an analysis report. The first step in this process is to create one (or more) entries in the ANALYS data file. This file contains the maximum (up to fifteen) number of details allowed on a particular report, naming each of the particular details. In addition, each detail is given a weighting to be used at analysis time. Default PROGRAM and LOCATION codes are also specified (with the keyword of "ALL" if all of either PROGRAM or LOCATION is desired). While the user retains the freedom to readjust the weights, program, location, and several other parameters at reporting time a particular detail can only be "disabled" by setting its weight to zero.

Structure for database: ANALYS.DBF

Field	Field Name	Type	Width
1	ANALYS	Character	4
2	TITLE	Character	30
3	DESCRIP	Character	60
4	DETAIL1	Character	4
5	DETAIL2	Character	4
6	DETAIL3	Character	4
7	DETAIL4	Character	4
8	DETAIL5	Character	4
9	DETAIL6	Character	4
10	DETAIL7	Character	4
11	DETAIL8	Character	4
12	DETAIL9	Character	4
13	DETAIL10	Character	4
14	DETAIL11	Character	4
15	DETAIL12	Character	4
16	DETAIL13	Character	4
17	DETAIL14	Character	4
18	DETAIL15	Character	4
19	WEIGHT1	Numeric	3
20	WEIGHT2	Numeric	3
21	WEIGHT3	Numeric	3
22	WEIGHT4	Numeric	3
23	WEIGHT5	Numeric	3
24	WEIGHT6	Numeric	3
25	WEIGHT7	Numeric	3
26	WEIGHT8	Numeric	3
27	WEIGHT9	Numeric	3
28	WEIGHT10	Numeric	3
29	WEIGHT11	Numeric	3
30	WEIGHT12	Numeric	3
31	WEIGHT13	Numeric	3
32	WEIGHT14	Numeric	3
33	WEIGHT15	Numeric	3
34	PROGRAM	Character	4
35	LOCATION	Character	4
** Total **			208

The final file used in the CAROC/P DSS is the REPDAT data file. This data file does not contain actual data entered by the user. Rather, it is a temporary file used by the analysis reporting procedure during the process of report creation. Normally this file is empty, only containing records during the actual report creation. Essentially, it is used as an interim storage file for correctly ordering the section records after each's total weighted detail code has been computed.

Structure for database: REPDAT.DBF

Field	Field Name	Type	Width	Dec
1	COURSE	Numeric	8	
2	COURSETIT	Character	30	
3	SECTION	Numeric	4	
4	SECTIONTIT	Character	30	
5	PROG	Character	4	
6	LOC	Character	4	
7	DISPLY1	Character	1	
8	DISPLY2	Character	1	
9	DISPLY3	Character	1	
10	DISPLY4	Character	1	
11	DISPLY5	Character	1	
12	DISPLY6	Character	1	
13	DISPLY7	Character	1	
14	DISPLY8	Character	1	
15	DISPLY9	Character	1	
16	DISPLY10	Character	1	
17	DISPLY11	Character	1	
18	DISPLY12	Character	1	
19	DISPLY13	Character	1	
20	DISPLY14	Character	1	
21	DISPLY15	Character	1	
22	TOTALWGT	Numeric	3	
23	VALWGT1	Numeric	12	2
24	VALWGT2	Numeric	12	2
25	VALWGT3	Numeric	12	2
26	VALWGT4	Numeric	12	2
27	VALWGT5	Numeric	12	2
28	VALWGT6	Numeric	12	2
29	VALWGT7	Numeric	12	2
30	VALWGT8	Numeric	12	2
31	VALWGT9	Numeric	12	2
32	VALWGT10	Numeric	12	2
33	VALWGT11	Numeric	12	2
34	VALWGT12	Numeric	12	2
35	VALWGT13	Numeric	12	2
36	VALWGT14	Numeric	12	2
37	VALWGT15	Numeric	12	2
** Total **			279	

The DISPLY fields store the interpretation of the value for each of the fifteen details (either "+", "o", or "-"), while the VALWGT fields store the actual values. At report printing time the values are multiplied by their percentage of their weight (adjusted according to the total of all of the weights for that report). Interpretations of a "+" earn a relative score of 200, a "o" a score of 100, and a "-" a score of 0. Factored with each detail's relative weight gives each section a total rank score in the range of 0 to 200, regardless of the number of details included in the report.

