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ABSTRACT

Seven papers making up Track IV of the 1989 conference of the Professional Association for the Management of Information Technology in Higher Education (known as CAUSE; an acronym of the association's former name) are presented in this document. The focus of Track IV is on policy and standards issues and the papers include: "Developing Guidelines for Information Resource Management: A Grass-Roots Process in a Decentralized Environment" (Lore Balkan and Philip Sheldon); "Establishing and Implementing Policies and Procedures for End User Training in Higher Education" (Anne Knight and Elaine Cousins); "A Methodology for Standardization: From Eighteen Word Processors to One" (Brenda L. Bailey, Richard A. Metzger, and Ginger M. Willis); "Data Administration: Problems and Solutions" (Ronald G. Hoover); "Preparing for CASE: Implementation of a Structured Project Life Cycle" (Richard H. Seivert); "Strategies for Delivering On-Line Application Systems to a Large Campus" (Warren H. Curry and Peter Maren); and "Administrative and Management Computing: The Next Steps" (Edgar Frackmann). Most of these papers include an abstract. (DB)

Managing Information Technology: Facing the Issues

Proceedings of the 1989 CAUSE National Conference

TRACK IV: Policy and Standards Issues

November 28 - December 1, 1989
The Sheraton on Harbor Island
San Diego, California

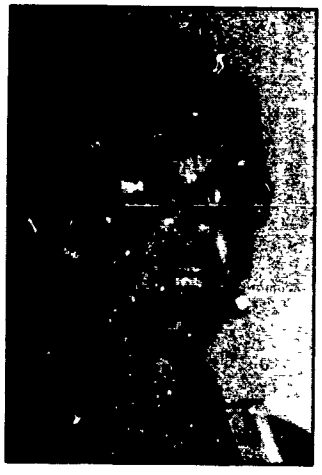
CAUSE89

Track IV
Policy and Standards Issues

Coordinator:
Jill Tuer
University of Michigan

The wide variety of functions included in managing information technology and the rapidly changing environment make the creation of policies and standards imperative. This track provided opportunity for sharing experiences in both the development of policies and standards and their subsequent implementation. Presentations covered such areas as: data administration (including security, integrity, access, dictionaries); disaster recovery; student, faculty, and staff computing access; microcomputing; standardization vs. autonomy; involvement of constituencies in policy making and planning; central vs. local models; institutional guidelines for information systems planning in distributed environments; and institutional standards for departmental system .

Ronald Hoover,
Penn State University



Anne Knight,
Harvard University

Edgar Frackmann, HIS Higher Education Information System, Federal Republic of Germany

Developing Guidelines for Information Resource Management:

A Grass-Roots Process in a Decentralized Environment

Lore Balkan

Data Base Analyst, Information Resource Management

Philip Sheldon

Assistant Director, Institutional Research and Planning Analysis

Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Abstract

The decentralization of administrative systems at Virginia Polytechnic Institute and State University has evolved both by design and by virtue of advances in technology and user expertise. Meanwhile, forces both external and internal to the University have focused attention on the need for minimum levels of standardization in order to utilize the various information resources to the institution's best advantage. In response to these pressures, the offices of Institutional Research and Data Administration (later renamed Information Resource Management) undertook a project that resulted in the development of a set of guidelines for information resource management.

This paper describes the historical evolution of the present situation, the forces that motivated the development of the guidelines, and the consensus-building activities that led to the acceptance of the guidelines as University policy. Noted in particular are: the key role played by an existing loosely-structured organization of systems coordinators; the bottom-up strategy for endorsement of the guidelines; and the management focus of the guidelines document. Insights gained along the way are presented to help those pursuing a similar endeavor.

Presented at

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Background Information

Virginia Polytechnic Institute and State University, also known as Virginia Tech, is the land-grant university of the Commonwealth of Virginia. With almost 25,000 students and over 1,500 full-time instructional faculty members, Virginia Tech is the largest university in the state. It ranks in the top fifty U.S. universities in total research expenditures, with an annual total approaching $100 million. Virginia Tech's computing capability includes an IBM 3090 Model 200 supercomputer, an IBM 3084, and several smaller mainframes. Access to the mainframes is provided by the 3,000 terminals across campus, as well as by many of the 12,000 personal computers on campus.

The Historical Evolution from a Centralized to a Decentralized Environment

During the late 1960's and much of the 1970's, administrative information systems at Virginia Tech operated in a highly centralized environment, based on common methods, repetitive procedures, and shared knowledge within a small group of experts. Essentially all major record-keeping systems were IMS systems developed in house by the central Systems Development office. This centralization offered the benefit of consistency across systems, along with the potential for large-scale integration. The level of expertise required to develop and maintain IMS applications also encouraged the maintenance of a central support system. Requirements for integration and security across systems and the sharing of limited mainframe computing resources led to a "build-on" approach to existing systems and furthered the need for coordinated and centralized data-base management.

Counterbalancing the forces promoting centralization were policies and decisions that led to the distribution of data management activities. Principal among these was the fact that central operational data systems were never operated as a "job-shop". Virginia Tech never intended to maintain a central pool of programmers providing support to administrative units who needed access to University data. Instead, the practice was for in-house-developed systems to be turned over to user offices (along with the addition of some support staff positions) for local management and maintenance of production systems. All major production applications were run by decentralized system-coordinating groups. On a somewhat informal basis, Systems Development staff provided continuing backup support for trouble shooting and minor modifications on the systems they developed. The central Data Administration office administered the IMS data base system and the UCC-10 data dictionary that supports IMS, coordinated and assisted with production implementation, managed security, controlled IMS space allocations, and maintained a system of shared tables.

During the 1980's, the move toward decentralization accelerated dramatically. Programming and systems-analysis staffs were growing in administrative offices across the campus, especially in support of the student, personnel/payroll, and accounting record systems, but also on a smaller scale in a number of other offices. While the budget of the computing center remained a central allocation of real dollars controlled by the use of allocations of computer dollars, the other costs associated with such staff growth — salaries, equipment, supplies, professional development, etc. — were direct costs in the budgets of the individual offices. This shift in dollars promoted a corresponding shift in the mindset of the managers of the administrative units, a shift toward a much more decentralized point of view. "If it's MY money being spent, then I'd like more control on how it's spent," summarizes this new perspective.

Software developments played a role in the move toward decentralization, as new less-complicated data-management systems and languages such as SPIRES®[1], FOCUS®[2], and SAS®[3] allowed operating

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[1] SPIRES is a registered trademark of Stanford University, Stanford, CA

[2] FOCUS is a registered trademark of Information Builders Inc., New York, NY 10001

[3] SAS is a registered trademark of SAS Institute Inc., Cary, NC 27511

offices increased independence from central support systems. Fourth-generation languages were eagerly examined by both the central computing-support offices and by the operating offices as potential new tools for maintaining systems and providing services. For the first time, the purchase of sophisticated off-the-shelf software packages began to be considered as a serious alternative to developing all major systems in house.

The Motivating Forces in the Development of Guidelines

The development of guidelines for information resource management at Virginia Tech should be viewed against the background of a number of campus events, trends, and initiatives of the latter half of the 1980's. A major force was the rapid expansion in the number of personal computers on campus, including many that were bought by administrative units that had never been heavy users of mainframe computing. Suddenly, offices that had no previous capability for using administrative data in unprocessed form were displaying appetites for data that were commensurate with their rapidly developing skills in word processing, graphics packages, spreadsheets, and data bases.

Another major contribution came from the University Self Study of 1986-88, which identified several concerns in the area of information resource management, including documentation, consistency of coding, and ease of access. Specifically, the self-study report contained the following points.

- A recommendation for an inventory of the data bases used for management information, and for the development of procedures for consistent coding, complete documentation, user training, and system integration.
- A suggestion that the office of Data Administration (which was later renamed Information Resource Management) take a lead role in the coordination, integration, and dissemination of the new wave of information technology.
- A recognition of Institutional Research as a major player in the process of gathering and analyzing data to support the planning and decision-making functions.

A concurrent campus initiative was the commitment to move toward a "Single System Image" (SSI), a vision being articulated by Dr. Robert Heterick, Vice President for Information Systems. (See "A Single System Image: An Information Systems Strategy", *CAUSE Professional Paper Series*, #1, May, 1988.) This vision accepts the increased pluralism of "native computing environments" — whether mainframe, minicomputer, or microcomputer, and whether spreadsheet, word processor, data base, or other — and develops a strategy for maintaining "coherency in computing and communications". In the context of administrative information systems, the SSI implies the capability of moving large amounts of diverse input and output to and from a variety of native environments. Essential to this transmission process is the establishment of standard interfaces, based upon intelligent data-management systems capable of doing the required translation.

Another motivating factor was the emergence of external standards, such as the International Standards Organization's Open Systems Interconnect (ISO/OSI) model for data communications and the American National Standards Institute's (ANSI) Information Resource Dictionary Systems (IRDS) standard, approved in 1988. Meanwhile the University began to witness growing acceptance of "standard electronic operating procedures" for particular business functions in the private sector where the University conducts business. As a prime example, vendors were positioning themselves to accept purchase orders using Electronic Data Interchange (EDI) standards. In order for Virginia Tech to anticipate, plan, and be responsive to these initiatives and reap the accompanying benefits, it was clear that some degree of conformance to standard practices for data management was imperative across the University's information resources.

The Self Study played another significant role in the move toward guidelines through its call — together with the University's positive response to the call — for the development of a strategic planning process. It was generally recognized that (a) such a process could place major new demands on administrative data systems to provide management information to support planning and (b) the ability of the University's decentralized data systems to provide the integrated data needed by such a process was suspect.

The problems inherent in one area of the administrative data systems — but symptomatic of problems in a number of other areas — were highlighted in the work of the Facilities Data Base Task Force, which completed its six-month study in September of 1988. The task force found a proliferation of special-purpose systems operating totally independently of one another, using imprecise or conflicting data definitions, and offering very few options for sharing of information. The task force's report identified several essential standards for data quality and usefulness including rigorous definitions, standardization of data items, uniform sets of codes, and documentation of data elements and structures.

Another motivating factor in the development of guidelines, itself a consequence of some of the forces described above, was the start of planning for a data dictionary. Data Administration was charged with looking at the products available commercially and the possibility of developing a data dictionary in house. The immediate goal was to provide a tool for the inventory and documentation of the entire administrative data resource. The ultimate goal was the development of a "university data base", a concept that had earlier been articulated in a position paper developed by Data Administration. In general terms, the university data base is a logical data base (not necessarily a physical data base) which provides a stable information architecture within which the authorized users of University information can obtain what they need to perform their duties.

A final event worth noting is the 1986 decision to purchase an accounting system to replace the IMS-based accounting system that was nearly twenty years old. This decision was made at a time when the resources of Systems Development were heavily committed to developing a new student system in IMS. The student-systems project had an immovable target date of Summer 1988, at which time the University would convert from a quarter to semester system. A decision to develop the accounting system in house would have meant several years delay in implementation.

Nonetheless, the decision to purchase the accounting system sent shock waves throughout the University administration, both for being the first commercial software package to be used for a major operational system, and for not being an IMS system. Unforeseen problems, delays, and expense also created a few aftershocks. The magnitude of the effort required to configure the new system to the University's computing environment raised the consciousness of the University's executive leadership about the need for communication between and consistency across data systems and about the associated costs when consistency is lacking.

The Development Process

The process of developing guidelines for information resource management began in Spring 1988 with meetings of a core group consisting of two representatives from Data Administration and two representatives from Institutional Research. These meetings had multiple agenda items. Both units wanted to define and develop their positions relative to the Self-Study mandates. Institutional Research representatives were anxious to talk about issues of consistency and communication among administrative data bases, as a consequence of both their traditional responsibility for data-gathering and reporting projects that involve multiple data bases and their prospective new role in support of the planning process. Data Administration representatives wanted to begin their feasibility study on data dictionaries and to define their long-term role in the development of a "university data base". In this connection, they wanted to discuss the possibility of using Institutional Research's Student Census File as a starting point.

Early in the discussions, a common thread among all of the agenda items became clearly evident: the need for guidelines and standards in the management of all of the University's administrative data systems. It also became clear that a fairly distinct division could be made between guidelines and standards, in the sense that guidelines indicate what should be done and standards indicate how it should be done. It was quickly recognized that the issue of standards, with its attendant enforcement questions and other political problems, had the potential for derailing the entire process. Everyone in the core group agreed to put aside standards for the moment and to focus first on guidelines.

An initial set of guidelines was drafted in August 1988. However, the group recognized that, without the perspective and the support of the individuals who operate and maintain the individual administrative data systems, these or any other set of guidelines had no future.

The next step involved the Administrative Systems Users' Group (ASUG), a loosely-structured organization open to all interested parties. The intent of ASUG is to provide an open forum for communication between central computing-support offices (Systems Programming, Systems Development, Data Administration, User Services, etc.), system coordinating offices (Accounting Student Systems, etc.), and other users (Institutional Research, Budget and Financial Planning, Extension Information Systems, Library, etc.). ASUG's monthly meetings include time for announcements of general interest and questions on topics of common concern. Despite its informal basis and its lack of any official status in the University administrative structure, ASUG has made productive contributions to the University beyond just serving its communication function. Since its inception in 1986, one ASUG subgroup has developed COBOL programming standards and another provided significant input on requirements for an access-control software package that was purchased in 1988. In both cases, the proposals from these ASUG committees were presented to ASUG as a whole where they were reviewed, modified, and endorsed.

In July 1988, five individuals were asked to represent ASUG on a committee to assist in the development of guidelines. Four of the individuals were from the staff — generally senior programmer-analysts — of the offices of Student Systems, Accounting, Facilities, and Budget. The fifth member was the EDP Auditing Manager from Internal Auditing. Two from the core group were also committee members and coordinated the group meetings.

The committee members were encouraged to reach their own conclusions, with little pressure to retain the features of the draft document prepared by the core group. After a series of meetings over a period of three months, characterized by a lot of thought-provoking discussion and a considerable sense of give and take, a guidelines document was finished. The document was basically a revision of the original draft of the core group, refined by the management perspective of the ASUG representatives. In the true spirit of compromise, no individual on the committee thought that the guidelines were exactly what he or she wanted, but they all agreed that they had a chance to be heard in the deliberations and were willing to support the document, both in ASUG and within their own offices. Perhaps the greatest concern expressed by the committee members was that they might be perceived as telling their own managers how information systems should be managed.

The revised set of the guidelines was distributed at the November meeting of ASUG, along with a request for comments and suggestions. It was announced that the guidelines would be on the agenda of the January meeting.

During December, a meeting was held for the managers of the various administrative data systems, including the immediate supervisors of several of the committee members. These individuals, basically the most senior among the ASUG members, were considered essential to building the consensus needed at the operational level. The group suggested some improvements in wording and other clarifying statements, and without a formal vote, generally endorsed the document.

At the January ASUG meeting, a representative of the core group led discussion on the guidelines, including the proposed changes incorporated into the document as a result of the December meeting. Among the points that came out in the discussion were these:

- The guidelines must be viewed as a living document; revisions will continue to be made as consensus dictates.
- Many of the "data custodians" (generally the individuals to whom the systems managers report) are not currently aware of their responsibilities as set forth in the guidelines. An important function that should not be overlooked is that of educating and assisting the data custodians.
- Data Administration must move toward standardized interfaces and security strategies for decentralized systems and provide tools such as a comprehensive data dictionary for information-resource documentation and reference.

- Some of the tasks implied by the guidelines are not currently being done. To accomplish them, additional resources (for example, documentation specialists) and/or new strategies will likely be required.
- Clarifications of responsibility and authority may be needed to ensure that the guidelines are followed. In particular, the need for clear responsibilities for data-exchange interfaces in the evolving distributed environment was noted.

The discussion concluded with an endorsement of the guidelines.

Also in January of 1989, the core group initiated discussions with the Assistant Vice President for Administrative Affairs, whose responsibilities include two that are directly relevant to the guidelines project. One is the ADMINSYS system, an on-line repository and reference system for University policies and procedures. The second is the office of Records Management, which was in the process of developing local records-management policies and procedures to conform with Virginia's state policy. Initial discussions focused on how electronic records fit into a policy which — although it refers to "information in any recording medium ..., including data processing devices and computers" — is definitely oriented to hard-copy records. While the endorsed guidelines do not specifically address procedural issues for electronic records management, they do provide a framework for determining such procedural issues. Since standards and procedures would be developed based on the guidelines, it was agreed that the guidelines belonged in the ADMINSYS system, with cross references to other sections of records management policy.

In March 1989, the guidelines document was presented to all those administrators who have responsibility for the major operational data systems. These are the individuals called the "data custodians" in the guidelines. They have titles like Controller, Associate Provost for Student Systems, and Associate Vice President for Facilities. Generally speaking, they hold positions just under the vice-presidential level and just above the level of the ASUG members. All of these individuals were provided with copies of the guidelines and invited to attend a meeting to discuss them. Again after only minor modification, the "data custodian" group endorsed the guidelines.

It is worth noting that in each meeting with the various constituency groups questions were raised regarding how the guidelines would be implemented or enforced. Although such lines of questioning are clearly relevant and important, the group was encouraged to focus only on the principles (the what) now. It was made clear that the standards and procedures that would later be developed to conform with the guidelines would again progress through consensus-building forums. It was encouraging that the concepts embodied in the guidelines were viewed as both reasonable and needed at all levels of the organization. In fact, in response to a question about auditing and compliance, a representative of Internal Auditing suggested that he would routinely use this policy in his review process.

In the final step of this informal "approval" process, the Director of Institutional Research and the Vice President for Information Systems (the executive-level supervisors of the members of the core group and the two top-level individuals most directly responsible for carrying out the Self-Study mandates on data management) met and discussed the guidelines. These two agreed that the guidelines were appropriate and authorized their inclusion in the ADMINSYS system.

