INFORMATION SYSTEMS FOR MANAGEMENT IN THE EIGHTIES

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A course in Management Information Systems must prepare future users and information systems professionals for their roles in analyzing application requirements and designing information systems to serve business and individual needs. The objectives, organization, content, and methods used to teach this course to both MIS and non-MIS majors within the School of Business at Southern Illinois University are described in detail. The systems development project, which involves students in learning tools and techniques for structured systems analysis and design, as well as in applying these methods to an actual design project, is one of the most important activities of the course. Students have an opportunity to work together in their respective roles as users and systems analysts and to use project management and control techniques to assure effective results.

Introduction

In his study of data processing growth, Richard Nolan describes a series of stages companies go through as they develop and learn how to use computer-based information systems.[1] At the initial stage, cost-effective accounting applications are introduced. Initial success generates enthusiasm for data processing, and rapid, uncontrolled growth of data processing systems. It isn't until stage three, when data processing moves out of its entrepreneurial phase, that formalized planning and control mechanisms are put into place. At this point in time, users become accountable for selecting which applications will be developed.

In stages four and five, the introduction of data base and communications technologies facilitates the sharing of data supporting management information systems. Database technology leads the way to a new phase, known as data resource management. Using data base query languages and application development tools, managers can gain access to information supporting decisions they need to make.

In the current corporate environment, many firms are experiencing the transition from management of computer technology to management of data resources. Increasing pressures on information systems professionals to create new applications have created an application development backlog ranging from two to five years in most firms. At the same time, there are insufficient numbers of trained programmers and systems analysts to fill current needs. Yet, new application development tools, such as data base query languages and application generators, provide opportunities to enhance programming productivity and to enable end-users to design their own applications.

In addition, managers in the eighties will be using a wide variety of information technologies, such as personal computers and office automation systems, to improve individual productivity. To use these new technologies effectively, managers must understand their application requirements and the systems development process. A course in management information systems must not only provide future managers with concepts but must also train them to become knowledgeable users of information technologies. The purpose of this paper is to describe in detail the objectives, content, and methodology used to teach such a course.

Objectives

The course in Management Information Systems is required of both MIS and non-MIS majors within the School of Business. Students completing the course should have:

1. A working knowledge of DP terminology and hardware/software concepts.
2. An understanding of frameworks for information systems.
3. An understanding of the role of general management in formulating DP plans to support corporate goals.

4. The ability to apply tools and techniques used in structured systems analysis to a systems development project.

5. A working knowledge of systems design, including the review of alternative design options and development of application specifications.

6. An understanding of the human factors in systems design and implementation.

7. The ability to apply techniques of effectively managing and controlling data processing projects.

8. An awareness of end-user application development tools, personal computing, and office automation.

Course Organization and Content

The following review of major topics covered in the course includes a description of content and methodology.

Frameworks for Information Systems

At the beginning of the course, students are introduced to the functions of management: operations, control, and planning. Information systems supporting these managerial functions are designed to process day-to-day business transactions (operational level), to provide information for effective allocation of resources within the organization (control level), and to generate information useful in identifying objectives and opportunities (planning level).[2] Using this framework for information systems, students work on cases to determine the current coverage of operational, control, and planning systems.[3] Their analysis serves as a basis for developing an MIS strategic plan which outlines application development opportunities supporting corporate business objectives.

Planning: Identifying Information Needs

Since both users and computer professionals participate on corporate steering committees to identify application development priorities, students preparing for these roles should be familiar with successful planning approaches. Students are introduced to two planning approaches used to define both corporate as well as individual manager's information requirements. The first, known as the Business Systems Planning (BSP) methodology, is used to define the information requirements of the total organization.[4]

During a BSP study, interviews with managers representing various functions within the firm are used to define critical business functions, data classes supporting these business functions, and data elements supporting these data classes. The purpose of the BSP methodology is to define data elements that are shared among a number of business processes, and used to support a variety of application requirements. Once these data classes are defined, an information architecture describing which applications should be developed first is created.

The second planning methodology, designed to assist individual managers in defining their own information needs, is John Rockart's Critical Success Factors approach.[5] In the course of his work, each manager uses certain indicators to determine whether or not certain things which are critical to the success of the business are going successfully. A Critical Success Factor defines "what must go right" for a particular business to be successful. In the supermarket industry, for example, a Critical Success Factor is effective inventory control. Once a CSF has been defined, a measure to determine whether it is being achieved can be designed. These measures can suggest what computer-based information systems should be developed. In the supermarket industry, for example, point-of-sale inventory control systems support their CSF's.

Systems Development Process

The next phase of the course, systems development, includes the analysis, design and implementation of computer-based information systems. During this phase, students work on teams consisting of MIS and non-MIS majors and complete a major case.