In order for the analysis report to print sections in a descending rank order the REPDAT file is indexed on a single tag named WEIGHTS. This tag is a fifteen character combination of the rank order value, the course number, and the section number. In this way different sections tied with the same relative ranking come out sorted in course-section order on the analysis report.

The Program Files

Fifteen different program files were written for the CAROC/P Decision Support System, encompassing over 5,000 lines of Dbase IV program code. These program files are divided into four distinct groups: Menu and Control, Data File Maintenance, Data File Reporting, and Analysis Reporting. The system was designed so that each of the fifteen modules could be run independently of the others in a stand-alone environment. When compiled and bound, the entire program becomes a single, executable file named ROCP-DSS.DBO, which can be executed from either the Dbase IV executive or the Dbase IV Runtime.

The Menu and Control program files consist of the ROCP-DSS.PRG and MAINMENU.PRG files. These two files provide the main and sub-menus of the DSS, including the specifications necessary for linking between the different program modules and their respective data files.

Each of the five data files is associated with its own independent maintenance program: MANALYS.PRG, MCOURSE.PRG, MDETAIL.PRG, MSECTION.PRG, and MVALUE.PRG. The full operation of these programs are described in the system's user manual. Essentially, each module is intended to allow the user to add, modify, or tag for deletion records appropriate to that data file. The exception to that is the MVALUE.PRG routine, which automatically adds records to the VALUE data file when necessary (the user is prohibited from manually adding records to this file).

Two other routines also exist to support file maintenance. PACKALL.PRG is a routine that removes all tagged for delete records from each of the five data files, reindexing each in the process. UPDATE.PRG is a stand-alone module that must be accessed outside of the regular menu system. This procedure can be used if, for some unknown reasons, the standing indices of any of the files should become corrupt or otherwise out of sync with the regular data files. This most typically occurs when a user adds records manually to the data files, such a might occur when data is imported from an existing records maintenance system. UPDATE.PRG can then be run to rebuild all of the indices necessary for the correct operation of the DSS.

Five reporting procedures also exist to create basic reports of each of main data files. These procedures are: RANALYS.FRG, RCOURSE.FRG, RDETAIL.FRG, RSECTION.FRG, and RVALUE.FRG. These routines are standard Dbase IV reporting routines, allowing the user to dump the entire contents of each of the data files in a standard report format.

The most complicated procedure of the Decision Support System is the RREPORT.PRG procedure. This procedure actually produces the analysis report, combining the data previously entered into each of the five data files. This routine first queries the user for the analysis code they want to use for the given report, previously entered into the ANALYS data file. Once that code's parameters have been retrieved the user can make manual adjustments to the LOACCEPT, HIACCEPT, DIRECTON, and WEIGHT values of each detail specified (up to the maximum of the fifteen allowed). The user can also specify particular programs or locations to restrict the report to. Once the report specifications have been made this routine extracts the necessary data from the five data files, writing the required fields to the REPDAT data file. Finally, the REPDAT data file is read back in according to the index order and the printed report produced.

Reference

Carkhuff, R.R. & Anthony, W.A. (1981). *The skills of helping*. Amherst, MA: Human Resource Development Press, Inc.