Of course, this is not the end of the story. Much work lies ahead, most notably the development of standards. On the software side, the guidelines clearly identify the need for data-management tools to help with issues of accessibility and compatibility, and they specifically mention the essential role of a central data dictionary. Development work is currently underway on a dictionary product which will run in a relational environment and which is based on the ANSI IRDS standard. Acceptance of these guidelines is an important first step for successful implementation of this data dictionary.

Strengths of the guidelines

Perhaps the most notable strength of the guidelines, and also a key to the broad base of endorsement, is their management focus, as opposed to a technical or operational focus. Nontechnical, nonthreatening terminology was used intentionally to promote shared understanding.

A second important strength of the guidelines is that the criteria for inclusion of a data base or data element under the guidelines is based on the University's usage of information and not on existing system structures. The guidelines introduce a concept called the Administrative University Data Base (AUDB), which is defined as a logical aggregate of data critical to the administration of the University. The criteria for inclusion in the AUDB cover all of the following classes of data.

- Data relevant to planning, managing, operating, or auditing major administrative functions.
- Data referenced or required for use by more than one organizational unit.
- Data included in an official University administrative report.
- Data used to derive an element that meets the above criteria.

Finally, the guidelines are strengthened by their definition of information management roles based on function, without regard to current or future organizational structure. This gives them general applicability which will not become obsolete in an environment of ever-widening distribution and ever-increasing use of administrative information. *Data custodians* are ultimately responsible for the data created and referenced within their particular area of responsibility and in turn, for conformance to the guidelines. *Data stewards* are those delegated the responsibility for data maintenance and dissemination as directed by data custodians. Individuals who have need for University data are considered the *data users*. Virginia Tech is considered the *data owner* of all University administrative data. The function of applying formal guidelines and tools to manage the University's information resource is termed *data administration* and is a role overseen by data custodians, but played by all participants. The recent reorganization and rename of Information Resource Management (formerly Data Administration) underscores the leadership and support role this office provides for the distributed data administration activities.

Also a credit to the guidelines is their breadth. Following the introduction of the AUDB concept and explanation of the information management roles, they deal independently with each of the following topics: data capture; data storage; data validation and correction; data manipulation, modification, and reporting; data security, data documentation, and data availability. Next, they address the need and procedure for annual review with possible update, reference related policies, and end with a section defining terms used throughout.

Lessons Learned

This final section presents some of the lessons learned by the core group as they progressed through the various steps in the development of the guidelines. Perhaps some of the insights gained along the way can be beneficial to others and — if incorporated into an initial strategy — serve to speed up this kind of process. The intent on this campus is to use a similar strategy in the process of establishing standards and procedures for conformance to the guidelines.

Perhaps the most important lesson learned and a primary point of success so far was the use of informal groups in the absence of formal organizational structures in the University community. Such groups generally brought to the process a set of diverse backgrounds and experiences, but were always able to identify common purposes and needs. Three of the key groups in this process — the core group, the system managers, and the data custodians — had never previously met together on a formal basis.

Even ASUG, the most structured of the participating groups, has no officially recognized role in the administration of the University. However, its choice as the first constituency group to work on the guidelines was particularly successful. It had a history of working on common problems in an atmosphere of mutual trust. Moreover, its members were the people who would be affected by the guidelines on a daily

basis, as well as the individuals whom the data custodians would consult about whether the guidelines were relevant and worthwhile. Getting this group's participation and endorsement as a first step turned out to be an excellent strategy.

Also contributing to the success of the process was the riding of the tides that were surging in the University community. The case for guidelines was built on a broad base of forces and events: the Self-Study, the purchase of an accounting package, the need for policy on records management, and several others. By capitalizing on the diverse array of motivating factors, the core group was able to convince a number of groups and University officials at various levels in the organization of the value of these guidelines.

Another lesson to be extracted from this process is the importance of creating focus as a means of avoiding unnecessary controversy and distraction. This was the reason why standards were put aside initially in order to build consensus on guidelines. Debate and discussion could be focused on this limited topic in order to build a foundation upon which to base further work and more attention to detail.

As in so many projects, one of the keys was to maintain reasonable expectations. This was important in at least two areas. First, it was recognized by the core group and articulated to the constituency groups that neither total agreement nor the perfect document were likely outcomes. Consensus, however, was attainable, even though no one who contributed to this process was likely to agree with every point in the final document. Second, it was evident at every step of the way that the process was and will continue to be an evolutionary one. The document is not "cast in stone", but is expected to continue to evolve in response to technological and environmental change.

The virtue of patience was yet another basic principle that was reinforced by the process of developing the guidelines. At each stage of the process, the guidelines changed slightly, as each new constituency group brought its new perspective into the discussion. From looking at the end result, it is evident that what seemed like minor modifications in fact served to build depth into the final set of guidelines. In retrospect, it seems unlikely that a top-down approach (which was the core group's first impulse) or any other less patient course of action would have worked as well.

The final point to be made here is perhaps a capsule summary of the entire process. By acknowledging and illustrating data management problems without laying blame, by describing desired outcomes and suggesting a path for achieving those outcomes, the core group helped to expand thinking beyond the limits of individual turf boundaries or existing organizational structures. As a result, the *Guidelines for University Administrative Information Resource Management* are not the "rules according to XYZ Department", but rather a platform that will support a variety of idiosyncratic architectures and individual missions and, at the same time, support the global information needs of the University.

APPENDIX

Virginia Polytechnic Institute and State University Policy and Procedures Section 2005

Guidelines for University Administrative Information Resource Management

1.0 Purpose

While all administrative data captured using University assets are resources of the University, they vary in their relevance to the administrative processes of the University. This policy is intended to apply to those data which are critical to the administration of the University. While these data may reside in different data base management systems and on different machines, these data in aggregate may be thought of as forming a logical data base, which will herein be called the Administrative University Data Base (AUDB). This terminology is not intended to imply that these data now or in the future should reside in a single physical data base. Rather, it is a recognition that regardless of where these data reside, there are some general principles of data management that should be applied in order to maintain the value and guarantee effective use of the information resource.

2.0 Policy

2.1 Information Management Roles

- The University is considered the data owner of all University administrative data.
- University officials, such as the Controller, the Associate Vice President for Personnel Resources, and the Registrar, are responsible for data in their functional areas and are considered data custodians.
- Staff delegated the responsibility for information management activities related to maintenance and dissemination of data are considered data stewards.
- Individuals who have need for University data in order to perform their assigned duties and are therefore authorized access are considered data users.
- The function of applying formal guidelines and tools to manage the University's information resource is termed data administration. Those data administration activities that do not fall within the realm of responsibility of designated data custodians are the responsibility of the Information Resource Management (IRM) department.

2.2 Data Included in the AUDB

- A data element is considered part of the AUDB and should conform to AUDB standards if it satisfies one or more of the following criteria:
  - It is relevant to planning, managing, operating, or auditing major administrative functions.
  - It is referenced or required for use by more than one organizational unit. Data elements used internally by a single department or office are not typically part of the AUDB.
  - It is included in an official University administrative report.
  - It is used to derive an element that meets the criteria above.
- Data elements which meet the criteria for inclusion may be identified as such by a data custodian, a data steward, IRM, or a user group.
- A data custodian should be identified for each data element to be included in the AUDB.
- IRM should assist in the negotiations for inclusion and for identification of data custodians.

2.3 Data Capture

- The data custodian is responsible for complete, accurate, valid, and timely data capture. These responsibilities may be delegated to data stewards.
- Electronic data should be captured at or near its creation point as identified by the data custodian.

2.4 Data Storage

- An official data storage location for each data element should be identified by the data custodian.
- A official data storage location of valid codes and values for each data element should be identified by the data custodian.
- Data element names, formats, and codes should be consistent with University standards.
- Archiving requirements and strategies for storing historical data should be determined for each data element by the data custodian.
- IRM should assist in determining data storage location and archiving requirements for AUDB data.

2.5 Data Validation and Correction

- Applications that capture and update AUDB data should incorporate edit and validation checks to assure the accuracy of the data.
- The accuracy of any element can be questioned by any authorized data user. The data user has the responsibility to help correct the problem by supplying as much detailed information as available.
- The data custodian or delegated data steward is responsible for responding to questions and correcting inconsistencies if necessary.
- Upon written identification and notification of erroneous data, corrective measures should be taken as soon as possible or in accordance with the consensus of the users to:
  - Correct the cause of the erroneous data.
  - Correct the data in the official data storage location.
  - Notify users who have received or accessed erroneous data.

2.6 Data Manipulation, Modification, and Reporting

- The data custodian is responsible for authorizing manipulation, modification, or reporting of AUDB data elements and for creating derived elements, which are also members of the AUDB.
- The data custodian is responsible for ensuring that data maintained are consistent with official University reporting requirements.
- The data custodian has ultimate responsibility for proper use of AUDB data; individual data users will be held accountable for their specific uses of the data.
- All extracted or reported AUDB records should include the time and date of data capture.

2.7 Data Security

- All AUDB data should be secured and access granted to a data user only for University business on a "need-to-know" basis and within predefined access rules and security requirements.
- The data custodian has ultimate responsibility for determining security requirements and authorizing access.
- The individuals or office responsible for implementing access control will be identified and charged with this responsibility in writing by the data custodian.
- The data custodian is responsible for documenting authorization procedures.
- The data custodian is responsible for monitoring and reviewing security implementation and authorized access.
- All data users of AUDB data should sign a statement indicating their understanding of the level of access provided and their responsibility to likewise maintain the inherent privacy, accessibility, and integrity of the data they are provided.
- The data custodian is responsible for assuring that data are backed up and recoverable in response to events that compromise data integrity such as system failure, inadvertent faulty manipulation, unauthorized user penetration, or other unforeseen disasters.

2.8 Data Documentation

- Documentation of data elements should be provided to IRM in machine-readable format and will reside in a University Data Resource Dictionary.
- IRM is responsible for the data administration function of maintaining the University Data Resource Dictionary and for making it readily accessible to data custodians, data stewards, and data users. In essence, IRM is data custodian for the the University Data Resource Dictionary.
- Documentation of data elements is the ultimate responsibility of the data custodian.
- Documentation/definition for each data element should at least include:
  - Name and Alias Names
  - Description
  - Data Custodian
  - Usage and Relationships
  - Frequency of Update
  - Source for Data Capture
  - Official Data Storage Location and Format
  - Description of Validation Criteria and/or Edit Checks
  - Description, Meaning, and Location of Allowable Codes
  - Access Rules and Security Requirements
  - Archiving Requirements
  - Data Storage Location of Extracts
- Documentation for derived AUDB data elements should include the algorithms or decision rules for the derivation.

- Change in any of these characteristics should be noted to IRM and/or recorded in the University Data Resource Dictionary in advance of the change.

2.9 Data Availability

- Data Custodians are responsible for providing accessible, meaningful, and timely machine-readable AUDB data for University use. This activity may be assigned to data stewards or to other University officials within the predefined access rules and authorization procedures.
- Data custodians and IRM share responsibility for AUDB data compatibility, accessibility, and interfaces.

3.0 Procedures

These ***Guidelines for University Administrative Information Resource Management*** have been prepared by the Information Resource Management (IRM) department and the Office of Institutional Research and Planning Analysis in association with the Administrative Systems Users Group (ASUG). They serve as a statement of objectives to manage the administrative information resource. These ***Guidelines*** apply to all AUDB data. In addition, these ***Guidelines*** should be considered and followed where possible by all those who capture data and manage administrative information systems using assets of the University. ***Standards and procedures should be developed to conform to the objectives embodied in these Guidelines.***

Copies of these ***Guidelines*** or related standards documents are available from the Information Resource Management Department and from the Administrative Information System.

3.1 Updates

As an ongoing document, these ***Guidelines for University Administrative Information Resource Management*** will be maintained and revised as needed by the Information Resource Management department (IRM) in cooperation with data custodians and administrative systems users groups. All administrative system users are encouraged to correspond with IRM describing any suggestions for improving these ***Guidelines***. When corresponding please refer to the document title and provide an appropriate section and page number reference.

Changes or updates to these ***Guidelines*** will be reviewed by the Agency Records Administrator to ensure compliance with ***Management of University Records*** (University Policy 2000) and related State regulations. Revisions to these ***Guidelines*** will be sent to the manager of the Administrative Information System (before the effective date of the change, if possible). The update will be made, the date and revision number changed and the revision noted in Section 6.0, and returned to be approved and released.

4.0 Definitions

1. **AUDB (Administrative University Data Base)** is a conceptual term used to identify that body of data critical to University planning, management and business operations.
2. **Data administration** is the function of applying formal guidelines and tools to manage the University's information resource.
3. **Data custodians** are the University officials responsible for managing a segment of the University's information resource.
4. **Data stewards** are staff members delegated the responsibility for data maintenance and data dissemination.
5. **Data users** are individuals who are authorized access to University data required by them to perform their assigned duties.
6. **University Data Resource Dictionary** is a database system that functions as a repository that contains comprehensive information about University data and documentation of University administrative systems.

5.0 References

1. ***Policy 2000*** "Management of University Records," effective February 1989.

6.0 Approvals and Revisions

Approved January 5, 1989 by the Administrative Systems Users Group (ASUG).

Establishing and Implementing Policies and Procedures for End User Training in Higher Education

Anne Knight
Office for Information Technology
Harvard University
Cambridge, MA

Elaine Cousins
Computing Center User Services
University of Michigan
Ann Arbor, MI

ABSTRACT

At some institutions the central administration mandates or facilitates the use of technology for administrative, instructional, and research needs. At other institutions it is the office staff and faculty who, by using it, have discovered the value of technology; in these institutions, support is informal. Those who facilitate access to technology usually acknowledge and generally support training for staff and faculty with funds and personnel. When access to technology is not actively supported, training is often ad hoc or obtained from sources both outside and inside the institution, usually for a fee.

Harvard University and the University of Michigan represent two contrasting, institutional models in the way they support technology. One applies a decentralized approach to user support, while the other is centrally supported.

Training is an aspect of user support that often receives short shrift: it is under valued and under funded by administration at many institutions. At Harvard, training, like all user services, is provided both centrally and de-centrally, and is not consistently supported within the various Schools. Harvard's Office for Information Technology provides training open to all University employees, yet it is based on a fee-for-service. In contrast, at the University of Michigan, the Computer Center User Services provides free training to all employees.

This paper will compare and contrast these two universities in their approach to technology and user support and the policies and procedures they use for end user training. The similarities and differences between free training and fee-based courses — similarities based on the nature of high-quality training programs and differences brought about by the structure of the institutions — may help other institutions plan for training programs of their own.

Both authors are managers of training programs for central computing organizations at their respective institutions.

Introduction

A group of college and university technology educators in southern New England began meeting regularly in 1988 to discuss issues and share ideas about training at their respective institutions. The early meetings, supported by Apple Computer, focused on Macintosh training. Preliminary discussions revealed the need to obtain a training profile of each of the nine institutions. The institutions include Boston College, Brandeis University, Brown University, Harvard University, MIT, Trinity College, Tufts University, Wesleyan College, and the U.S. Coast Guard Academy. The survey, completed by training managers or coordinators, gathered data about the training programs, classroom facilities, training policies and procedures, evaluation methods and marketing strategies. The section identifying successes and challenges raised the issue of how policies and procedures for training were established — through central ... date or by default — and what made particular training models work in each institution.

Description of the Institutions

Harvard University. Harvard University is decentralized: it consists of 11 graduate and professional schools and an undergraduate Faculty. Central administration consists of the President's and Vice Presidents' Offices, Budget Office, General Counsel, News and Public Affairs, Alumni Association, Development Office, Office for Information Technology, and more. Founded in 1636, Harvard is the oldest university in the United States. It awards at least 17,400 undergraduate and graduate degrees each year. Supporting the student population, there are 2400 full-time and 600 part-time faculty members as well as a staff of 15,000.

The University of Michigan. The University of Michigan is also decentralized with 16 graduate and professional schools and an undergraduate Faculty. The University community in Ann Arbor is comprised of over 36,000 students, 3,000 faculty, and 15,000 staff. The University organization is comprised of the Offices of Business and Finance, Government Relations, Academic Affairs, Research, Development, and Student Services. The Information Technology Division is headed by a Vice-Provost who reports to the Vice-President for Academic Affairs. In addition to the main campus in Ann Arbor, The University of Michigan also includes a campus in Flint and one in Dearborn, with a Chancellor at the head of each.

Recognizing the importance of Information Technology to the research, instructional, and administrative activity on campus as well as to the quality of life, the University has made a major commitment toward support of Information Technology on campus. The Information Technology Division consists of approximately 700 employees engaged in the provision of computing, communication, and network services. A campus-wide network environment has been created that connects the entire campus in a network of interlinked, local- and wide-area networks connecting mainframe, microcomputer, and minicomputer users . The network uses a variety of media including fiber and twisted pair wire. There are currently 9300 asynchronous ports connecting faculty and staff offices and student workstations in public clusters and residence halls.

Planning and Budgeting

Harvard. Planning and budgeting occurs in each School and Faculty at Harvard before the central budget is compiled. As with all other aspects of University life, the way budgets are done also affects information technology planning and implementation. Individual Faculties and administrative Departments have developed systems to meet internal needs and provided users with tools for data management. Concurrent with the increasing use of distributed computing is a plan to connect the entire campus by fiber, enabling a computing network of pcs, minicomputers and mainframes within five years.

According to the 1987 Long-Range Plan of the Office for Information Technology (OIT), "no University-wide framework for technology use exists at Harvard, and there are no University-wide standards and controls for implementation." The plan's objectives were, "in addition to identifying OIT's long-range goals and strategies, to begin a process for gaining consensus on these goals and to build awareness throughout Harvard of the University's future information technology needs."

The plan emphasized that information sharing tools are needed and that extensive training is equally important in order to upgrade individual technology skills. OIT's publications and its computer training program were established in their present form along with this plan. The information dissemination and training services are designed to raise consciousness about information technology in higher education, and are intended to stimulate discussion and increase customer self-sufficiency in using information technology.

Although there is no central mandate about technology at Harvard, expenditures in this area grow at the rate of 8 percent per year. With no central standards, OIT can only set some de facto standards through sales of a limited range of hardware and software at the Technology Product Center and by providing training for selected software packages. Individual schools set their own standards and provide their own computer support structure, which may or may not offer training.

Michigan. Budgets at Michigan are also prepared by each individual school, college, or administrative unit. Since 1984, the Information Technology Division budget has grown from 4 million dollars to its current level of 17 million. The majority of this funding is comprised of direct funding from the University's general fund, but it also includes revenue from mainframe charges to external clients and modest user fees. Having recently realized many of its important strategic goals (including the installation of a campus-wide network and the deployment of 1600+ workstations in campus computing sites), it is expected that the ITD budget will remain relatively stable in the near future. Increases to the budget are more likely to come as a result of additional user fees than from additional central funding.

Computer support in a decentralized university such as The University of Michigan is not surprisingly also decentralized. While at one time it was thought that a "centralized, controlled, rational approach to a microcomputer environment at the University of Michigan would be nearly impossible to achieve[1]," computer support is now best characterized as the result of individual units working together for mutual benefit. While it is true that there is not a "centralized and controlled" environment, there is a great deal of "rational thought " being expressed. Individual units can make whatever decisions they wish for the acquisition and support of information technology, but it is not unusual to find decisions being made in favor of ITD-supported solutions. We find that support responsibilities are typically shared -- with general support usually provided by the central service and discipline-specific support provided by individual units, schools, and colleges.

Several mechanisms exist for sharing information and shaping support policies. Of key importance is the concept of ITD supported products. Individual units know what products are supported and what services they can rely on from the Information Technology Division. Evaluation teams made up of both ITD and non-ITD personnel make recommendations for supported products. An ITD Selection Committee makes final support decisions based on the availability of support resources and the perceived demand for a particular product. Information about needs and directions for information technology are shared at regular meetings of several campus groups of computing support professionals and key policy makers from within and beyond ITD.

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[1]The University of Michigan UCCPU SubCommittee Report "University Microcomputer Policy" January 4th, 1984

Computer Education and Training

Harvard. OIT's training classes are open to the entire University as well as to non-profit institutions in the area. These classes are hands-on, skill-building sessions offered in two dedicated classrooms in Cambridge and one shared facility in the medical area in Boston. During the 1988-89 academic year, more than 900 people were trained on the Macintosh and the IBM PC/PS2 in 121 classes of 21 different courses. People taking these classes were representative of eligible organizations: 60 percent were staff members from all Harvard schools, 19.5 percent were from OIT, 2.7 percent were faculty, 3.8 percent were graduate students, .8 percent were undergraduates, and 13.2 percent were from non-profit institutions.

In addition to classes, the technology education group of three professional people, under the management of Anne Knight, organizes a colloquium series, hosts user groups, and holds product demonstrations throughout the year. The educational program has grown steadily since 1986.

Most of OIT's services are supported by user fees. Very little central funding is provided. The classroom must be full cost recovery. Thus, the importance of high quality programs and services is obvious. The biggest challenge is to determine client demand from the widely scattered audience and to set fees appropriate to the market. Harvard's training program must be as good if not better than its competitors and must be offered at a lower price. The setting of goals and standards for OIT's training program became vital to its success.

Michigan. Computer education programs at Michigan are designed for faculty, staff, and students of the University. Non-University participants are eligible only for the University's mainframe (MTS) classes. Michigan's end-user computer education program began with mainframe training in the 1970's. In 1984, with the influx of microcomputers and Michigan's participation in the Apple University Consortium program, workshops became an effective and efficient way to communicate with the rapidly growing numbers of novice computer users who needed to learn more about what computers could do for them and who needed to develop their computer use skills. Since 1984, the workshop program has grown enormously. Current education programs include:

- regularly-scheduled workshops
- self-guided instructional materials (print and computer-based)
- training the trainer activities
- special workshops

Regularly-scheduled workshops are offered in systems use (Macintosh, DOS, and Michigan Terminal System), application areas including electronic messaging and conferencing, database management, spreadsheeting, word processing, data communication, local area networks, authoring systems for creating multi-media courseware, and workshops to facilitate access to UM data. There are over 14,000 registrations for workshops each year and over 1,800 hours of instruction in more than 100 different workshop titles each semester.

Workshops are offered in a variety of formats including lecture/demonstrations and hands-on classes. A Macintosh classroom and an IBM PS/2 classroom are regularly used for hands-on classes. Each of these rooms contains 16 workstations and overhead projection capabilities. The computers in the IBM Lab are connected to one another on a local area network with a network file server containing all programs and practice exercise files. The Macintosh lab will be added to the same network as soon as commercial releare connected to one another on a local area network with a network file server containing all programs and practice exercise files. The Macintosh lab will be added to the same network as soon as possible. A 3rd classroom equipped with a Macintosh and a PS/2 is used for lecture/demonstration workshops. This room is also equipped with projection equipment for each computer.

The workshop population at Michigan is composed of approximately 55% staff, 39% students, 5% faculty, and 1% MTS clients. This is not an exact mirror of the University statistics for these groups. Faculty are representative, but staff clearly outnumber students in workshops.

The University of Michigan's Computing Center education program is managed by Elaine Cousins, assisted by a staff of 5 full-time instructor/consultants, a full-time registration clerk, and a part-time secretary. Staff from other areas of User Services also regularly teach workshops. Their time commitment may vary from 6 hours of classroom instruction per term to over 40 hours. In addition to the Computing Center education program, other ITD education programs include the Office of Administrative Systems program (with 3 teaching staff) and the Residence Halls program which makes use of student trainers to teach students in the residence halls.

Because workshops are not the only way to teach about computers, self-guided print tutorials and computer-based tutorials have been created. These include introductory training on mainframe use and the widely-used computer conferencing facility at Michigan. A series of tutorials on basic concepts of computer applications is currently in progress.

In keeping with the desire to help users help themselves, the University of Michigan Computing Center assists departmental trainers, faculty, and teaching assistants to teach computer topics using Computing-Center developed materials. Approximately 20 groups took advantage of this service last year and it is anticipated that more will do so in the coming year.

The end-user education budget at Michigan is approximately 300,000. This represents salaries, material preparation and production, advertising, and software for teaching. Not included are teaching lab hardware costs, staff expenses for supplies and equipment, and non-education group salaries (approximately 1.5.FTE).

IV. Goals and Standards for Training at Each Institution

Harvard: The goals of Harvard's training program are to:

- impart skills to its customers
- maintain high-quality course content and delivery
- have satisfied, repeat customers
- build and maintain a good reputation for OIT

The classroom standards that were established include:

- an instructional methodology with lecture, demonstration, and hands-on exercises and group problem-solving in the advanced courses
- in-class opportunity to practice
- one person to each machine to provide a hands-on experience
- a comfortable learning environment — a bright, clean classroom and an assistant for large classes;
- using current, appropriate, reliable technology
- regular support by a technical person.

Michigan. The goals of The University of Michigan's computer education program are to contribute to the quality of instruction, research, and the administrative work environment by facilitating better use of Information Technology. We do this by:

- Providing information about Information Technology resources on campus
- Enhancing the computing skills of the U-M and MTS community
- Assisting faculty and computer support staff with their education/training responsibilities
- Encouraging self-help and strategies for continued learning

The program standards we have adopted to help us realize these goals include:

- talented and knowledgeable instructors who are an integral member of our support team
- up-to-date training equipment in comfortable classrooms with overhead projection equipment
- varied formats that encourage active learning and problem-solving
- supportive, group-oriented environment with 2 students per workstation in workshops

V. Policies and Procedures

Harvard. The mission of the training program at Harvard is to increase the customers' skill level and self-sufficiency in using information technology. The overriding management objective is to make the classroom function full cost recovery. High standards were established to attract clients. Timeliness and clarity is important for marketing the courses. A training catalog published each semester is distributed in September and January as an insert in the Technology Window publication to all 1,400 Harvard employees. Certain courses, such as SAS, require targeted mailings, and publicity in the medical area has received special attention. General publicity is handled through calendars in other Harvard publications and via announcements on Harvard's information telephone number called FACTLINE. We maintain a training information telephone mailbox and "hotline" to respond to customer questions. Decisions about each semester's offerings are based on software sold at the Technology Product Center, software used by OIT staff and discussed in the User Groups, and on information gleaned from other information technology forums at Harvard.

Introductory courses for the PC and the Macintosh are offered more frequently than intermediate and advanced courses, and they are offered in two half-day segments. The intermediate and advanced courses are one and two days long (7 hours each, including mid-morning and mid-afternoon breaks and an hour for lunch), depending on the amount of material to be covered. In addition to the operating system courses, word processing, desktop publishing, spreadsheets, databases, and statistics courses are offered. File transfer and local area network training is also offered. Adjustments to the schedule are made each semester, based on past experience. When use of software packages represents a critical mass, training programs are offered, and support is provided.

Pre-registration for all courses is required via mail or in person, with payment and confirmation letters sent acknowledging enrollment. Fees range from $125/day for introductory courses to $395 for three- day courses. Student rates are $15 to $70 lower, depending on course length. When a class is filled, the registrant is contacted about enrolling in the next class offered. Waiting lists are maintained, if necessary. Cancellation within five working days is accepted with full refund. OIT reserves the right to cancel classes with insufficient enrollment (less than five people) or because of inclement weather. Failure to show up for a class does not entitle the student to a refund.

The student/teacher ratio is 8 or 9 people. If there are more students in IBM PC classes, up to a maximum of 12, a classroom assistant is hired. No assistant is provided in the Macintosh classroom where 9 students is the maximum.

Although prerequisite skills are defined for all classes, frequently students come to classes they are not prepared to take. This year we have instituted a self-assessment skill test, which is sent to all registrants with their confirmation letters. This enables students to determine whether or not their skills are sufficient to proceed to a higher level course.

The problem of varying levels of expertise among the student population is handled by the instructors. They adjust their rate of instruction to the majority of the students and try to provide extra help for slower students during the exercises.

Technical support is provided for all classrooms. OIT's technical support person prepares the systems before class and is available to troubleshoot any problems that may arise during class with the network, the individual systems, the projection unit, or the printers.

Harvard contracts with independent trainers as instructors. Each instructor is selected on the basis of an interview and recommendations from other employers. They are evaluated during their first course by the manager. Their fees are negotiated and depend on level of experience, amount of course development necessary, and on years taught for OIT.

Fortunately we have never had to cancel a class because of instructor illness or failure to show up. We do not have backup provisions for instructors, so "the show must go on."

Course outlines are prepared by all instructors, and either third-party courseware or instructor developed courseware is used for instruction. Bibliographies and "cheat sheets" are prepared by the instructors. OIT provides each instructor with a policy manual and technical notes. Twice a year the instructors meet with the OIT staff to review, discuss, and evaluate the past semester. Often, suggestions are adopted by all the instructors.

At the end of all classes, the students complete a course evaluation form. These evaluations are reviewed by the instructor and the training coordinator. Problem areas are discussed immediately with the instructor, and appropriate adjustments are made to course content, length, or presentation.

A Paradox database is maintained of all registrants on a PS/2 Model 70. This database is updated regularly with data from the central Human Resources database. Reports can be generated upon request on enrollment (numbers, distribution according to department or staff type), courses (name, type, number, hours, fee, etc.), and income and expenses. These reports are used for planning purposes and preparing the Department's annual report.

Some Departments or offices at Harvard request special training sessions, especially if they have more than five people to be trained. These sessions are scheduled according to classroom and instructor availability. Occasionally on-site training is provided, especially for the President's and Vice-President's offices. When OIT cannot meet a training request, we refer people to outside vendors or try to accommodate the request next semester.

As yet, OIT has not developed follow-up surveys of our customers. In order to reach the faculty, a needs analysis may be conducted in the spring of 1990 to determine their desire and availability for training sessions.

Michigan. Policies at Michigan have grown out of our experience and our desire to offer high-quality, effective programs that meet the needs of our participants.

Dependability and Consistency:
Because it is important for the campus community to be able to plan ahead, an entire semester's schedule is published one month in advance of the coming semester. Information about the workshop schedule is available in a Computing Center publication, *Non-Credit Computing Courses on Campus* , as well as in other campus publications published each term by the Human Resource Development office and the Hospital Training Department. Our ITD newsletters and general University publications publish weekly workshop schedules as well. An online file that is widely accessible on campus also carries information about workshops and any last-minute schedule changes.

In order to narrow the gap between participant expectations and reality, our publications try to clearly convey exactly what will be covered in a workshop and what prerequisite skills are necessary. Information is also provided about the length and format of the workshop.

So that it is not necessary to cancel workshops in the event of an instructor illness, substitute instructors are available and specially-prepared "Instructor Notes" are assembled in notebooks for reference. Workshops are cancelled only in the case of insufficient enrollments (fewer than 5 registrations for advanced, limited-audience classes and fewer than 10 for traditionally more popular classes).

Printed materials have become an important part of Michigan's workshop program. Some are designed as reference materials while others are step-by-step tutorials. In either case, our participants have come to expect high-quality support materials for post-workshop use. Many people also find that our handouts substitute for attending a workshop when their schedules are particularly busy.

Excellent workshop instructors are particularly important to our program's success. Our instructors are very knowledgeable and enthusiastic teachers who enjoy training. Instructors work in teams to design new workshops and are available as consultants to users both before and after workshops. The workshops they design grow out of their experience on the U-M campus and reflect campus needs. Wherever possible, we try to assign more than one person to teach a particular workshop title. This helps when we need substitute instructors and it also makes consistency in workshops essential. Instructors of advanced courses need to know that the same material is covered in introductory courses regardless of which instructor may have taught it.

Appropriate Scheduling:
Schedules are planned taking into account University class schedules and the curriculum is modularized so that individuals can sign up to learn the skills they need. Although we have very few evening workshops, we have scheduled some to accommodate students, faculty or staff who find evening workshops more convenient. Registration and enrollment statistics are monitored carefully so that we can offer the right number of workshops each term and at the right time of the semester. In general, introductory courses are offered more often than advanced classes.

Classroom Policies:
A myriad of policies and procedures seem to govern attendance and registration. All of our policies, however, are designed to improve the classroom experience of those attending or eliminate a "no show" problem.

Some of our classroom policies are:

- Late-comers forfeit their seats to "walk-ins"
- Registration is required, but walk-ins are encouraged
- Registrations are accepted no earlier than one month in advance
- Class limit of 30 participants for hands-on classes
- 2 participants per workstation is the norm
- No eating or drinking in the classrooms
- No mail registrations to enable immediate confirmation of registration
- Modest fees are charged for all but introductory workshops and hands-on systems use workshops. (typically $5.00 per hour; no charge for students)

Other Policies:
Computing Center developed tutorials are distributed for a nominal fee ($10.00) and may be duplicated freely. Commercial tutorials will be available for checkout beginning in the winter term. Print tutorials and workshop handouts available for $2.00 or at no charge (for workshops that have no fee.)

Special workshops may be requested by faculty or departments. Departments are charged roughly $150/hr for special workshops and development time for special workshops that are not regularly taught is charged at 40.00 per hour. An estimate is given to each department requesting special workshops in advance.

Program Analysis and Ongoing Improvement:
At Michigan, we monitor our program and its effectiveness regularly. Workshop evaluations are completed by participants after each session and these are compiled for each workshop each semester. Instructors are the first to receive the evaluation data and often respond to feedback in the evaluations immediately. Participant evaluations are also very useful for identifying problem areas that can be addressed in a special meeting. Some recent such topics have included enhancing presentation skills, teaching to a mixed level participant group, handling questions, and teaching newly arrived foreign students. Longer-term follow up evaluations have not been carried out with the exception of special workshops where the Education Manager always talks with the organizer of the training several weeks after the training has been completed.

Consultants provide input into the curriculum planning and registration and attendance data are analyzed for trends and indicated changes to workshop schedules. Beginning next term, we will be instituting a plan for peer evaluations. The Education group meets biweekly to address any problems that arise and once or twice each semester, the entire teaching staff assemble for topics of mutual interest and the sharing of teaching tips and skills.

I. Challenges for Training Programs at Each Institution

Harvard. The ongoing challenges for Harvard's training program are:

- requiring full cost recovery for the classroom, which includes all overhead expenses (space rental, instructors, staff support, course materials, printing, telephone, hardware and software, etc.)
- setting and maintaining standards for course materials (course descriptions and outlines, pre-tests, student materials in proper sequence with page numbers, quick reference sheets, integrated exercises, bibliography, and student data disks)
- keeping our excellent instructors happy (pay commensurate with skill and experience, providing staff assistance, dinner meetings semiannually)
- getting students to self-assess their skills and enroll in appropriate classes only.

The challenges for the future of Harvard's training program include:

- preparing and training faculty to evaluate and use technology for personal and professional tasks by cooperating with computer services groups within the various Schools
- keeping up with the rapidly changing technology (when to upgrade and what expenditures for hardware and software to capitalize)
- developing effective training coordination mechanisms within Harvard (regular meetings of user support managers from the various Schools, quarterly meetings of training coordinators and trainers, etc.).

Michigan. Challenges for Michigan in the coming year are numerous and revolve around budget, changing technologies, and changing user needs. Among the more interesting are:

- Reaching increasing numbers of users with static resources
- Keeping up with rapidly changing technology and changing user needs
- Narrowing the gap between experienced and novice learners in the same class
- Continued exploration of alternative training media and strategies
- Becoming an effective lobbying voice for user needs and improved software
- Helping users work "smarter" with new technology

About the Authors:

Anne Knight, Manager of Technology Education, Office for Information Technology, Harvard University, 50 Church Street, Cambridge, MA 02138 (617/495-8863)
BITNET: knight@harvarda

Elaine Cousins, Computer Training Manager, Computer Center User Services, 611 Church Street 2nd Floor, University of Michigan, Ann Arbor, MI 48104 (313/998-7639)
BITNET: elaine_cousins@um.cc.umich.edu

A METHODOLOGY FOR STANDARDIZATION: FROM EIGHTEEN WORD PROCESSORS TO ONE

Brenda L. Bailey
Coordinator, Institutional Research
Edinboro University of Pennsylvania
Edinboro, PA

Richard A. Metzger
Manager, Administrative Computing
Allegheny College
Meadville, PA

Ginger M. Willis
Academic Computing Specialist
Allegheny College
Meadville, PA

ABSTRACT

The ever-increasing computer usage at Allegheny College demanded an increase in computer support. By 1987 the 450 employees and 1900 students of Allegheny used eighteen different word processors.