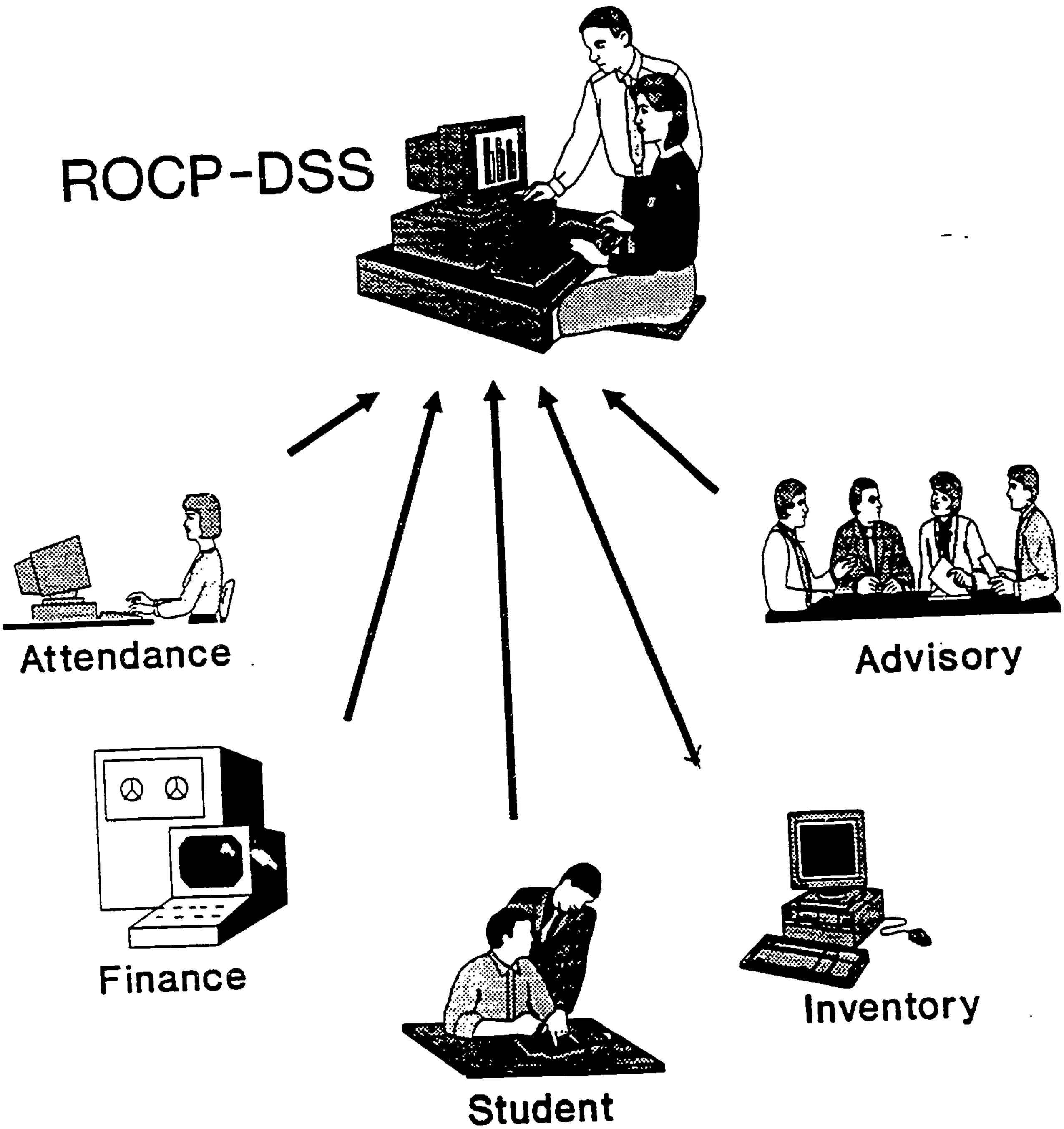
Document 9

Illustrated Benefits of the ROCP-DSS software

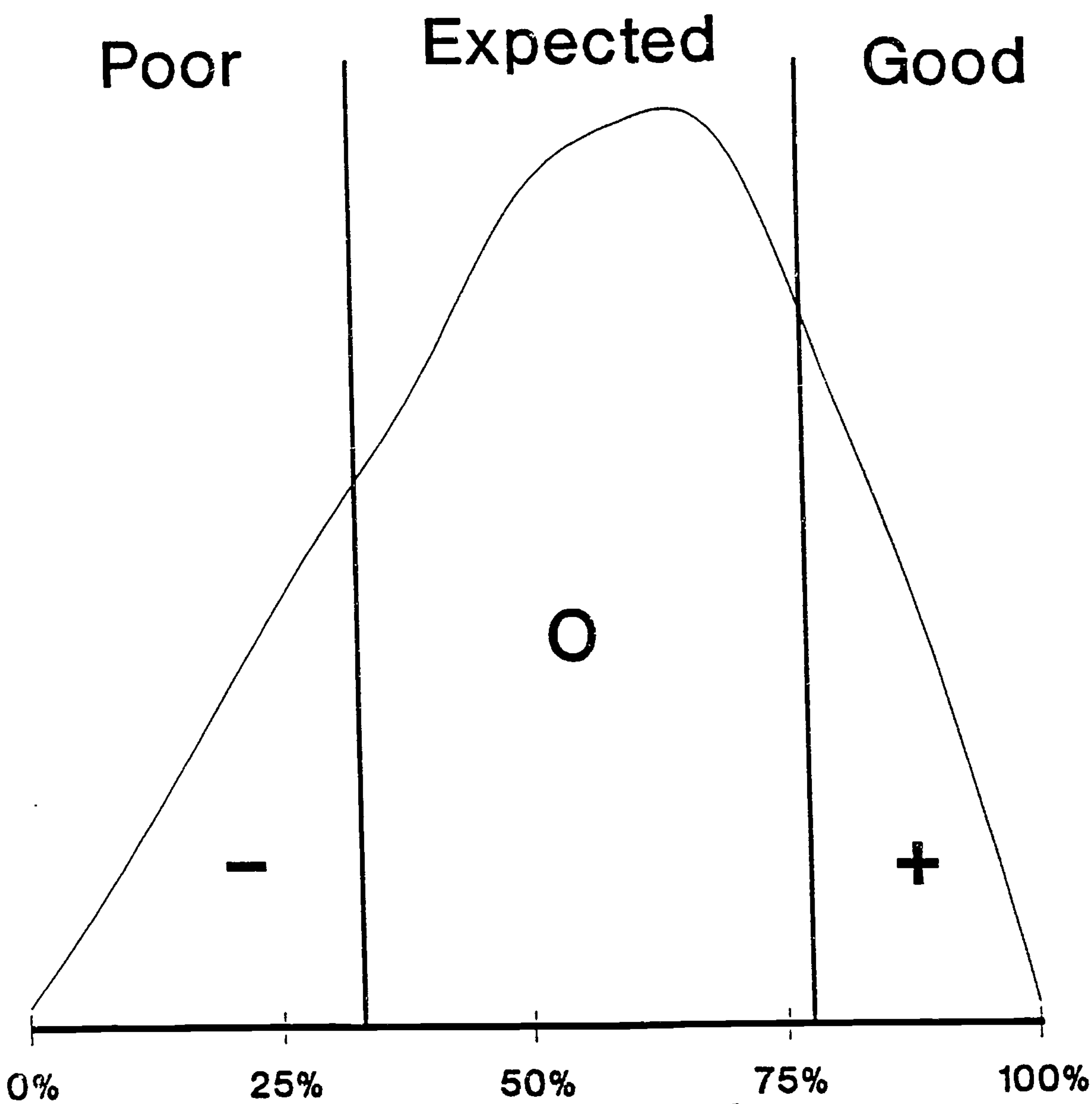
Benefits of the MIS Model

- Integrates information
- Clarifies priorities
- Establishes standards
- Interprets available data
- Refines data definitions
- Strengthens communication
- Monitors accounting/reporting
- Insures local control

Integrates Information

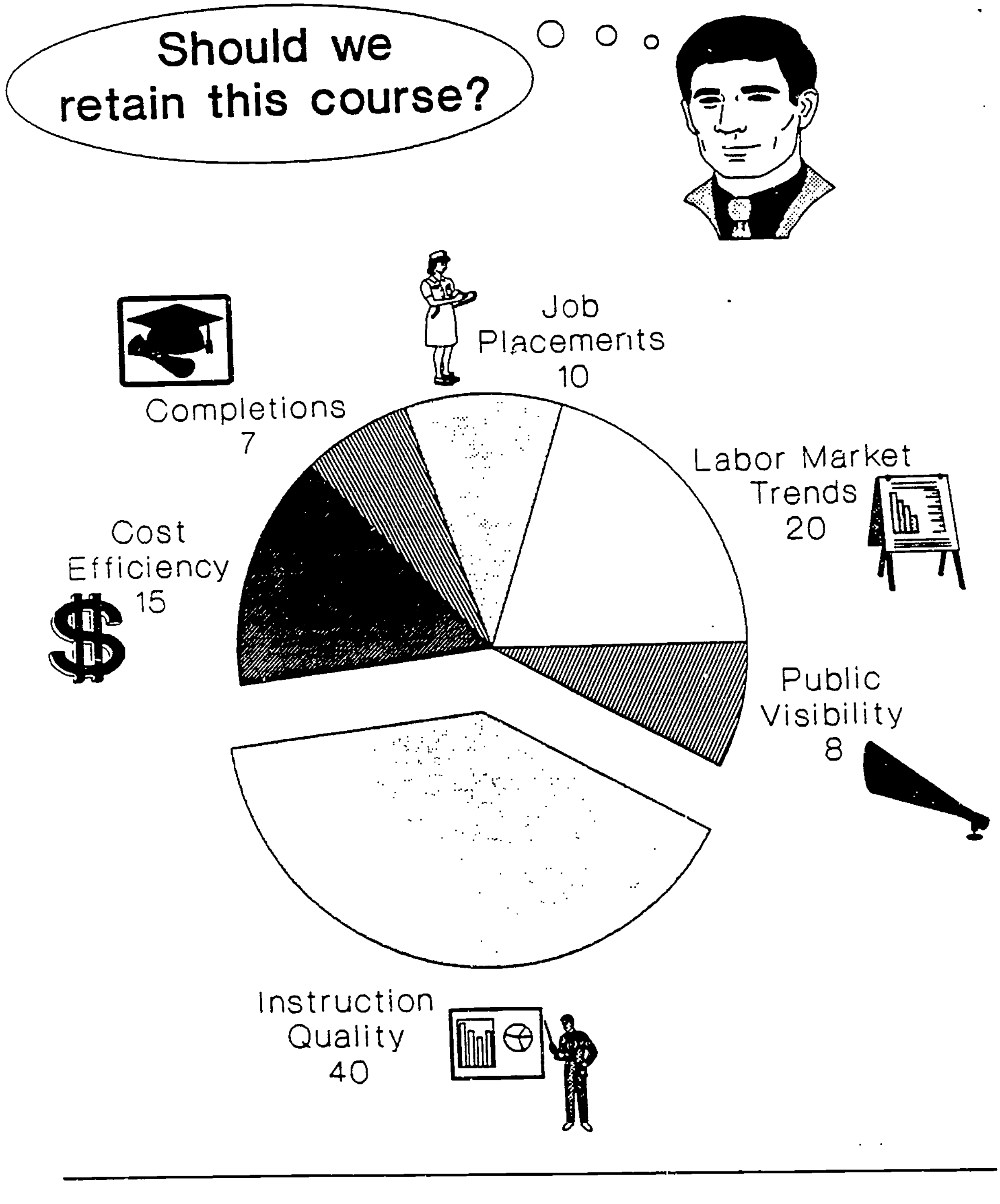


Establishes Local Standards

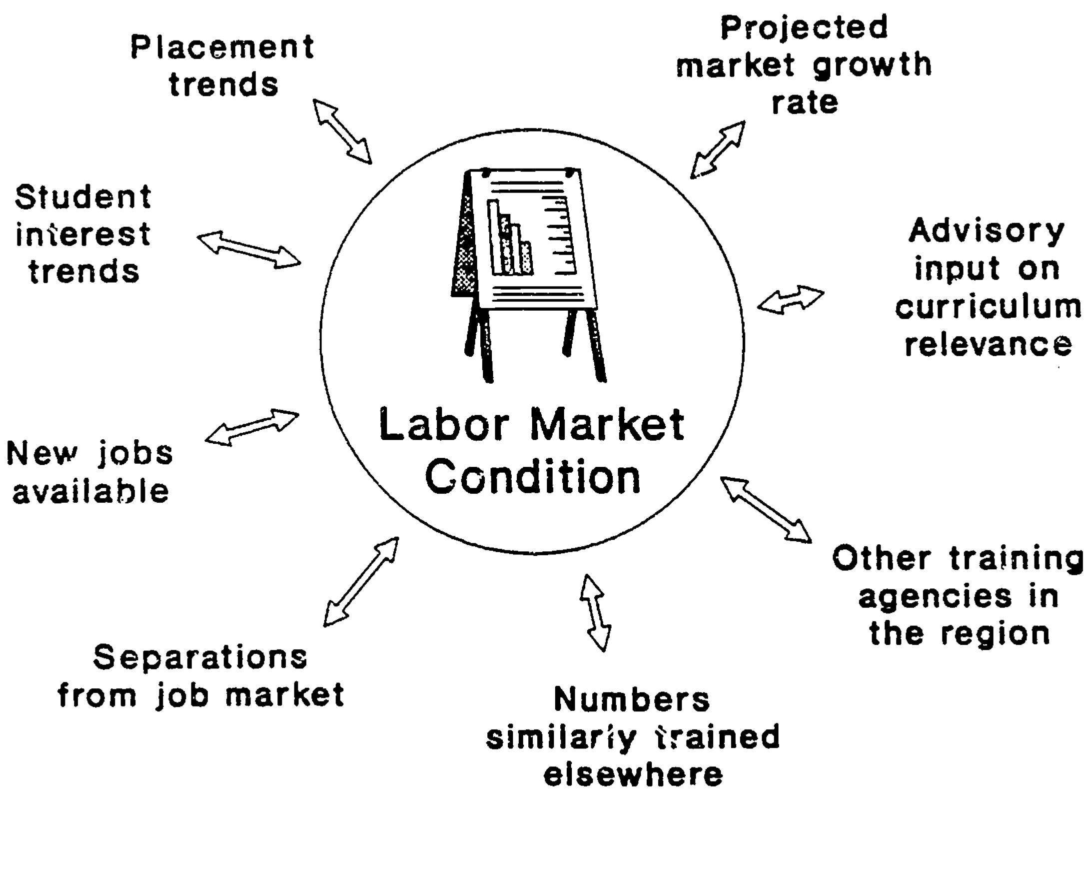