The Computer Center found that standardizing on one word processor was one way to increase productivity without increasing computing staff size. The complex change process required the support of top management as well as user involvement in the decision. Workshop training with hands-on experience was found to be the best strategy when teaching novice users. A users' group allowed for continuing user involvement. Project evaluation using a questionnaire provided necessary feedback.

A METHODOLOGY FOR STANDARDIZATION: FROM EIGHTEEN WORD PROCESSORS TO ONE

This paper reviews the procedure used at Allegheny College to standardize the use of word processing. Founded in 1815, Allegheny is a small, private liberal arts college. The 254-acre campus located in northwestern Pennsylvania in Meadville is 90 miles north of Pittsburgh. Meadville is a small city of 15,000 people, surrounded by farm country and rolling wooded hills.

The methodology for standardization included the following steps that proved successful:

1. Needs assessment
2. Top management support
3. User involvement in the decision process
4. Questions and answers
5. Workshops and training
6. Distribution of the software
7. Formation of a Users' group
8. Project evaluation

The Need to Standardize

Before standardization, the 450 employees of Allegheny College used eighteen different word processors, many at different version levels. The most popular were PC-Write, Multimate, Volkswriter, WordPerfect, WordStar, and MS Word. The 1900 students primarily used PC-Write. Support and training for all these packages was a very time consuming no-win situation for the Computer Center staff.

The quality of support offered by a computer center depends upon three factors: the staff, the number of products supported, and the level of support offered.[1] If the majority of the college community were to use one versatile, powerful, user-friendly word processing package, we would be able to concentrate our support on one good package.

By January 1938, it was apparent to the Computer Center staff that an attempt must be made to standardize on one word processing package at Allegheny. In addition to improving user support, standardization makes the exchange of information much easier and increases efficiency. The Computer Center performed an evaluation of major word processing packages to select the most appropriate program as a standard for Allegheny. Product reviews and professional literature suggested that WordPerfect was the most widely used and highly rated word processor on the market.[2] A recent survey of CUMREC members also found WordPerfect to be "the easiest and most helpful software."[3] The package met our criteria of being both easy to use and learn, with powerful and versatile features for both general and academic use. The Computer Center suggested that Allegheny College adopt WordPerfect as its standard.

Administrative Executive Committee Support

Research indicates strongly that in any complex change process, there is a critical group of people whose commitment is necessary to provide the energy for a change to occur.[4] Support of top administration is essential when attempting to effect most organizational changes. All department heads had to be willing to supply the time required for training.

The first step in this process was to approach Allegheny's Administrative Executive Committee (AEC), comprised of senior officials reporting directly to the president. The cooperation, support, and guidance of this committee was sought from the outset of the standardization effort.

By the end of February 1988, the AEC agreed in principle to support the concept of limiting support to one or two standard word processors on campus. They requested the development of a formal mechanism for selecting the appropriate word processor. They believed it was important for the users to play an active role in arriving at the decision. They shared a common belief that resistance can limit the successful implementation of computer applications.[5] User involvement tends to reduce resistance. The users needed to have a strong input.

The AEC wanted a vehicle for all constituencies of the college - student, faculty, and staff - to provide input to the final proposal. As this retraining effort was to affect all members of the college community, the AEC saw it as an opportunity to improve communication on campus. If workshop participants could discuss the type of work each did, people would to get to know each other better. As participants discovered that they shared many similar concerns and problems, an increased sense of community might develop. Forming a users' group would provide an opportunity for people to come together on a regular basis. Thus a secondary goal of standardization was to provide opportunity for communication across boundaries.

The AEC gave its support for funding on two conditions: first, that workshops would include a mix of people from different offices and different levels of authority; and second, that a users' group would be formed.

Word Processing Standardization Committee

The Computer Center began to discuss ways to involve the entire college community in the decision. We rejected the idea of sending out a questionnaire and explored the idea of an ad hoc committee. By May 1988, we had focused on the formation and purpose of the Word Processing Standardization Committee. This committee was to make explicit the reasons for adopting a standard word processing package at Allegheny. Using the existing evaluation materials provided by the Computer Center, we wanted the committee to take into consideration cost, power, flexibility, and ease of use and learning. We anticipated this committee would reach the same conclusion we reached, choosing the same word processing package that we had in mind. The decision had to be made as soon as possible so training could take place during the summer months when the computer labs were available for employee use.

In June 1988, the committee was formed. The Word Processing Standardization Committee included five staff, three administrators, three faculty, and three students. We chose members not only from various areas, but also with various computer backgrounds. The chairperson of the committee was a member of the Computer Center staff. The Computer Center prepared a working document to simplify the task facing this committee, emphasizing that it was only a recommendation. The committee would analyze the material within this document, and discuss the issues and strategies with colleagues. As representatives of the college community, they would build a consensus around a final strategy for standardization. The document included the following reasons and objectives for standardization:

1. Communication Communication cannot happen when everyone is speaking a different language. Standardization provides the ability to exchange information effortlessly with any office, administrative or academic. A free flow of information eliminates both communication barriers and problems of misinformation and speculation.

2. Community Better communication makes for better working relationships and increases understanding among groups. Standardization would require cooperation among the many offices on campus who have similar needs but rarely find occasion to discover the similarities. The entire campus working as a team toward a single goal could bring the college community together.

3. Integration To have everyone using the same tools encourages a sense of creativity, harmony, and organizational solidarity.

4. Efficiency When multiple word processing packages are used, employees must use a conversion program or retype to share documents among offices. Secretaries in academic departments find themselves working with documents from faculty who use different word processors. All of these tasks waste time and energy at a time when emphasis on improving productivity continues to increase at Allegheny.

5. User Satisfaction and Productivity Research shows that two important factors that impact end user computing are the efficient and productive use of available software and the quality of interaction with computer specialists.[6] The level of training and support the Computer Center could provide by concentrating on one package should improve both factors. This would lead to increased productivity, expertise, and user satisfaction.

6. Quality One of our goals was to equip faculty, students, and staff with the best possible tools. We evaluated several word processing packages and found what we judged to be the most likely software to meet the needs of almost all groups on campus. The package we recommended has powerful, easy-to-use features for general and academic word processing needs.

Questions for the Computer Center

The prospect of standardizing raised several questions, issues, and problems that needed to be addressed:

1. Transition We expected a period of transition during which the new standard word processor and the old word processors would all be in use. The transition period would take approximately one school year for administrative users. Converting faculty and students would take longer because of the number of upperclassmen using PC-Write and the time constraints faculty face in attending training workshops. During the transition we would continue to support the most widely used word processors. Any new employees and students would learn the standard package.

2. Time We saw the commitment of time to be the most universal problem. This commitment must have priority and come from the top down. Department heads must give staff the time to learn the new package. We anticipated each person learning the package would spend ten hours in workshop training over a period of 2-3 months. The time to achieve competency in the new software would vary considerably from person to person. For optimal results, we suggested that people begin using the new program immediately after training. For about one month, we estimated this could add one hour per day to the time it would take them to accomplish their normal work. We also recommended that for about one month trainees spend 1-2 hours per week away from their offices to work on the program, preferably in the microcomputer labs where people who knew the package would be available to answer questions and provide help.

3. Training Individualized instruction is most effective when teaching word processing. A small group accommodates differences in learner abilities, attitudes, and backgrounds.[7] We planned to conduct workshops attended by no more than 18 participants with two instructors for each group.

We planned to provide training in steps - an introductory session, an intermediate session, and then workshops on advanced topics. This would give users the opportunity to work with the program, absorb what they learned, and formulate questions before the next session. Individuals did not need to attend the introductory session if they felt comfortable with basic features of the program. They could attend the intermediate or advanced levels as they saw fit. The sessions emphasized the type of work participants were most likely to do with their word processor in their own working environment.

4. Support We had in mind a number of support mechanisms. The formation of a users' group would provide excellent and timely help for people having problems and an opportunity to share helpful hints discovered while using the package. Each office would identify a word processing expert. These liaisons would answer most questions and act as the word processing contact with the Computer Center. Telephone support from the Computer Center would also be available. We would distribute tip sheets and handouts.

5. Access/Distribution The standard package would be available on all college-owned computers and networks. Anyone who had his or her own equipment could purchase the software for a highly discounted rate. WordPerfect is not a public domain program. Unlike PC-Write, we could not duplicate and distribute it free of charge.

Word Processing Standardization Committee Decision

The Word Processing Standardization Committee met twice. During the first meeting the members discussed the problems and concerns. The committee made the decision to support standardization on WordPerfect during its second meeting. If this project were to be a success, it was important that the users understand the reasons for standardization, the commitment to it, and the long-run benefits.[8] To meet this requirement, on July 18, 1988, the committee sent a memo to the Allegheny community. Many areas in this memo reflected the recommendations of the Computer Center to the Committee. This memo presented the rationale for standardization and the reasons for choosing WordPerfect as a standard.

Workshops and Training

By mid July 1988, the Computer Center had negotiated a license agreement with the WordPerfect Corporation and ordered the software. It was time to formalize the training process. Many trainers say problems arise when users with different levels of PC experience and different job requirements are together in the same workshop.[9] However, one of our aims was to improve communication across the campus by getting people together. We chose to include employees from various departments in each workshop. In order to stimulate conversations, each workshop included a 15 minute coffee and cookie break. Users are more likely to seek help after their initial training if they are personally acquainted with the support staff.[10] The coffee breaks allowed the Computer Center to become acquainted with the users in a personal, friendly setting.

Now the problem we faced was who would teach the workshops. Up until this time, two people from Academic Computing taught nearly all computing workshops. Both had extensive experience teaching workshops, and one was the WordPerfect expert on campus. However, these two computer professionals could not possibly teach all workshops. Although the rest of the Computer Center staff had no knowledge of WordPerfect, everyone would join in and help with the training.

Here is where the plan met some resistance. "Any programmer, any DP type, any computer scientist, wants to program, not train."[11] Some of the staff were very reluctant to teach workshops since they had neither teaching experience nor training. One person refused to teach a workshop; the rest said they would, but they were hesitant because of their lack of experience with WordPerfect. A key ingredient in workshops is the instructor. The instructor must have a deep understanding of the program. It is important that he or she understands the fears and apprehensions of new users. In addition to prior teaching experience, instructors should have extensive experience with both the personal computer and the software that they are teaching.[12] Many of us were mainframe programmer/analysts who had never used WordPerfect. Most of

us had no teacher training. So what were the chances for a successful training program? The workshops had to be a success. We could not risk failing in even one workshop group.

Our solution was to have the inexperienced teachers assist the experienced trainers in the early workshops to get a feel for what to expect. This worked out quite well. Even the one programmer/analyst who had refused to teach a workshop agreed to give it a try. After assisting in several workshops, we felt comfortable enough to teach, and in fact, we enjoyed it and did a good job.

Along with the July 18, 1988 committee memo, we sent a memo to all administrative offices announcing the WordPerfect workshops. We asked each office to identify the employee who would serve as the word processing liaison for the department. Liaisons were considered the key word processing experts in each office and would be the first to receive training in the package. They acted as the contacts with the Computer Center, received the software for distribution, and converted files from other word processors when necessary. When users had problems, liaisons would be the first people to consult.

Focusing on Allegheny's 125 administrative users, we conducted ten Introductory workshops and five Intermediate workshops during July and August. Each workshop met for two two-hour sessions. The Introductory workshops required no experience with WordPerfect. These workshops covered basic features of the package. The Intermediate workshops were for those who had taken the Introductory workshop or had a working knowledge of WordPerfect. They covered such features as working with blocks of text, advanced printing features, and search/replace.

Advanced workshops met for one two-hour session. Conversion workshop #1 showed how to use the conversion utility provided in WordPerfect. Conversion workshop #2 showed how to use Mastersoft's Word for Word to convert files created in Microsoft Word or Volkswriter. The Mail Merge workshop covered the techniques of merging a list of names and addresses with form letters. A Document Processing workshop dealt with the use of WordPerfect with the HP Laserjet.

The mix of staff, administrators, and faculty in the workshops was roughly 4:2:1. Each workshop had participants from an average of eight different offices. The workshops were definitely accomplishing the goal of bringing together the different groups on campus. People were mingling and introducing themselves to others, mostly because of the coffee and cookie breaks we included. We gave people time to talk and get to know each other. Everyone we talked to, including those of us teaching, enjoyed the workshops.

Distribution

On July 25, 1988, we distributed one copy of the WordPerfect software (six disks) to each computer on campus, accompanied by a quick reference card and a keyboard template. Each copy included instructions for using WordPerfect from floppy diskettes, installing and using

WordPerfect from a hard disk, and selecting a printer. Manuals were distributed at a ratio of one manual for every three machines.

Users could check out workbooks with self-paced lessons from Academic Computing Services. We DID NOT recommend using the on-line tutorial that comes with the WordPerfect program as we were experiencing some problems with it. This worked to our advantage since research shows that an on-line training package is a less effective teaching method than workshop training.[13]

WordPerfect Users' Group

End-user attitudes toward word processors affect efficiency and productivity. Assuming that more positive attitudes produce greater job satisfaction and productivity, we attempted to improve user attitudes.[14] In August 1988, we formed the WordPerfect Users' Group as the medium for exchanging solutions to problems, macros, and other helpful information. We encouraged anyone interested to attend the meetings. Two college employees with PC experience, who were not members of the Computer Center staff, coordinated the users' group. This was a further attempt to involve the users. The Users' Group planned to hold informal monthly meetings in a computer classroom where demonstrations could be given.

Problems

Many of the problems we experienced with the project were anticipated and measures were in place to deal with them. Other problems were unexpected. One major problem we encountered was that as we were about to standardize on WordPerfect 4.2, WordPerfect Corporation came out with a major upgrade--WordPerfect 5.0. "There are substantial differences between the two versions."[15] Not only did we have the task of teaching WordPerfect to the college community and ourselves, there was no one on campus who was an expert at WordPerfect 5.0. In addition, WordPerfect 5.0 requires 384K memory while version 4.2 required only 205K. Many of our PCs had only 256K memory. Version 5.0 runs best on a hard drive or a network with lots of free space.[16]

Another problem was that during this same time frame, many offices were converting to laser printers and hard disks. Besides learning a new software package, users were dealing with new hardware. Often calls concerning WordPerfect were actually questions having to do with the new hardware.

We logged all calls and reports of problems, sending students or personnel out to help users when necessary. Most problems seemed to be with printers. An IBM Wheelprinter driver was not available at the time we received the WordPerfect software. Eighteen offices on campus used the Wheelprinter. Furthermore, we had to experiment with suitable drivers for older dot matrix printers not supported by WordPerfect 5.0. As problems arose, we prepared handouts outlining solutions or ways to avoid the problems. These handouts as well as several useful macros were distributed through the users' group.

Project Evaluation

Although the standardization process was far from being complete, in November 1988 we performed an evaluation using a questionnaire sent to all employees of the college. This feedback would allow us to make modifications to the plan if necessary. Of the 450 employees receiving the questionnaire, 36% responded.

The questionnaires were analyzed using SPSS-X. Of those responding, 30% were administrators, 36% were faculty, and 34% were staff. Of the 59% using WordPerfect 5.0, 33% were administrators, nearly 27% were faculty, and 40% were staff. Of those responding to the survey, 61% attended a workshop: 87 attended the Introduction, 63 attended the Intermediate, 19 attended the Mail Merge, 9 attended the Document Processing, and 12 attended the Conversion workshops. The workshops were rated excellent by 61% of the respondents, good by 34%, and fair by 4%. None of the employees rated the workshops poor.

Despite the positive ratings, comments on the questionnaires pointed to three areas in need of improvement. First, the constructive criticism illustrated the importance of workshop evaluations. Before the next round of workshops in December, we would design an evaluation form to be completed by participants at the conclusion of each workshop. This immediate feedback would allow us to monitor the quality of instruction and make timely adjustments.

A second difficulty involved our practice of integrating users with various levels of computer expertise into a single workshop. To meet our goal of providing cross boundary communication, we combined users with different levels of PC experience. We overlooked the option to include users from various areas without including users of various levels of PC expertise. To eliminate this problem in future workshops, we would either match participants by ability, or require users with little PC experience to attend the Introduction to the PC workshop. Employee comments also led us to question the timing of the workshops. Participants in the summer WordPerfect workshops often attended an Intermediate or Advanced workshop without enough practice at the introductory level. Enforcing prerequisites would alleviate this problem.

Closing Thoughts

Throughout this project we have stressed user involvement. Research shows that the training strategy not only affects learning efficiency, but also affects attitudes end users develop toward the system.[17] We expect the favorable ratings of the workshops to carry over into the work area.

The first wave of training, with over 300 participants, was a success. We will continue to offer WordPerfect workshops, asking participants to perform an evaluation at the conclusion of each workshop. We have learned that feedback is a necessary part of the change process. Thus far, feedback shows that our expectations are being met.

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DATA ADMINISTRATION:
Problems and Solutions

Ronald G. Hoover

The Pennsylvania State University

University Park

Pennsylvania

ABSTRACT

This paper describes some of the problems encountered in the administration of data at The Pennsylvania State University and the solutions that have been implemented to solve these problems. It is recognized that the technical aspects of these solutions may not be applicable everywhere, however, the techniques presented will hopefully stimulate ideas for solutions to similar problems at other institutions.

INTRODUCTION

The implementation of data administration can vary widely from one university to another. However, some of the problems encountered in administering data are common to organizations that have active data administration functions. It is the purpose of this presentation to describe the structure of data administration at The Pennsylvania State University, and to detail some of the solutions to problems we have encountered.

Hopefully this discussion will provide useful information to those who are contemplating data administration, and alternate solutions to problems experienced by organizations that have already established data administration functions.