Distribution of Section Performance
on a Typical Quality Indicator

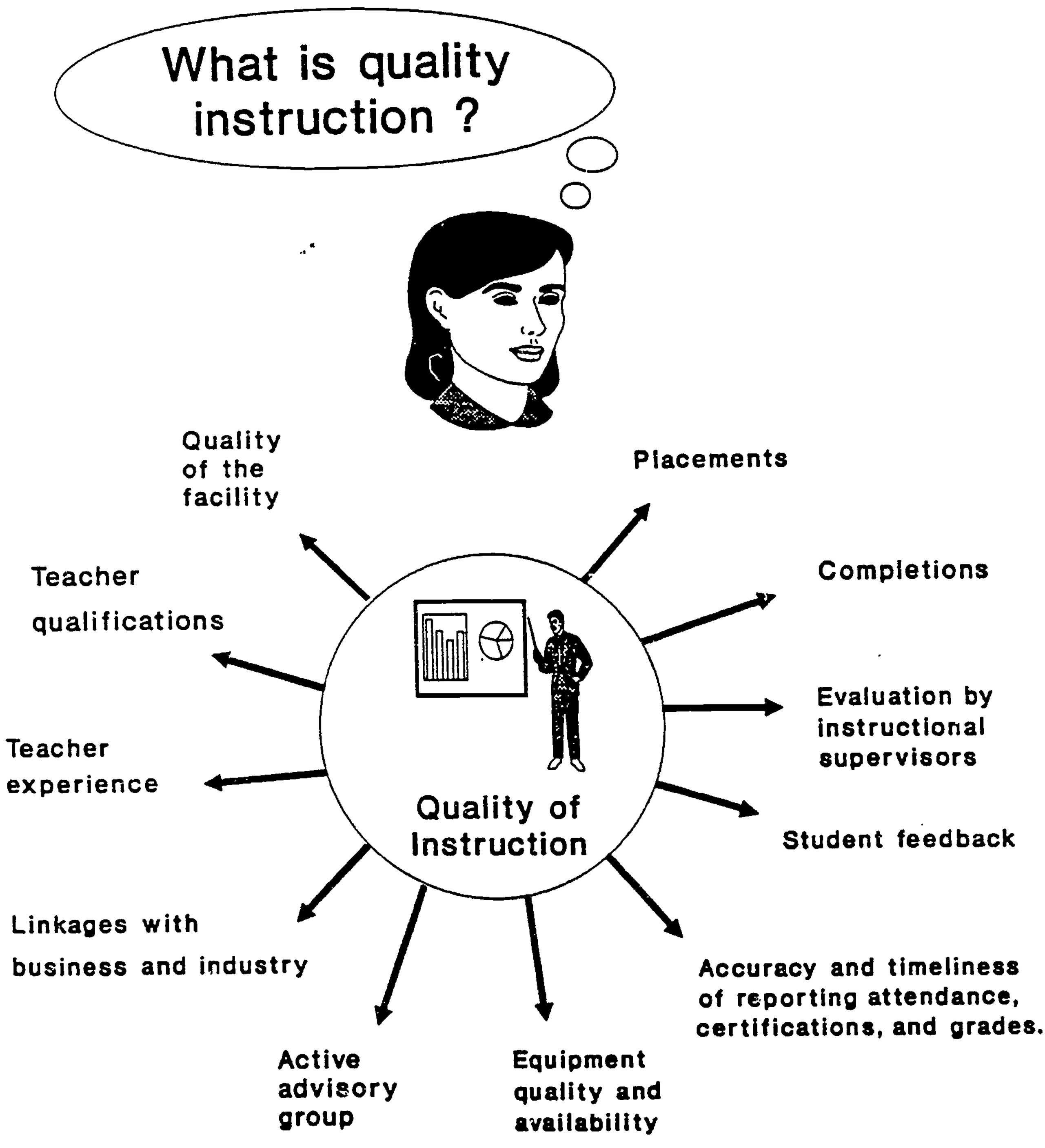