DATA ADMINISTRATION HISTORY AT PENN STATE

Data administration has existed at Penn State for many years. Initially it was in the form of policies, procedures and security measures that were necessary for the normal day to day operation of the computer department. As systems grew larger and more numerous, a more formal method of keeping track of university data was needed. This need was met through the acquisition of a system called Pride from M. Bryce & Associates Inc. Pride used paper forms to collect and relate information about files, records and data elements. The system was good for the collection of information but proved inadequate for reporting purposes. To correct this situation, a in-house system was developed to place the data from the forms onto magnetic tape. Updating and reporting facilities were also developed. This became the first machine readable dictionary used at Penn State. The administration of this system was the responsibility of the systems development group.

In 1974 the University acquired IMS as its first database management system. At that time a database administration group was created and assumed many of the responsibilities associated with data administration. In 1982 work began on a major effort to develop new student systems using the ADABAS database management software and its fourth generation programming language NATURAL. The new systems are on-line oriented and have created an environment where more data is available to more users than ever before. This environment emphasized the need for a more formal data administration function which was established in 1986. The goals of this function are as follows:

1. Institutional data are to be:

    a. Accurate
    b. Complete
    c. Accessible
    d. Secure

2. Information systems are to be:

   a. Coordinated
   b. Consistent
   c. Efficient
   d. Protected
   e. Flexible
   f. Accommodating

DATA ADMINISTRATION ORGANIZATION AT PENN STATE

With the establishment of the above goals came one of the first problems encountered by most organizations contemplating data administration. Where in the organization's structure should data administration reside? At Penn State it was decided that data administration would not be empowered in a single person or organization; rather, all units interacting with the system would share the responsibilities of data administration. Identified below are the key participants and their responsibilities:

1. Executive Director of Computer and Information Systems

   The primary responsibility of the Executive Director is for initiatives for system planning, policy development and research activities that affect data administration. The initiatives are undertaken with the direct involvement of the Committee for Administrative Systems Planning in which key offices are represented.

2. Manager of Data Administration

   The Manager of Data Administration is responsible for facilitating and coordinating overall data system planning, policy development, research activities, communication, system efficiency, data security and data accessing. The installation, maintenance and efficiency of the database and data dictionary systems are also the responsibility of the Manager of Data Administration.

3. Data Stewards

   Each data element in the administrative systems is assigned a steward. The stewards are responsible for developing coding structures for data, ensuring data accuracy, determining updating frequency, establishing requirements for data protection and authorizing access to data within the stewards area.

4. Access and Security Representatives (ASRs)

   ASRs are established in the major offices of the university and are responsible for requesting access to data for their organization and for ensuring appropriate access, use and protection of the data within their purview.

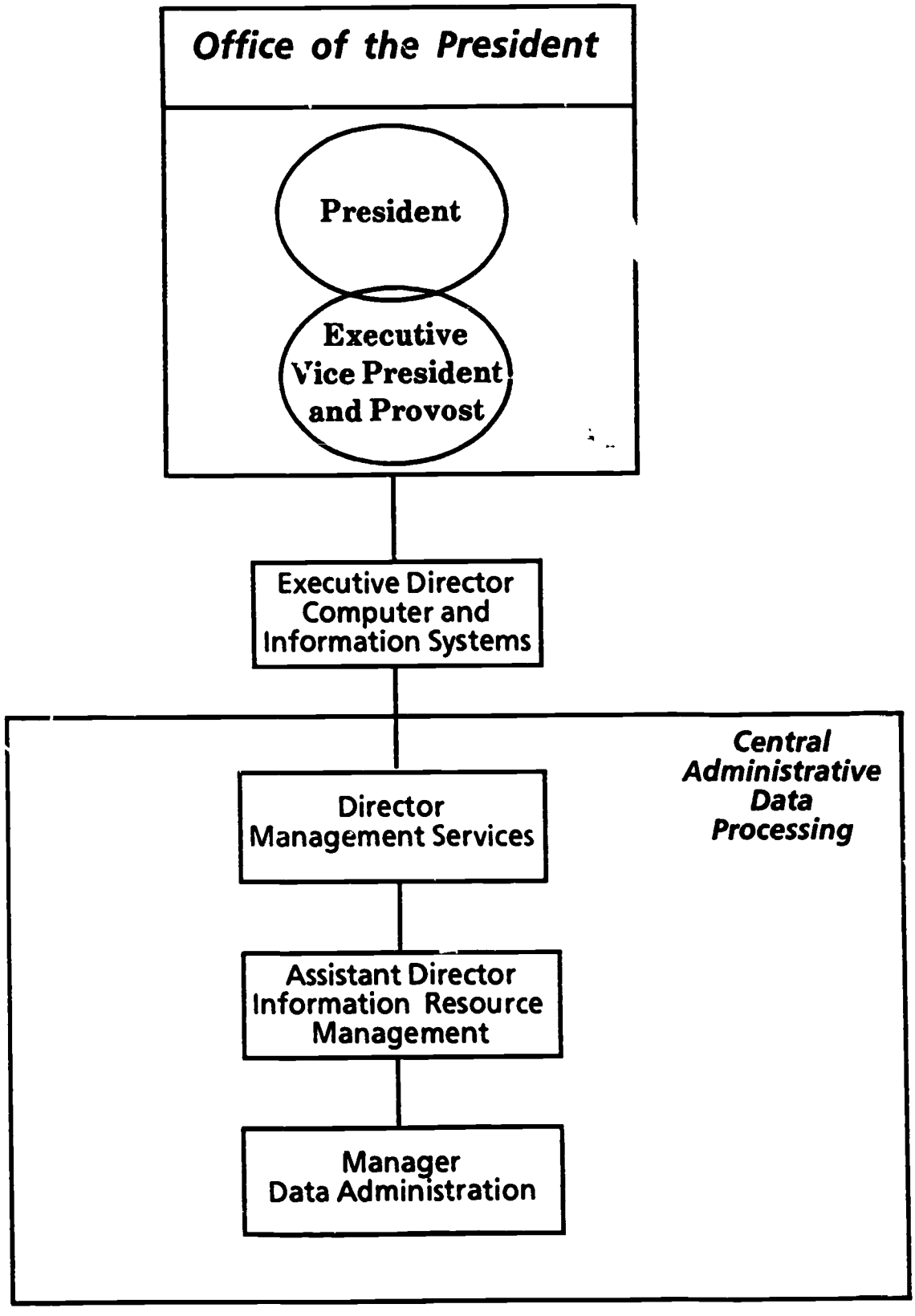
Office of the President
President
Executive Vice President and Provost
Executive Director Computer and Information Systems
Central Administrative Data Processing
Director Management Services
Assistant Director Information Resource Management
Manager Data Administration

Figure 1

Of the above participants, the Manger of Data Administration is the most active. This office handles the typical data administration functions of the University. The placement of this function is usually critical to the success of an organizations data administration efforts. Figure 1 shows Penn State's placement of this function within the central administrative data processing department which reports to the Executive Director of Computer and Information Systems and the Provost. This structure has advantages in permitting data administration to work directly with the operations, process control and security staffs to enforce standards and take immediate action in controlling data access. In addition, the database and data management staffs report directly to the Manager of Data Administration and provide technical expertise for software and systems solutions to many problems.

A Potential disadvantage of placing the data administration function in the data processing center could arise when a problem occurs that affects organizations over which the Manager of Data Administration has no authority. Generally these problems take longer to resolve but have been successfully addressed through the coordination of data administration and the data stewards. In the event a problem cannot be resolved, the data administration reporting structure permits the escalation of the problem to the Executive Director of Computer and Information Systems and potentially to the Provost.

USER ACCESS TO DATA

The first challenge that faced data administration at Penn State was to provide a way of requesting access to computerized institutional data that would meet the needs of the users and all parties involved in the authorization process. From the users standpoint, a vehicle was needed that would allow them to identify the particular data they wanted to access. The data stewards wanted information describing why the data was needed and how it would be used. They also desired the capability of specifying any restrictions that were to be imposed on the use of the data. The security office required an identification of the individuals who would access the data and a signed statement that the users understood their responsibilities for using data as outlined in university policies and as agreed to by the stewards. Data administration needed a way of recording the request and subsequent approvals or disapprovals of everyone involved. In addition, it was highly desirable that the process be kept as simple as possible.

The initial solution to this problem was the design of a general form for requesting access to computerized institutional data. It was decided that a single one page form would reduce confusion on the part of the requestor and aid in the standardization of the request process. The front of the form, as illustrated in Figure 2, is completed by the access and security representative from the requesting office. This portion of the form is used to identify the data needed, the reasons for the need, and the individuals who will access the data. Each individual is uniquely identified by a "userid" assigned by the security office. The back of the form, as shown in figure 3, is used to record the signatures of those involved in the request, approval and implementation processes. In the event additional space is required, additional pages are attached to the form. When a request is completed, a copy of the form is returned to the requestor and the original form is filed in the data administration area.

PENNSTATE

Management Services

3 Shields Building
The Pennsylvania State University
University Park, PA 16802

Request to Data Administration for Access to Computerized Institutional Data

MGMT SVC USE ONLY	
Log Number	_____
Date Rec'd	___-___-___
Date Stewd	___-___-___
Date Ret'd	___-___-___
Access Est	___-___-___

1. **PURPOSE of REQUEST:**
(Specify why data is needed)

2. **SCOPE of DATA REQUIRED:**
(Specify desired population, selection criteria, and specific data values – if appropriate)

3. **INSTITUTIONAL DATA REQUIRED:**
(List specific file names, or list of data elements. Attach additional pages – if necessary)

4. **TIME PERIOD:**

The data is requested for the period from _____ to _____ or

☐ Semester_____, ☐ Quarter_____, ☐ Current,

OTHER_____

5. **INDIVIDUAL ACCESS INFORMATION:**
(Enter userIDs of individuals from your area who will access the data)

Figure 2

-5-

6. ACCESS and SECURITY REPRESENTATIVE SIGNATURE.

I affirm the data I accept will be used in accordance with the agreement specified by the Steward(s) of this data and I have read and understand University Policies AD-20, "Data Security and Privacy" and AD-23 "Use of Computerized Institutional Data"

Name: _____ Administrative Area: _____
(Please print)

Signature. _____ Date: _____

Forward the completed form to the Manager of Data Administration, 3 Shields Building, University Park.

---

7. DATA ADMINISTRATION ACTION:

Request _____ Approved _____ Disapproved _____

Comments: _____

Signature: _____ Date: _____
(Manager of Data Administration)

---

8. DATA STEWARD(S) APPROVAL:

I agree to release the requested data which is under my stewardship, under the conditions and time periods noted on the reverse side of this form.

Steward's office _____ Signature _____ Date _____

Restrictions (Attach additional sheet, if necessary)

Steward's office _____ Signature _____ Date _____

Restrictions (Attach additional sheet, if necessary)

---

9. MANAGEMENT SERVICES APPROVAL:

Signature: _____ Date: _____
Director, Management Services

---

10. INFORMATION CENTER ACTION:

The following data sets were created to satisfy this request.

_____ _____

_____ _____

Signature: _____ Date: _____

---

11. INSTALLATION SECURITY OFFICE ACTION:

Appropriate access was established for this request.

Signature: _____ Date: _____ 10/26/89

Figure 3

The above process has worked well over the past three years with only minor changes to the request form as dictated by experience. The next step in the process will be to include the request form in an electronic approval system that will eliminate the paper form and speed up the approval process. This system will also provide requestors the capability of monitoring the progress of their requests.

ELEMENT CLASSIFICATION SYSTEM

The request form was not in use very long when another problem presented itself. Requests began to appear asking for access to entire data base files rather than individual fields. In these cases the stewards were provided with listings of their data elements from the requested files. For some stewards this meant reviewing listings of up to a thousand data elements. At times the steward would just finish one review when a request from another user would start the process all over again. Needless to say, the stewards soon asked for a better way to handle access requests.

What appeared to be needed was a system that would allow the stewards to grant access to classes of data elements rather than individual data elements. This meant the stewards required a methodology to group their data elements for access authorization purposes. The first proposal for providing this methodology used government classifications such as top secret, secret and confidential. This proposal was not well received for two reasons: The stewards felt that terms such as top secret and secret did not fit into the university environment, and no one could decide on a set of criteria for classifying data into these categories. A second proposal was then made that was more structured in its approach. It called for only two categories: classified and unclassified. A work sheet was also provided to aid in the classification process. The work sheet listed six factors to be considered for each data element. These factors were:

1. Competitive value
2. Fraud potential
3. Legal liability
4. News-worthiness
5. Financial exposure
6. Impact on management decisions

This proposal was also rejected. The stewards felt that two classifications levels were not enough and the factors on the work sheet were difficult to apply across the board. The third time is a charm and the third proposal was accepted by the stewards. It involved classification levels of 0 through 3 and two simple rules. Rule 1: Data elements classified at level 0 are available for anyone to access. Rule 2: Classification levels are inclusive of the levels represented by lower level numbers. For example, a user who is give access to level 2 data will also have access to level 1 and 0 data.

Other than level 0, no attempt was made to define the meaning of levels 1 through 3. The stewards were free to create their own criteria for assigning elements to each level. The classification levels are maintained in the data dictionary for each data element. Now, when a user requests access to a file, the stewards simply specify access to a classification level. As is sometimes the case, the solution of one problem often highlights another problem. The stewards were now able to authorize access in record time but the creation of tailored user views to match those authorizations was a painfully slow manual process. This was made worse by the fact that a given file usually contains elements for many stewards and therefore many access levels had to be considered in the creation of a user view for the file.

AUTOMATED USER VIEW SYSTEM

Eliminating the manual process for creating tailored user views was the next challenge to be addressed. The data dictionary system provided an on-line capability for creating user views from file descriptions. However, it was not able to use the steward's element classifications in the process. Half of the solution to this problem was in place with the documentation of data element classifications in the dictionary. What was needed was a system to link the element classifications with levels of user access authorizations for each steward and each file, and then to automatically create tailored user views based on these links. An existing code table file was used to contain the link information. A new code set was defined that contains an entry for each unique file, user and steward combination. The entry also contains the level of data access approved by the steward for the user. The final piece of the solution was the creation of an on-line program to read the code set and dictionary and create a user view that is tailored to the approved access for a particular user.

As with any system, exceptions do arise. Occasionally a user will request access to elements at a level higher than they have been authorized. When this occurs the stewards have four choices:

1. Authorize the user for the higher level.

2. Change the classification level of the elements in question.

3. Disapprove the request.

4. Grant access to the elements on an exception basis.

Choices 1 through 3 are handled by the automated user view system in normal fashion. Choice 4 requires some additional processing. In these cases, the code entry containing the user's access authorization is flagged to indicate an exception exists. The user view generation program then accesses another code set that identifies the data elements to be added as exceptions. The stewards have done a good job classifying their elements and the use of the exception process has been rare.

During the design of the automated user view system, provisions were made to select an alternate element classification level for sensitive data elements when used in conjunction with entity identifying elements. For example, a data element containing grade information may have a classification level of 1 if used alone or with other elements that do not identify a particular entity. This permits studies to be done on grades with no links to entities such as students or colleges. However, if the grade data element was requested along with entity identifying elements such as student id or college name, the access level of the grade element can be raised to 2 or 3. The stewards have the ability to designate entity identification elements and to specify alternate access levels for any data element. It is interesting to note that this feature has not been utilized. The stewards have opted to maintain a simpler system based on a single element classification.

DATA DICTIONARY USER ENHANCEMENTS

As institutional researchers and other users began accessing university data, they uncovered problems in the documentation of data elements in the dictionary. Typically, the element descriptions in the dictionary were created by individuals who worked closely with the data and had an in depth knowledge of it. As is often the case, these individuals assumed a similar understanding on the part of others and their documentation was difficult for the uninitiated user to understand. This problem was further compounded by the fact that the dictionary did not provide good facilities for the storage and retrieval of the kind of textual information required by the user.

The first step in the solution of this problem was for the users to get together and develop a list of the kinds of information they felt should be part of the data element documentation. The list they created is as follows:

1. USAGE INFORMATION - This category of information describes how an element is used and interpreted. Some examples are:

   a. Descriptions of algorithms used to calculate element values.
   b. Unexpected features of the format of an element.
   c. Cautions about the use of elements that have known limitations.
   d. Time dependencies and order of entry for array elements.
   e. Any special requirements for interpreting the values of an element.

2. VALUE INFORMATION - This information describes:

   a. Legitimate values for an element.
   b. Default values
   c. Indications of what values mean as well as what they do not mean.
   d. The effective dates for specific values.

3. UPDATE INFORMATION - The data to be collected in this category is to reflect:

a. How an element is updated.
b. When it is updated.
c. Who is responsible for the update.

4. RELATIONSHIP DATE - The information in this category describes relationships to other data elements and processes.

5. HISTORY INFORMATION - This documentation lists the date a change was made to an element and describes how the element was affected by the change.

A form was designed for the collection of the above information. A separate form for each data element was printed and distributed to the appropriate stewards for use in providing the requested data. A policy was also established requiring the completion of the form for new data elements and for changes to existing elements. This policy is enforced by the data administration staff which is the focal point for data element maintenance.

The second part of the solution was to design a data base to contain the new information and to develop an on-line system to access and maintain the data. The scope of the on-line system was expanded to include access to the regular data dictionary as well as a keyword data base. The keyword database is created by selecting words from data element names and descriptions and sorting these words to form a cross reference to the data elements. When used through the on-line system, this cross reference permits the user to select a keyword of interest, such as "degree", and view all data elements that contain this subject in their element name or description. A generic keyword can also be entered to allow access to all elements with keywords beginning with the selected characters. All on-line users have read access to this system and stewards have read and update access. Whenever an update is made by the stewards, the system enforces the creation of a history record to document the reason for the change and the date it was made. Future enhancements to the system will provide the stewards with an on-line capability to view the accesses they have approved through the previously described element classification system. They will be able to view approvals by user or by file.

The solutions presented in this paper to the problems encountered at Penn State have taken advantage of the vendor software in use for database and data administration. While the technical aspects of these solutions may not be totally applicable to similar problems at other institutions, the ideas and techniques presented should be adaptable to most environments.

PREPARING FOR CASE: IMPLEMENTATION OF A STRUCTURED PROJECT LIFE CYCLE

RICHARD H. SEIVERT

UNIVERSITY OF AKRON

AKRON

OHIO

Most academic institutions' long-range plans call for the implementation of automated aids to system development, including a full complement of CASE tools. In order to fully utilize the benefits of these tools, a computing organization must have a well-defined structured development methodology and must follow it religiously.

The University of Akron, like many other institutions, has been using a well-ingrained classical methodology for many years. This presentation discusses the development and implementation of the University's Structured Project Life Cycle. It covers the investigation of the various structured techniques to be adopted for analysis, design, development, maintenance, and project management; the development of procedures for building the data models, process diagrams, and structure charts, and the training methods used to ensure implementation of the new methodology. Future plans for modification of the project life cycle to accommodate future tools are discussed and several recommendations are made.

INTRODUCTION

> "By the 1990s, CASE tools and software development workstations will be as common to software development as programming languages and compilers have been for the last three decades. Computer-aided software engineering will take a central position among software technologies." - CARMA MCCLURE

As recently as a year ago, I was one of those who felt they had heard all of this before and that the whole idea of CASE and structured systems development was going to be just another "flash-in-the-pan". A couple of very important things have happened to change my mind.

The first was the realization that our traditional techniques were no longer having the desired results. Although systems were being developed at a fairly decent rate, the designs were not standard, even among the project leaders that had been in the department for many years. Additionally, files and databases were being designed and built that were totally unacceptable. Access to these files, even when they were very acceptable to the user, were difficult to maintain and ignored institutional data needs that should have been considered.

The second thing that happened was the "legitimization" of CASE and structured techniques. I'm referring to the announcement of AD/CYCLE by IBM and the adding of three of the top CASE product companies (Bachman, Index Technology, and KnowledgeWare) to the IBM "partnerships".

Although I'm referring to this as a "case study", it is actually an unfinished case study. We have gone only part of the way toward implementing the structured techniques and the CASE tools. In my contacts with other universities and corporations, I have found that most of us are at approximately the same point. We have either made the commitment to utilize structured techniques or have decided to stick with the traditional techniques until the dust settles.

This is the story of how we made our decisions and how we plan to go about implementing the tools.

ENVIRONMENT

The main campus of the University of Akron has a student enrollment of just under 29,000, making it the third largest of Ohio's state universities. The academic and administrative computing on campus share the facilities and resources of the University's Computing Center.

The University of Akron's administrative systems utilize an IBM 3090/200 running MVS/XA. Most of our programs were written in-house using COBOL and CICS. We use Easytr_eve Plus for batch report generation for both users and programming staff, IMAGINE for batch query for our users, SAS-Graph for our batch graphic needs, and over the last two months, have developed our first set of online screens using IBM's Cross System Product (CSP).

The Model 204 relational database from Computer Corporation of America (CCA) was installed late in 1986 and several systems have been constructed utilizing Model 204's utilities, including a complete rewrite of the Accounting System. During the last few months, a commitment has been made to install IBM's DB2 as a second database.

Over the last twenty years, administrative applications have been implemented in all of the major areas: student systems, financial systems, human resource systems, alumni/development systems, and physical facility systems. There are currently 64 different systems that include a total of 3,200 programs. The number of programs in a system range from a bookstore report system consisting of one program to the personnel system with 374 programs. We spend about sixty percent of our productive time maintaining and modifying these systems.

REQUIREMENTS FOR CHANGE

In the spring of 1986, the University completed a five-year plan for computing. The seven committees that developed the campus plan over a period of about six months covered the major automation topics of: large mainframes, micros and minis, graphics, office automation, computer based education, administrative systems and programming, and networking and telecommunications.

A great deal of the good planning of these committees has already resulted in the implementation of some fine automated systems. What was missing was any commitment toward the development of new systems development techniques or the need for them. The closest anyone got toward suggesting such a step was the recommendation that

> "--a primary effort be exerted by the Computer Center's Administrative Systems and Programming department on providing the support necessary to enable the University's administrators to better utilize the available data and that these needs be given major emphasis."

The actual requirement for making some changes came from several other sources.

First, we had been trying to update our development life cycle for several years. The current development techniques have been in use since 1974, are totally traditional, and are based on manual operations to be automated and the subsequent delivery of specific documentation.

Second, there have been many requests for Executive Information Systems (EIS) and Decision Support Systems (DSS) from the highest levels of the University. These requests may not be a direct request for EIS or DSS, but will show up as a request for a quickly-needed inquiry covering several years of comparative data, some type of forecast, or a graphics output. Although we have set up a "Quick Response" group within the department, this is not the long-term answer.

Third, with the commitment to DB2, it has been emphasized that a good solid set of development techniques based on structured methods was a necessity if we were to be successful.

Fourth, it became apparent during the analysis and design of the last couple of database systems that our systems developers could not rely on traditional design methods and develop an acceptable system.

LIFE CYCLE METHODOLOGIES

Over the years, the primary objectives of the project life cycle have remain unchanged. According to Ed Yourdon, they are:

1. To define the activities to be carried out in a systems development project.

2. To introduce consistency among many systems development projects in the same organization.

3. To provide checkpoints for management control for go/no-go decisions.

Whether you were using a version of the classical project life cycle or of the waterfall model of systems development or a combination of both, the objectives stated above still remained valid. The problem stems from the fact that all of these methodologies required a sequential progression and bottom-up implementation.

According to Ed Yourdon again, the difficulties with requiring a sequential progression are as follows:

1. It doesn't allow for real-world phenomena such as politics or project leaders who make mistakes.

2. It allows for user indecision; indeed it is very common for users to change their minds several times during the development of a system.

3. It relies on outdated techniques; in fact, it totally ignores structured techniques.

There are several other difficulties listed by Ed Yourdon when bottom-up implementation is demanded:

1. Nothing is done until it's all done; there is nothing to show the user during development other than an enormous pile of listings.

2. Trivial bugs are found at the beginning of testing, serious bugs are found at the end.

3. Debugging is extremely difficult during final stages of system testing.

4. Requirements for computer test time rise exponentially during final stages of testing.

STRUCTURED METHODOLOGIES

For several years now, there has been a growing recognition that structured techniques were available to help us solve our problems. The big question was: how do we go about implementing them? Some organizations went to a semistructured project life cycle. Although it utilized top-down implementation and the coding and testing of high-level modules first, it was still a largely manual effort the depended on narrative specifications.

Another version of the top-down approach that has become popular lately is the prototyping life cycle. Although I do consider prototyping to be a useful part of good development life cycle, I don't see this type of life cycle as a complete answer to the development problem.

The structured project life cycle as proposed by Ed Yourdon contains nine activities: survey, analysis, design, implementation, acceptance test generation, quality assurance, procedure description, database conversion, and installation. There is a lot to say for the planning, analysis, and design procedures in this life cycle, but the process is hard to learn and the various documents to be delivered by each of the activities are difficult to produce without heavy manual effort.

Unlike the traditional approach, any or all of the activities can be taking place simultaneously. In fact, the "radical" approach calls for all activities to take place in parallel.

STRUCTURED TOOLS - CASE

There are now more than a hundred companies selling "CASE" tools. Even 4GLs are now being called CASE tools if they generate some type of code.

My definition of a CASE tool is a tool that automates the structured techniques. By this I mean a series of programs that automates the development of the various components of each of the structured activities, maintains the information in a master dictionary, justifies the various relationships between the components, and generates the code. Any changes to the system should require changes to the components, not to the code.

Carma McClure lists 40 software packages as representative CASE full life cycle tools. I'm not sure I agree with her. Most of the tools listed depend on another tool for completion of the full life cycle. For example, Index Technology's Excelerator has excellent planning, analysis, and design tools but, at the current time, depends on another product such as Telon or Micro Focus to generate code.

We have only found two tools that we feel are full life cycle tools - KnowledgeWare's Information Engineering Workbench (IEW) and Texas Instrument's Information Engineering Facility (IEF). More about them later.

SYSTEMS DEVELOPMENT AT THE UNIVERSITY OF AKRON

The project development life cycle in use at the University of Akron since 1975 contains four activities: systems survey, systems design, systems definition, and programming. The deliverables are in narrative form except for a couple of manually produced flow charts. In fact, nowhere in the Computer Center's standards manual is this called a "life cycle". It is merely a list of items to be delivered after the system is developed.

As I mentioned earlier, we have been trying to develop a new development methodology for many years. Our latest attempt (about year ago) had five activities: project initiation, requirements definition, system design, programming and testing, and implementation. Although data flow diagrams, prototyping, and structured walkthroughs were listed as parts of the activities, the basic idea was still a sequential, bottom-up, traditional life cycle. Because of disagreement among management as to the actual structure needed, it was never implemented.

The University of Akron made its first jump into the database arena in late 1986 with the purchase of Model 204. Prior to that time, lack of hardware resources made that move impossible. Several medium sized systems were developed and the rewrite of the Accounting System was our first major effort in Model 204.

Although the development with Model 204 was successful, the interfacing with other systems was difficult. If we could have stopped all development and taken the time to rewrite all of our systems in Model 204, it would have been very acceptable. However, this was never considered an alternative.

As we added new application tools and longingly looked at others, it became evident that Model 204 was not in the "mainstream" and was most likely not going to be. Most tools, including CASE tools, had not been developed with Model 204 in mind.

The commitment to implement IBM's DB2 was made about six months ago.

CASE PROGRESS

The whole area of CASE tools and where they fit within the applications development picture has become much clearer within the last couple of years and the tools available have had a tremendous increase in capabilities. I have attended some good sessions at CAUSE over the last couple of years presented by happy users of Excelerator and IEF.

We looked closely at Excelerator from Index Technology. The flexibility and usability of the system are apparent and they have a great track record. I'm sure there are several Excelerator user's at this presentation today. The only shortcoming we saw was the need for a separate product for code generation.

We also looked closely at IEW from KnowledgeWare. Like Index Technology, KnowledgeWare became an IBM partner a couple of months ago. Unlike Excelerator, IEW now has its own code generator.

The four activities in IEW (planning, analysis, design, and construction) and the components of each are well integrated. Since James Martin is the head of this company, it necessarily follows his Information Engineering methodology very closely. Because of the automated integration of the various components, the flow of the resultant life cycle is also much easier to understand than the nine step approach proposed by Yourdon.

Carma McClure lists the following benefits to be gained from the implementation of a CASE supported methodology:

1. Makes structured techniques practical
2. Enforces software/information engineering
3. Improves software quality through automated checking
4. Makes prototyping practical
5. Simplifies program maintenance
6. Speeds up the development process
7. Frees the developer to focus on the creative part of software development
8. Encourages evolutional and incremental development
9. Enables reuse of software components

She lists the following causes of CASE failures:

1. Confusion about what individual CASE products actually do
2. Using CASE tools to address problems for which they were not intended
3. Placing too much emphasis on CASE tools as a whole solution
4. Ignoring the importance of good management
5. No development methodology or standards in place
6. Poorly integrated CASE tools
7. Poor tool documentation and training
8. Not enough functionality present in CASE tools
9. Unclear about which software problem needs to be solved
10. No methods for measuring impact of CASE on software development and maintenance
11. No software development methodology training
12. Indecisive - unwilling to make a decision about how to use CASE technology
13. Unwilling to change current way of developing and maintaining software
14. View CASE as a high-risk technology
15. No plan detailing how to implement CASE technology

What, then, is the most frequently used development methodology in the United States? Nea 30% of the structured technique users use Yourdon's structured design. Gane-Sarson and DeMarco users together make up about 25% of the total with Orr and Jackson users making up another 10%.

THE STRUCTURED PROJECT LIFE CYCLE

The development life cycle we will be implementing has seven steps: project initiation, requirements definition, system design, programming, system testing, implementation and production, and post implementation review. This is fairly close to the Yourdon structure that I mentioned earlier. In addition, data flow diagrams, entity-relationship diagrams, and structure charts, the basic-three of structured techniques will be interjected as part of the life cycle.

The structured project life cycle we envision consists of seven steps: project initiation, requirements definition (to include the activities of planning and analysis), design, construction, system testing, implementation, and post implementation review. We plan on incorporating the IEW activities and components into this life cycle.

IMPLEMENTATION

In addition to the standards currently being developed for the structured project life cycle, there are other standards we are working on that will be implemented during the next six to nine months. These include CSP, DB2, and the CASE tool usage.

One of the most important components of the implementation is the training of the project leaders and programmer/analysts. We started the training in May using two hour sessions every two weeks and planned to complete the initial training in nine sessions. So far, we have had about eight sessions and have made it through the requirements definition activity. The introduction to systems development alone took three sessions.

We will restart the training sessions again after the holidays. We plan to cover the structured techniques first though before continuing with the life cycle.

Another big question to be answered was whether or not to implement the structured techniques and the structured development life cycle fully before implementing a CASE tool (install them sequentially) or to go with the structured techniques and the CASE tool at approximately the same time. We decided on the latter approach because we feel that the CASE tools structure should help provide some badly needed consistency in our analysis and design.

RESULTS

We have already taken several steps on our long range SAA plan. We installed a local area network connecting all of the administrative project leaders and managers. We implemented CSP, completed the pilot project, and will be training additional users within the next few weeks. In addition, in preparation for DB2, we installed several upgrades to our operating software.

The next phase will begin about the first of January, 1990, and should be complete about September. This includes the implementation of DB2, IEW, and several other application tools, as well as training our personnel.

Future phases include expansion of the encyclopedia to the mainframe and additional IEW workstations in 199', and the implementation of TIF and AS in 1992.

RECOMMENDATIONS

Structured techniques and CASE is the future. The two are singular: structured techniques will never succeed without CASE and CASE is useless unless structured techniques are implemented.

Nothing good is cheap. Providing a full tool capability for all of your developers will be expensive from both a software and hardware standpoint, but the techniques and tools can both be phased in rather easily.

Prepare to spend large amounts of time and money on training. There is some excellent training being provided by consulting organizations at the present time.

Sell, sell, and sell. Everyone I talked to, even the most excited users, stressed the need to continue selling management on the fact that CASE tools and structured techniques are the systems tools of the 90s.

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STRATEGIES FOR DELIVERING ON-LINE APPLICATION SYSTEMS TO A LARGE CAMPUS

Warren H. Curry
Administrative Computing Services
University of Florida
Gainesville, Florida

Peter Maren
Division of Human Resources
University of Florida
Gainesville, Florida

ABSTRACT

This paper presents a look at the approaches, problems and successes of delivering Administrative Management Systems which affect both Central Processing Areas and Departmental processing of information. These systems affect policy, procedures and training required to operate the administrative functions involved.

As system implementors, our management of the application development projects must be sensitive to the user's perceptions which inevitably surround all development projects. Our experiences in on-line systems at the University of Florida have guided us to develop strategies which have been successfully used on several development projects.

Introduction

Building information systems solutions that work effectively for a business is a tough job for all those involved. Top management must find ways to ensure success and economy. Users must learn to use equipment and processes which often seem foreign to them. Middle managers must rethink the procedures and structure of their office and staff. They must learn to manage, train, and motivate a group of people experiencing drastic changes in their daily routines. The Information Systems Department must become knowledgeable in many areas of the business. They must also maintain a high level of skill in rapidly changing areas of technology. The above forces have been common knowledge to most Data Processing Managers for years.

Within the workings and agendas of a large public university such as the University of Florida (UF), these forces are diversified and multiplied. Projects undertaken in this environment must be closely managed and guided from inception through completion if you intend to implement successful Information Systems (I.S.) projects. Furthermore, you must continue to manage the project throughout the system's operational life time. Lack of coordination between top management, operational managers, system users and information systems personnel will provide for a difficult (perhaps impossible path) for developing quality information systems that work and continue to work as the demands on the university change.

To provide insight into the magnitude and scope of these issues at the University of Florida, the following profile should be considered. UF is a top 20 school in size of student population. As a member of the American Association of Universities (AAU), UF is among the nation's leading research universities. As a Land Grant educational facility, UF is responsible for Florida's Institute of Food and Agricultural Sciences (IFAS) and the related extension centers throughout the entire state of Florida. Also part of the university is a large Medical Center with related professional schools. It performs extensive research and operates many patient clinics.

UF has 20 colleges and schools. All programs are coordinated and offered on a single campus of more than 800 buildings spanning 2000 acres. Program offerings include:

137	Academic Departments
114	Majors in 52 undergraduate degrees
123	Masters degree programs
76	Doctoral programs
100	Interdisciplinary Institutes and Centers

Post Baccalaureate Studies are also offered in law, dentistry, medicine and veterinary medicine.

All these statistics indicate UF is a large campus with a wide diversity in procedures, needs and management styles. A staff of over 13,000 faculty, administrators and university support personnel and 35,000 students must be coordinated through the never ending list of administrative procedures, regulations and mandated requirements placed upon a university with a budget of over 900 million dollars.

Administrative System Directions

The University of Florida has installed many successful applications during the last 5 to 6 years. Some of these are listed in Table 1.

Table 1: Recent Systems Developed or Installed at UF

Project	Installed	Description
P/P/B	7/84	Comprehensive On-line Integrated Payroll/ Personnel/Budget
SAMAS	7/86	Statewide Accounting System with state provided software.
Central Leave	6/87	On-line Personnel Leave Management
Performance Appraisal	9/85	Support Staff Performance
ACCESS	6/89	Central Employment
FTE/Effort	5/89	Faculty Staff FTE/Effort Tracking
Student Cashiering	8/87	Cooperative On-line Cashiering System
Automated Cashier Balancing	8/88	End of day Cashier Balancing System
Salary Commitment Tracking	1/89	On-line Salary Projecting
Purchasing	5/88	On-line Purchase Request Management
Purchasing Departmental	2/90	On-line Purchasing Departmental Entry
Employee History	11/89	Personnel Historical Retrieval
Traffic & Parking	3/90	Management of Parking Decals and Traffic Tickets

The systems have been installed with a relatively small staff by industry standards, and we have had a high level of acceptance by our campus community. More importantly, our Information Systems Staff has gained credibility and is in demand for a number of additional development projects.