Clarifies Priorities



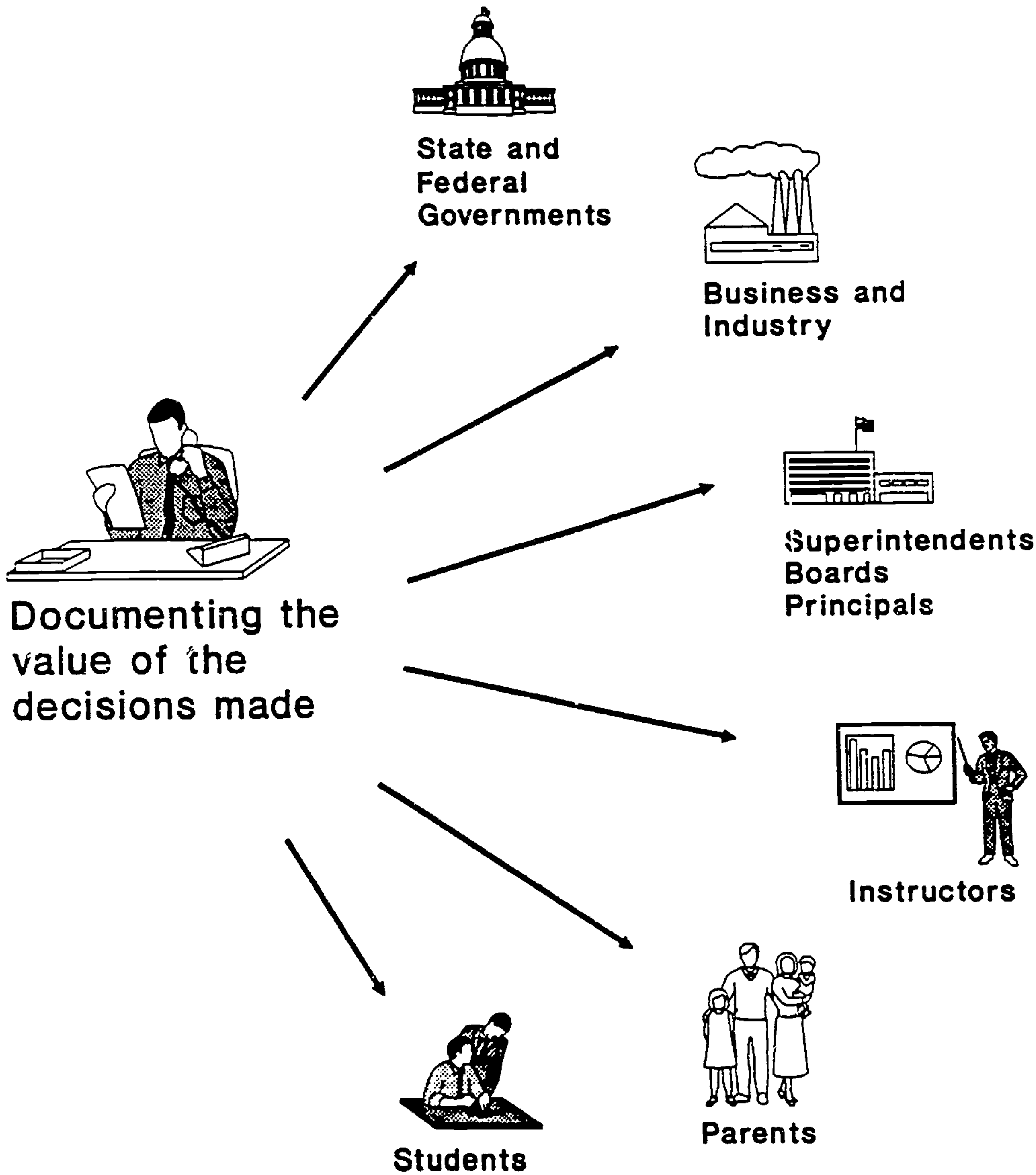
Interprets Available Data



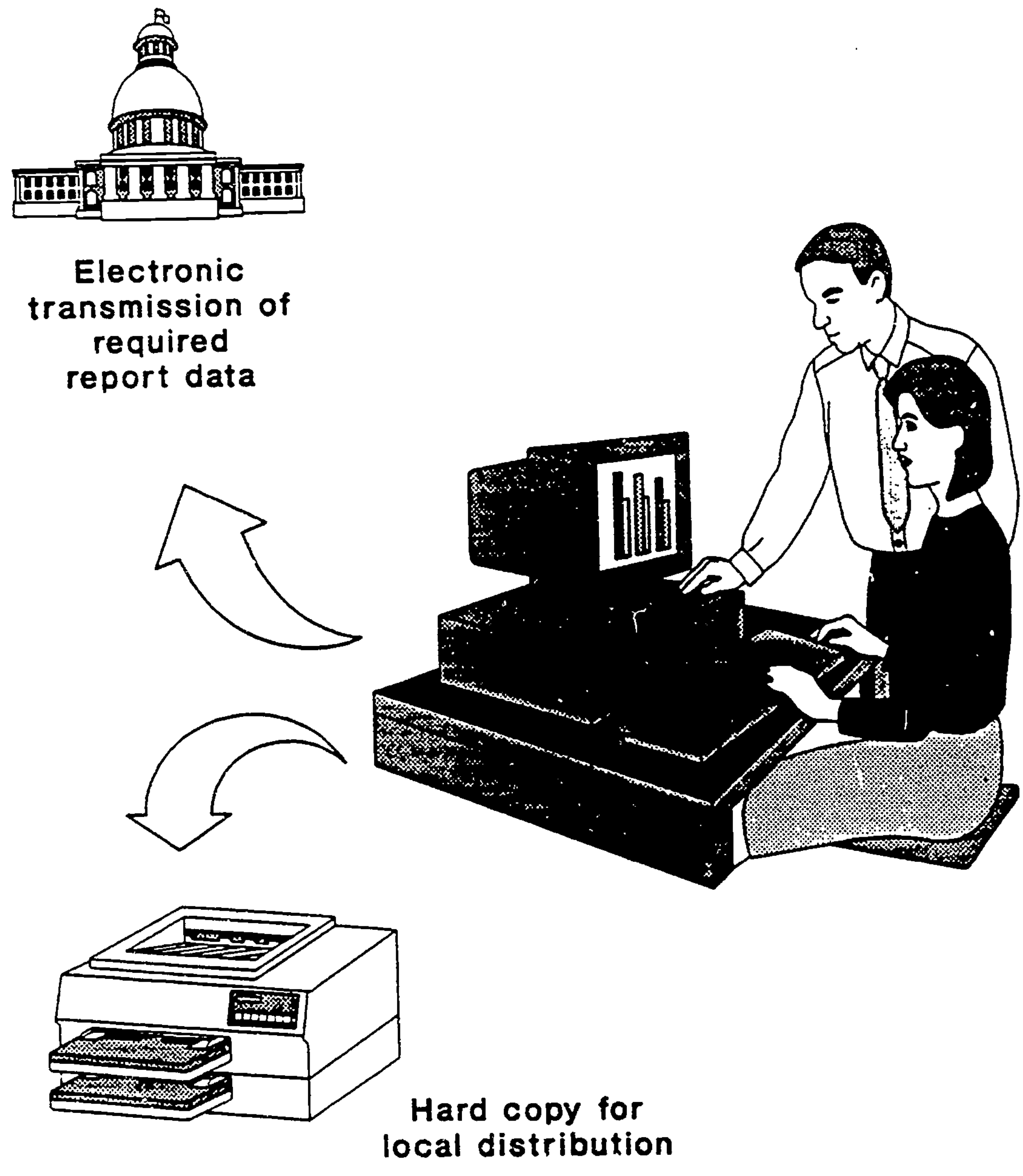
Refines Data Definitions



Strengthens Communication



Monitors Accounting and Reporting



Insures Local Control