Several common directions persist throughout all of these projects. These concepts are described below:

Systems are being provided ON-LINE via an IBM CICS Administrative Application Region to staff stationed primarily on our campus but with access from facilities in most of Florida's 67 counties. These systems provide management areas a mechanism for collecting accurate information and for reducing paper flow and usage.

Policy and audit enforcement can be built into the system. Massive time consuming reviews can be accomplished much easier via adhoc or routine reports.

Centralized control of functions and information formerly recorded and kept in manual files are now accessible. Administration is able to track and evaluate information housed in the databases. For example, prior to the Central Leave System, employee leave records were kept in manual files at the employee's department. Once a year, or based on sampling visits, audits were done to assist in policy enforcement. Leave liability was known only for the annual financial status and only then through a lengthy data collection activity. We are now able to record leave faster and more accurately than before. The department clerks need to work only with leave usage. The system determines leave earned automatically and accurately.

Technology within the systems is continually being upgraded as new tools become available for our use. Our approach to technology encourages our technical staff and management to use technology to assist the smooth working of UF. The choice of the most current technology for a project is not always necessary. As managers, you should evaluate all the issues and factors regarding an application and select the appropriate technology. There are places for Batch, On-line, Cooperative Processing Techniques and for VSAM, DB2, Sequential, and tape in all of our day to day operations. Generally, however, you want to choose the most current tools.

Staff training for the efficient use and management of the systems has been encouraged at all levels of UF's organization. Training and skills are to be enhanced at our user departments, management areas and within information systems. This is a continuing and ongoing activity which should begin early in every project and never stop even after the system is fully operational. Ongoing training is an important success factor for systems on our campus. Turnover and changes in responsibilities is a constant problem to overcome. We have over 1000 terminals accessing our business applications and the staff using the network must be comfortable using the applications.

UF Administration has identified several areas of concerns which we closely monitor during each project. These concerns are managed jointly during and after the project by the "owner" and Information Systems Department. Although varied in nature, each of the items below plays a key role in the production of a successful project.

1. Technology and Methodology
2. Security Management
3. Communication (of the human kind)
4. Departmental Training
5. Staffing
6. Management of Expectations

The strategies implemented for our projects are sensitive to the six items above. Attention is provided to all of these throughout a UF project.

How Projects Begin

The "TONE" and "STYLE" of interactions between participants of a project is often influenced by the initial formation or conception of a project. The term "How Projects Begin" refers to the origination of the concept or need for a new or enhanced information system. An awareness of the project origin will allow the I.S. department to present the solutions to users involved in more effective formats. If the I.S. department can keep the best possible working relationships with the system owners and related departments, the projects success will be more easily secured.

UF has identified three basic points of origin. Upper management promotes the project to be implemented. This scenario ensures the high level VP support needed for a project. The operational owners and end users may need to be convinced in some cases that the system will be worth all of the implementation effort. They will be required to participate and are an important success factor during the system startup. The line management will often conceive of ideas which deserve attention by I.S. and upper management. They must sell there idea to the VP in charge of their area so it can be studied for development. This situation provides a devoted and ready to work owner to implement and operate the system. The third type of project orgin often encountered is the external mandate. We have all grown to expect and react as necessary to these often short deadlined requests.

Implementation of information systems follow a three level thinking process for the project manager. First, "AWARENESS" of the problems that might occur. The second stage is understanding why these problems happen, "DIAGNOSIS". The third stage involves the "TREATMENT" of the specific problems you have diagnosed.1 The issue of who or where a project is started can affect the factors commonly associated with implementation success. Refer to Table 2 to review the factors.

1Dickson and Wetherbe, The Management of Information Systems, McGraw-Hill. 1985. pp380-409

Table 2: Factors Associated With Implementation Problems

	Factor	Description
1.	Ease of Use	The intended users perception of the degree of difficulty to use the system must be weighed against the perceived benefits to the user.
2.	Previous Systems Experience	A previous bad or good experience can carry over to a new system activity.
3.	Data Problems	If the data is not or felt not to be accurate or complete, the users will lose confidence and tend not to use the system.
4.	Perceived Need	The users must perceive a need for the system for it to be used successfully.
5.	Control over Change	People do not resist change, rather they resist not having control over it.
6.	Mutual Understanding	Technical Designers and Managers must communicate a workable solution. Often there is failure to communicate and understand each other.
7.	Expectancies	The way users expect a system to contribute to their performance and their belief that performance is related to rewards they receive are important to how these users employ a system.
8.	Power and Social Change	The roles of power and political issues involved include: - rivalries - territorial threats - fear of obsolescence - resistance to outsiders - cultural factors - worries of job security - information possessiveness - changes in job pattern
9.	MIS Staff Turnover	Losing staff members during the project can cause a great deal of information loss to the technical staff.

Analysis Techniques

Developing an information system requires a great deal of analytical and technical expertise. However, the expertise must be governed by a method which provides tools to clearly communicate the analysis results to the programmers, owner and upper management when necessary. Characteristics required of the method used include:

1. Graphical	A picture paints a thousand words.
2. Stepwise Refinement	Various levels of detail are required.
3. Support English	Simple English explanatory text regarding application semantic content is easily attached.
4. Automated	It must have a computer based interface which ideally includes color graphic, intelligent diagramming and data dictionary abilities as a minimum.

These tools resemble the approach used by an architect designing a building. The architect must concisely and precisely define the specification of the building for a variety of technical experts (contractors) and the client. The drawings will be at various levels of detail with each level providing an accurate analysis of how and what the end product will be like when completed.

Analysis techniques for an automated system should try to provide three goals. First, the analyst should decompose and clearly understand the business functions to be automated. Define what the system must do or accomplish for the enterprise. Don't define how it will be done procedurally until later steps. Second, use the tools to decompose the information required to support the business functions. Once you have identified the information define the relationships between the information elements to provide a relational information structure of at least 1NF and preferably 3NF. The third step is to combine the function and information into a sound procedural flow of data.

At UF we have chosen to use a CASE tool and other support packages to provide intelligent graphic diagrams with attached data dictionary support. The tools provide the analyst with hierarchical function decomposition diagrams, entity relationship data modeling, and Gane-Sarson Style DFD diagramming. The supporting tools provide a means to produce a prototype of the on-line system for early review of system feasibility. A walk-thru should be conducted that challenges the designers decisions. The analyst should be called upon to defend the design choices he has made. A good design will be made better and a good design will withstand the process. When a poor solution is encountered, the walk-thru team must provide the impetus and direction to correct problems. Under no circumstances should a poor solution be accepted into a new on-line system. The system will only get worse if you allow the process to produce components with questionable quality.

In summary, analysis techniques are really quite simple. Understand the function, information and flow of data through the system. Build a prototype which allows your management, owner, and even departmental users to react and provide suggestions and/or confirmation to your vision of their system. It may be useful to think of this as the architect's sketches depicting the floor plan and external appearance of a building. His client will be able to look at his design concept, understand it, and then decide to accept, reject or suggest modifications to make it acceptable. A well conceived prototype provides a system analyst with a similar capability for an information system project. Lastly, the project manager must be committed to a quality solution and demand that his staff provide accurate and complete technical implementations of the prototype. You must demand quality in your system solutions.

Communication, Training and Expectations

Even with the best technicians available you are ensured a failed development project if you do not communicate and train the required audience of your application system. With training the users and management will be more comfortable and know what to expect. To be successful, you will need to provide the system you have conditioned the users to expect. Therefore, it seems to be extremely prudent to manage the communication and training processes carefully.

The communication and training process at the University of Florida is a three dimensional process.

- I.S. ensures that the owner understands how the application works. The owner/user assists actively in system testing. Classroom sessions are held to train the staff of the owner area.

- Owner manager ensures that his staff understands the new system. Procedures must be documented to accompany the new system at startup. I.S. personnel will assist the owner as needed.

- End users at the department are trained by the owner. A set of pilot departments should be considered for initial startup.

Communication and training should start early in the project's life. You should be persistent and deliberate, and be sure to avoid rushing through a training program. Finally, don't stop training after the system is operational. UF has systems with over 1000 departmental users. Turnover, promotions and changes in our staff require that we maintain an ongoing training program. Encourage departments to participate in the training programs and announce to users how they may attend a training session. Provide an easy to read and understand users' guide which is kept updated as system changes occur.

Summary

Reviewing the strategies discussed in this document will reveal three themes. Awareness of the environment and feelings that are held by the key participants of the project will allow the I.S. department to approach the problems without alienating required participants. A sound analysis methodology should be followed. The keys to the method are graphics, English semantic definition, and a prototype of the proposed system. Lastly, you must communicate and train all levels of the University community on the use of the application. Top management, the owner department, academic management and clerical staff must all understand their role with the system and be convinced to expect life to be better if the system is correctly utilized. Ignoring either the political, technical or communication and training aspects of the system development project will make it more difficult to achieve a successful system. Attention given to communication, training and the project's nature of origin will make a good technical solution successful.

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ADMINISTRATIVE AND MANAGEMENT COMPUTING

- THE NEXT STEPS -

by

Edgar Frackmann
Hochschul-Informations-System GmbH
Goseriede 9, Postfach 29 20
D-3000 Hannover 1
Federal Republic of Germany

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Abstract

During the present period of decentralization of administrative computing in German universities which is marked by separate departmental computers and data-processing systems for each administrative department, some universities have started planning for the phase of "re-integration". Tasks to be fulfilled by more than one administrative department, cross-departmental data access necessities, office automation and communication, and management computing are the main impetus that force the universities to put the so-called re-integration on their agenda. The paper describes the state of the art of administrative and management computing in German universities, the planning pocess for re-integration, and the expected future development regarding the opportunities and limitations of re-integration.3

CONTENTS

1. Introduction

This paper deals with the state of the art and future perspectives in administrative and management computing in German higher education institutions. To fully understand the organizational and implementation problems dealt with here, it should be explained that most of the 244 higher education institutions in the Federal Republic of Germany are state funded. Although each institution is provided with a certain autonomy it belongs to one of the eleven states of the Federal Republic, it is governed and administrated according to the respective state laws and regulations, and the role, power and functioning of the state ministry of higher education may be compared with a combination of governing and coordinating boards of higher education systems in the United States.

The paper will address three main topics. A first section is dedicated to the distinction of three consecutive stages of administrative and management computing at German higher education institutions, a second part will focus on goals and concepts of a new era of administrative and management computing, and the final section describes planning and implementation problems, including suggestions how to resolve them. The paper attempts to address the problems in a generalizing way such as to provide valuable information beyond the borders of German higher education systems.

2. The Main Stages of Administrative and Management Computing

2.1 The "Big System" Era

It is interesting to remember that administrative computing in German universities started with an integrated management computing approach. The idea in the early seventies was rather to build the integrated Managment Information System (MIS) to improve planning of higher education than to support the institutional administration. Although the real outcome of the software production efforts was not the one big integrated Managment Information System for state higher education policy but merely institutional administrative support systems with almost no integration between adminstrative systems exept that they were run on the same mainframe, I would like to keep the term "big system era". This term might be justified by the fact, that these "big" administrative systems

- were run on mainframes ("big" computers)
- claimed to support the main (big) administrative domains
- emphasized (nothing but) the (data) administration of the huge amounts of data that happened to occur in the higher education administration.

These administrative domains and the supporting data administration systems of this first phase were: The student record systems including examination administration, the personnel and position record system, the equipment and other investment administration system, the buildings and space administration system and the stock administration system. The accounting system remained in that first phase of administrative computing in a "semi-automated" stage, i.e. implemented on magnetic card computers.

In this whole period from the late sixties to the early eighties higher education administrations witnessed certain developments in administrative computing with regards to several dimensions: the first systems started to be implemented and run on the (multi-purpose) academic computing mainframes and the later systems ended up on central administrative mainframes intended for all administrative computing systems to be implemented and run in one institution. The first systems of this phase of course were batch systems, and at the end of this period only dialog systems existed for administrative support. And if we regard the three groups of university staff involved in administrative computing, a shift of responsibility and closeness to computing facilities occurred within that period: At the beginning of administrative computing on the academic mainframes, the central academic computing staff was held fully responsible for everything, the hardware, the processing of the software systems and even the data stored on the mainframe devices by the batch programmes. The administrative computing staff, continiously emerging out of the planning and institutional research offices, during this period had to care increasingly about the hardware and software facilities, but diminishingly about the data. Whereas the users started in the case of batch systems with being totally seperated from the computing facilities and ended up with keyboards and screens on their desks linked to the central administrative computer and being fully responsible for their data and data administration.

The software was written in COBOL. ISAM or in some cases hierarchical data base systems used to be the data management systems. Regarding the whole Federal Republic a wide range of mainframes and operating systems were in use in the institutions. Although the systems were implemented on the same one mainframe (academic mainframe in the earlier part of this phase and administrative mainframe later) almost no interfaces between the systems, in the sense of whatever integration efforts, used to be implemented.

One could consider this type of computer use as a really partial support of the clerk's work mainly and merely focusing on supporting the administration of the huge amounts of data in the university's administration. A certain amount of management information or rather statistical information was extracted from the files, but rather on the basis of preformatted fixed reports, by intermediates such as institutional researchers, and rather for the middle management levels or the reporting duties to be fulfilled by state mandate than for the chief executives.

2.2 The Decentralization Era

This era starting about the middle of the eighties and still ongoing at most of the institutions is the era of the departmental computers, i.e. almost each of the university's administrative systems or a set of very closely related systems is implemented on a seperat computer. As a consequence each administrative department has its own computer or computers. Whereas this era started with a certain variety of operating systems of the so-called mini-computers in use at the institutions, we now witness a situation in which new purchases of departmental computers have almost exclusively the operating system MS-DOS for the single user PC's and the multi-user PC-networks (based on Novell), and Unix for the multi-user computers.

Computers and application systems for administrative support are spreading in both directions, in breadth and in depth. On the one hand new areas of the central administration are about to involve computer systems and computer support. The "big system approach" for only large data set administration is no longer valuable

Many small systems on the margin of the big systems with even less or few data to be handled were developed and implemented, such as travel-expense-refunding, social administration, key-administration, room-cleaning service administration, budget planning, fund allocation models, purchase order system, billing support system, electricity and power supply costing system, administration of research projects, planning of the use of teaching room facilities. On the other hand it was a new experience for the central organizers and administrative computing personnel to realize that there was an administration on decentralized levels such as the academic departments, academic institutes, projects and other organizational subunits on the academic side, sometimes doubling the central administrative efforts on a disaggregated level, sometimes substituting central administration. These decentrally located administrations demanded their computer support as did the central administrations previously.

It is also a phase of the considerable spread of word processing, now almost exclusively on PCs with one of the three most common word processing software (Wordperfect, Word, or Wordstar). Such organizational units with their word processing machines installed earlier are now in a process of implementing the second generation of automated word processing solely on PCs.

It is also the phase of a tremendous increase in a specific "fast" (compared with the traditional "snail mail") external communication means: telefax.

As to the degree to which the clerk's work is supported by computers and computer systems, one could speak of a more comprehensive support compared with the previous phase of administrative computer support. The work on keyboard and screen is less interrupted by paperwork, as more data are available electronically and more process elements are supported by the software of the system applied.

This more comprehensive support approach is due to and coupled at the same time with a high quality and highly user-friendly and supportive user-interface on the screens, comprising the following main characteristics:

- selection in menues by positioning of the cursor instead of data input
- use of function keys for every other control function
- totally self-explaining screens/formats
- immediate check of field input
- widely use of windows for secondary file access
- browsing in secondary files based on random access according to numerical identification or in alphabetic order
- reports optionally on screen or on paper.

This user-interface is however still "specific", i.e. a part of the respective administrative system, in contrast to standard user interfaces such as MS-Windows or GEM.

The improved retrieval functions and userfriendliness are due to the fact that development tools, programming language and software environment of relational databases are used (such as Informix with 4GL for the UNIX environment and Clipper/dBase for MS-DOS PCs). The ameliorated retrieval options also allow direct computer output for management support. While middle managers such as administrative department heads indeed use the computer directly for their information requests, chief executives still rely on intermediates to get their information.

As in this phase of decentralization the hardware moves closely to the administrative departments, i.e. to the end users themselves, the responsibility for everything, the hardware, the purchasing and processing of the software and the responsibility for the data tends to follow this decentralization direction as well. Although central administrative computing staff should maintain a certain responsibility in decisions concerning the purchasing process of hardware and software, coordination, user training, and maintenance, one witnesses with the rapid growth of computer use in this decentralization phase not always such an ideal sharing of responsibilities between end-users and computing staff.

2.3 The Re-integration Era

After this excessive spread of stand-alone computers all over the central and decentral administration it is nothing but a logical step that a re-integration should take place. Although this phase is nowhere fully implemented but rather in its conceptional and planning phase, one can conceive the main traits and rationales of this phase:

- There are certain administrative tasks that are fulfilled not only by one clerk at one desk, but are to be handed over from one desk to another until completed. A purchase order from the central purchasing department, e.g., is followed by an input into the central accounting system. An input in decentral accounts, e.g., should be followed by an entry into the central accounting system (on an aggregated level). An integration with respect to the different computer systems according to the need of the administrative processes could be reached by two alternatives: by direct update or by file transfer.
- The passing over of data out of the administrative files to text files for word processing purposes is another issue of re-integration.
- University internal communication such as Message Handling Systems (MHS) require integration in the form of networks.
- There is a need for at least read-only access to central files inside the university, from various decentral places and positions.
- Statistics, reports and management information often have to rely on more than one administrative system and file in order to integrate this information into one report.
- The use of central resources such as high speed laser printers, central back-up storage, access to external tele-communication services (X25) and external information services from more than only one terminal in the institution demand integration of single or multi-user places.
- Telefax and analog telefon is a non-integrative form of external communication. One could easily predict that telefax in the future will be succeeded by teletex as the most used form of telecommunication, apart from telefon.
- The multi-functional terminal and a common user-interface controlling whatever application from word processing to administrative systems at the individual working place from the clerk to the chief executive is another facette of integration.

In contrast to the decentralization era, where we were talking of a rather comprehensive support of the clerk's work by computer systems, this era might be characterized by a quasi total and integrated support with almost no "paper-based" interrupts in the clerks' administrative processes at the keyboards and screens. It will also be the phase of executive support systems with executives' direct access to and "hands-on" desk-top keyboards, mice, screens etc.

If the central administrative computing staff does not take over the full responsibility for administrative computing in the central and decentral offices yet in the stage of concepts and planning, re-integration with all the benefits expected will never become reality.

3. Goals and Concepts for the Next Step of Administrative and Management Computing

3.1 Strategic Relevance of Administrative and Management Computing

The next steps are, of course, depending on the actual stage in the respective institution, both the decentralized spread of single purpose computers and the re-integration of these seperated facilities. But it is rather the integration-phase, needing planning, conceptualization, in contrast to the incremental growth of the decentralization phase. And it is also the re-integration phase, giving rise to more general thoughts on goals, objectives and general benefits and the strategic meaning of administrative and management computing. The question might also be posed as to whether and how university administrative and management computing differ significantly from the corporate world and its computing services. There are four aspects to be considered:

(1) **The "service" aspect:** Whereas administrative computing in the corporate world, ecpecially in industry might be fully integrated into concepts of CIM or PPS, and thus serving the clients of the organization as well as internally, in the university administrative computing is almost totally seperated from the primary production processes and customer services. Thus the university administration and administrative computing is not directly linked to the aim of serving the university clients, but rather the members of the university production processes inside the institution, of whom, of course, the students are both customers and producers. But the better, the faster, and the less bureaucratic the central or decentral administration might function, due to the computer system support (but also due to the behaviour, efficiency and effectiveness of the administration employees), the more the overall atmosphere, functioning, effectiveness, productivity and creativity of the university's primary producers and production processes might be enhanced. Administrative computing - on whatever developmental stage - should primarily help the administrative employees do their jobs better, and in the integration phase to get the decision makers more involved into the benefits of administrative computing by improved and direct information retrieval options.

(2) **The "Leading Edge of Technology" aspect:** Taking into account the research and development functions of the universities, it would fit very well into the "image" of the individual institution to provide its own administration with the leading edge of the technology equipment and systems, even compared with the corporate world. But one has to be careful not to get confused about the size of the "enterprise" university. The higher education institution has to be compared with small to middle sized corporate enterprises. It was e.g. a mistake, as far as we can judge, to base administrative computing in the phase of the mainframe computers on data base software such as IMS, UDS and ADABAS. It would have been better to stick to the ISAM data management, in order to "consume" less computer resources compared with the data to be administred and compared with the retrieval needed at that time. But nevertheless it would suit the higher education institutions very well to have the leading edge of the technology implemented in their administrations, compared with the "right size" corporate enterprises.

(3) **The "information" aspect:** European higher education institutions have recently tended to be more exposed to a competitive "market" of higher education and research.

The more autonomy they are granted in that sense and the more they have to care about their strategic uniqueness and their market niche, the more their chalienges are converging to those of the corporate enterprises. Executive managegement information, especially for the managers on the academic side of the enterprise university (President, Vice-Presidents, Deans) gains increasingly in having a strategic relevance. The information domains focus not only on the resources, processes and performances of the institution, but on various aspects of the institution's environment.

(4) **The "implementation" aspect.** University administration in Europe has more in common with public administration than with business administration. Although public administrations often show in their organizational structures quite a lot of hierarchical levels, the daily work and administrative processes of the subordinates seem rather to be shaped by laws and fixed regulations than by the guidance of the respective leadership-level persons. As a consequence often subordinate clerks have more influence on the implementation of computer support than the respective leaders of the administrative department or than the chief administrator. Although this might be beneficial for the motivation of the clerks it bears the danger of perpetuating organizational structures and impeding strategic decisions as regards the university administration, strategic decisions that could be made in the course of computer support implementation.

3.2 Premises, Goals, Objectives, and Concepts for the Next Steps of Administrative and Management Computing

It should be stressed once more that the next step of administrative and management computing in higher education is both a continuation of the decentralization together with the spread of departmental computers and systems, and the re-integration based on computer networks.

The premises, goals, and objectives of the next step are stated rather similarily by all institutions that are going to work out concepts, as follows:

- The concept of the central administrative computer should be abolished as far as possible. Departmental computers should be the prevailing concept of administrative computing.

- All levels of the university's administration should be supported by computers and systems. The amount of data to be stored and handled is no longer a criteria for automation.

- Access to data and the general user-interface should be highly comfortable.

- Access to "central" files (i.e. to departmental computer systems in the central university administration) should be provided for those who need this information for administrative or decision making purposes.

- Whatever transfer of data and documents is necessary inside the institution, it should be handled electronically and not by paper-documents. Data-input should not be necessary more than once in the flow of the administrative process.

- The primary goal of the so-called office automation is to implement word processing everywhere from the scientist to the secretary.

- Message handling (MHS) seems not to have the highest priority inside and between German higher education institutions.

- There is an increasing demand for better, faster and desk-top information for all levels of university management, now for the chief executives as well.

- Data security and privacy as regards personnel data (student record files and personnel records) seem to have a very high priority with severe consequences for all concepts of networks and access to data. Administrative and statistic data have to be seperated from each other. Academic and administrative computing stringently seperated.

These premises, goals and objectives lead to some common traits of the concepts that have recently been developed at various institutions:

- Administrative departments are to be supplied with their own computer to run only the one system or the set of very closely related applications for this department. There are indeed four models for the departmental computer configuration, usually mentioned in the plans and concepts: (1) The MS-DOS PC with Clipper/dBase or Informix as relational database systems for those applications with only one user and rather limited data sets to be adminstred. It is also the typical configuration for the rather small decentralized administration in the academic departments, in academic institutes or in the research projects with their own administrations. (2) The second model is the Unix-computer for those applications and administrative departments with more than one user at a time. The relational database and the programming language used are Informix and 4GL. (3) The third model, being just an alternative for the same multi-user constellation consists of a PC-network, using Novell as network software and having a central file- and network-server (386-PC). (4) The fourth model consists of a combination of both, the Unix computer with PCs instead of non-intelligent terminals, and the underlying reason for this model is a combination of central and decentral computing at the individual working place.

- Data and document transfer between administrative departments and systems in the course of administrative task fulfilment should no longer be handled on paper basis but rather electronically. Although direct update from one system to another department's system would be imaginable, file transfer with subsequent update by the clerk responsible for the receiving system, is the favoured model according to the present concepts.

- To handle the data communication and transfer of data and documents between the seperated administrative computers and applications online, an adminstrative network is being planned. This network usually has two components or units: the central university administration and the decentral administration in the academic departments.

- Because of the extraordinary high security, privacy and confidentiallity requirements the academic and the administrative network are thought to be seperated physically almost totally. In fact there are four quasi seperated "planning units" as regards computer support and networking in German higher education institutions with only few overlap: the central administration, the decentral academic administration, the academic computing, and the library including access to external data bases. The main interface necessary for all four units is the access to external communication facilities: the German Academic Network (DFN) including all X25 facilities.

The fact that there is only little overlap is due rather to the security and privacy requirements (especially with regards to student and personnel data) than to other reasons based on the working processes. In case the academics need access to administrative or statistical data they have to use the academic administration terminals with their access to central information files instead of academic computing facilities.

- Even the link between the decentral academic and the central university administration is thought to be somewhat "buffered" for the same security and privacy reasons: three alternatives are to be found in the university concepts: (1) If direct access to the administrative computer and files is planned to be allowed at all, it is a read-only access, using the retrieval programmes provided on the administrative computer, and documenting every successful and unsuccessful attempt at access to data. Whenever update in central administrative files is necessary it will be handled through file transfer, the transferred files being used for update by the central administration clerks themselves. (2) Information retrieval according to the second even more "secure" alternative takes place on seperate information files to be maintained on seperate computers in the network and to be fed periodically from the administrative systems. (3) The most consistent "buffering" alternative is a requester/server or mailbox-concept, where the decentral requesters formulate their information retrieval requirements through a message handling system into a central mailbox, and central administration clerks answer the request by means of e-mail after having looked into their mailbox.

- Both for security reasons and for the reason of user-friendly and easy-to-handle user interfaces, the concepts provide for or even mandate the "hiding" and "locking" of the operating system and its operations against direct user interference. In the case of single user PCs often security software such as Safeguard are declared mandatory. The most advanced concepts even think about common user interfaces to take over the control for all applications or even sub-functions of applications on one terminal at one working place. On Unix computers Uniplex and Q-Office are examples to be investigated in further detail.

- The re-integration phase seems to provide the maturity of computer-technology for direct executive support. The more advanced concepts contain special sub-networks linking at least the President, the Vice-Presidents, the Chief Administrative Officer, and the institutional research and planning office together, with nodes consisting of MS-DOS PCs or MacIntoshs, the latter using new user interface concepts such as Hypercard. The primary goal of executive support seems however not to be communication on the base of a message handling system, but rather direct executive access to information. The following information elements are planned to be implemented and maintained (the maintenance being the most crucial and sensitive parameter in this kind of executive support systems):

  - "self-discriptive" data with respect to the individual institution
  - non-numeric, verbal information on the individual institution (role and mission statements, central and important decisions etc.)
  - inter-institutional comparative data on critical success factor areas
  - general higher education related data, describing the relevant environment of the institution (highly aggregated statistical data, economic data, demographic data etc.)

- non-numeric, verbal information of importance for the institutional policy and decision making (such as statements of legislators and politicians, information on federal and state financial programmes and initiatives, definitions of data elements etc.).

4. Problems of Planning and Implementation of Administrative and Management Computing

The following section is based on the experiences in the "big system" and the "decentralization" phase and is extrapolated into the phase of "re-integration" with its specific characteristics. It is also an attempt to find answers and solutions to problems that emerged during planning and implementation processes.

4.1 Comprehensive Planning or Incrementalism

Comprehensive planning in the past turned out to impede rather than to facilitate quick responses to computer service need in the university administration and to technological opportunities. The technological development and prices of computer hardware are changing so rapidly that plans tend to become obsolete at best soon after their completion. A thoroughly and comprehensivley conducted analysis of word processing need of a whole university in 1984, e.g., ended up with the recommendation to install at most of the word processing places electronic typewriting machines (with one line displays and small memories), whereas today 286-PCs and laser printers at places with intensive word processing activities seem to be the common standard. The coordination function of central university wide plans with regards to the variety of computer hardware and software (including administrative applications as well as word processing) on the campus can be achieved more "silently" and indirectly by offering central services for only selected hardware and software on the campus, such as training for users, maintenance, consulting and "trouble shooting" hot lines. Today one should really count on the normative and standardizing forces of the so-called "industry standards" and standard software available in the MS-DOS and Unix environment. Networking, of course, needs somewhat more planning, but one should not hesitate to plan for and implement sub-networks, which even take better account of security and privacy aspects than comprehensive administrative or campus-wide networks.

4.2 State-wide (System-wide) Co-ordination

There are some states in the Federal Republic of Germany with rather extensive state-wide coordination mechanisms concerning almost all university administrative computing items, with the aim of unification and for economic reasons. One stringent means of state coordination is a central state budget for all administrative computing purchases and decisions to be made centrally in coordinating committees on the state level. There is one major advantage to be emphasized with regards to this central coordinating model: It assists the university administrations to survive the competition with the academic computing investments, which often would leave only very small "budget bits" for administrative computing facilities. State central recommendations, decisions and budgets may back the technological advancement of administrative computing. But the disadvantages seem to overshadow the advantages of state central decision making committees: Those university administrations or administrative departments which do not really want administrative computing facilities may easily hide their reluctance behind the long lasting coordinating processes while these processes at the same time tend to impede a quick decision for those administrations which urgently need and would like to implement computing support.

Coordinating and decsion making committees tend to require each PC to be decided upon in the central committee meetings!

4.3 Academic and Administrative Computing Relationships

Most institutions have their academic senate committee to decide upon the big investments, regardless whether academic or administrative support is under review. Especially in the "big system" phase of administrative computing this decision making structure as a result treated the university's administration as as "stepchild" with regards to computer facility investment. One solution would be to decentralize decision making on computer facilities by decentralizing budgets. But again the budgets for administrative computing might be limited too much in favour of academic computing budgets. The best solution is, of course, an enhanced visibility of administrative computing services for the academics, i.e. quick and direct online access to data they might need for their administrative, teaching and research activities. This kind of "involvement" of academics in administrative computing outcomes indeed showed less reluctance towards administrative computing investments in recent decison making processes. Compromises have to be found between high standards of security and privacy protection on the one hand and quick and easy-to-handle retrieval facilities for the academic side.

4.4 The Role of the End-User

As stated earlier the final end-user of public administrations including the university administration is rather powerful as to the organization of his/her work and administrative processes. This power extends to the formulation of requirements towards the data processing systems' developers and the implementation and processing of these systems. It does often, especially in the case of big administrative departments, not suffice, to have only one person responsible for the definition of user requirements towards the system developers, one person who rather tends to become a data processing expert than to remain the advocat of the user-requirements. Rather especially in the implementation phase, one should build on "concentric circles" around those users who show special identification with the new technology, who received special training, and who could help guarantee the motivation and immediate problem solving more than any other more centralized organization of user support.

There is however the danger that the relative power of the administrative end-user leads to a perpetuation the way in which administrative tasks are fulfilled. End users might tend to formulate requirements for automation such as not to change the flow of processes at all. Unless one does not succeed in involving the leaders in this process and build on their responsibility for the overall efficiency of university administration, the benefits of computer technology for the administraion will not be fully appreciated and used. The involvement of the Chief Administrator of the institution and of the President in the hard- and software implementation decisions and processes seem to be crucial, especially in the phase of re-integration, where things can really be changed.

4.5 Responsibility of the Central Administrative Computing Staff

As ever in organizations the motivation of the individual is more crucial for the fulfilment of the organization's functions than formal structures and responsibilities.

In the phase of decentralization it was indeed an undoubtable experience, that those implementations of administrative systems worked best, where the end users felt responsible for everything, from requirements analysis to the daily running of the departmental computer and the daily back-up of the modified departmental data files. This "informal" or non-formalized responsibility cannot however serve as the model for administrative computing organization, especially in the case of network facilities existing in the university administration. There should be a stable and secure responsibility at a university central administrative staff level for the maintenance of hardware and software of the decentralized computers as well as for the network, training, immediate trouble shooting, further developments of software especially to serve additional retrieval requirements. There is however a shift in the activities of these staff members to be perceived from daily running of the administrative systems to more long term activities and ad hoc involvement in exceptional situations in the course of the daily running of the computer systems.

4.6 Self-made or Purchased Standard Software

Several reasons in German higher education administrations suggest the preference for standard software for administrative support. Institutions usually have not enough administrative computing staff in order to do both maintaining existing software and developing new software systems for the administration. To have students of computer science or business administration programmes develope systems in the context of courses or examinations, did not proove a valuable approach. The use of methods, tools and principles is more important for the students' learning process than the immediate result for the university administration, and there is a lack of continuity in the maintenance of these "academicly" self-made systems.

Due to common laws and regulations, some of them even on the federal level, others at least on the state level, and being applied mandatorily by all institutions in one state, the implementation of "standard systems" seems to be possible. These "standard systems" provide at least support for the so-called core functions of the administrative processes in the institutions. With the central administrative computing staff remains however the task to do the adjustments (especially additional and special retrieval functions) at the margin of the core systems.

4.7 Laws and Regulations

The often most influencial laws as regards the planning and implementation process of computer support in university administrations seem to be the law to garantee formal participation (co-determination act) and the law garanteeing privacy and protection of personnel data. There is no other solution for the success of the system implementation as to involve those being the formal representatives of participation and data protection as early as possible in the process of planning and implementation. If the final end-users are really convinced about the benefits of the new systems then there is no reason for those formal representatives, who rather tend to defer or even to impede computer support implementation, to oppose heavily. Severe data protection and privacy laws impact the decoupling principles and mechanisms between administrative support and retrieval functions for others than central administrators, that have been described earlier in this paper in the context of university wide networks.

4.8 University Management and Administrative Computing

University Management, be it the middle management level of administrative department heads, the Chief Administrative Officer or the President have not been involved enough in administrative computing decisions in the past. Administrative computing can however benefit greatly and even receive its major incentives from management requirements. Its early attempts owes administrative computing to the management information requirements (compare the MIS approach in the late sixties and early seventies which marks the birth of administrative computing in German higher education institutions, which was however more directed towards state and federal state level management information than towards the support of institutional management).

University Management involvement in administrative computing planning and implementation seems to be crucial, in order:

- to overcome the perpetuation of once existing administrative structures and to fully use the efficiency potentials of computer technology
- to fully set to work the strategic importance of administrative computing
- to fully use the potential of present computer technology with regards to executive support.

The development and use of executive support systems by the executives themselves may not only impact their involvement in administrative computing issues but may also shape decisively the administrative support systems which then will have an additional function to supply executive support systems with aggregated data automaticallly and periodically.

5. Conclusions

German higher education administrative computing has undergone and is still in the process of a "dramatic" decentralization of computer hardware and software implementation and use, with the prevailing concept of seperate departmental computers. The main emphasis of this phase of administrative computing support was laid on very high standards of the individual clerk's work support and on very user-friendly and easy-to-handle user-interfaces. The next step, a re-integration of the seperated computer and system facilities, will help reduce the paper-based interrupts and data input with regards to the clerk's work.

But perhaps the even more important benefits of this next step of administrative and management computing will be the direct access to data and information by those in some distance from the daily administrative processes, i.e by the institutional managers. The executive support system perspective seems to be the most interesting perspective of this future era.