Structured Systems Analysis: Tools and Techniques. During the analysis phase, the following activities are included:

1. Problem definition.

2. Logical data flow diagram of the existing system.

3. Organizational analysis.

4. Statement of system objectives.

During the analysis phase of the project, students apply structured tools for analysis to a case problem.[6] A physical description of the existing system is used to develop a logical data flow diagram of the existing system.[7] There are a number of reasons for using the logical data flow diagram. First, experience indicates that users need a logical model of the current information system to understand current business processes, information flows, and data requirements. Errors made at the analysis phase of a project cost many times more to fix at later phases, and particularly after programs have been designed, coded, and tested. These errors are often made because the user and analyst didn't agree on requirements during the analysis phase.

The logical data flow diagram provides the user with a total view of the total system and subsystems. Using the logical DFD, tentative automation boundaries can be defined. Other tools and techniques for analysis which are covered include the logical data dictionary, which describes data elements and their characteristics; the direct immediate access diagram (DIAD),

which defines secondary indexes for the files; and decision tables, which depict logic governing various processes.

The reason why such tools enable the user and systems analyst to talk the same language can be explained using the decision table as an example. In many cases, a systems analyst or programmer tries to determine the logic of a policy or procedure which is stated or written in English narrative. A slight mis-interpretation of a policy with multiple conditions and multiple actions may not reflect the user's intent. The error, however, may not be found until after the erroneous logic has been coded into the program. The cost of re-designing the program is quite a bit higher than the cost of additional time documenting program logic during analysis.

During the analysis phase of the project, it is also important to describe current organizational structures and tasks. Some of the tools which are useful here are the organization chart, a task analysis of major jobs, and a function chart depicting major functions and subfunctions.[8] These tools are important because automation may affect the way in which work is distributed, the way certain functions are performed, and the way in which jobs are designed.

At the end of the analysis phase of the project, students state the objectives for the new system. These objectives are stated in business terms, and are measurable. For example, a business objective may be: improve sales reporting by assuring that the Daily Sales Analysis will be available at 9:00 a.m. every morning. A good design must enable the user to achieve these objectives.

Systems Design: Tools and Techniques. The systems design portion of the project gives students an opportunity to develop:

1. A revised data flow diagram.
2. A revised organizational design.
3. Review of alternative design options.
4. File design.
5. Forms design.
6. Cost-benefit analysis.

The first task of the design phase is to develop a logical data flow diagram for the proposed system.[9] During the analysis, a number of problems with the existing system, such as redundant procedures, may have been identified. The new logical model provides a good design which will enable the firm to achieve its objectives.

Another requirement is the revised organizational design. A proposed organization chart, along with a new function chart describing the hierarchy of new functions, are two tools which provide effective ways of documenting changes in job responsibilities as well as the re-organization of functions.[10]

The process of design involves the review of a menu of alternative design options, which may include a batch, an on-line, distributed, or dedicated microcomputer system.[11] Students are given a menu of realistic alternatives for the specific case they are using for the project. The menu may include three alternative microcomputer-based systems, with appropriate hardware and software options detailed.

During this part of the project, team members set up criteria for evaluating alternative design options. Then, each team member visits a vendor and reviews one of the three alternatives. After the demonstrations and individual analysis, members compare the alternatives using the pre-established criteria for evaluation and then select the best system. Since many of the projects' requirements can be met with the use of microcomputer-based systems, students are usually able to obtain demonstrations and supplementary materials from local computer stores and retail stores. This experience is one of the most valuable aspects of the project.

Two other design requirements fall under the area of physical design. Students are required to design one of the forms to be used, and to design one major file. This exercise includes the logical record layout and description of data elements in a logical data dictionary. These projects provide a chance for these potential users and analysts to become involved in developing specifications for the new system. In advanced courses, the MIS majors have an opportunity to design forms, files, source documents, and report layouts.

Cost-Benefit Analysis. In addition, students are asked to do a cost-benefit analysis for the best design option. In doing so, they look at both recurring and non-recurring personnel costs, equipment costs, supplies and expenses, as well as overhead costs. This is done for the start-up year as well as for the first five years of operation. Using net present value analysis, the students determine the benefits of the system, and the potential return on their investment. Both tangible (hard dollar savings) and intangible (soft dollar savings) are built into the analysis.[12]

Project Management and Control. A systems development project requires effective monitoring of major project activities and the completion of a number of tasks. Since students work on the project in teams, they are asked to distribute work and to report on project activities. Each group member keeps a record of time spent on individual tasks and the total group efforts are recorded.

The major tool used is the Gantt Chart, which keeps a record of project status. The Gantt Chart indicates the estimated dates on which jobs are assumed to start and to end, and also depicts the actual dates on which jobs are started and completed. The value of using the Gantt Chart is that it charts the progress of various project activities; provides an indication of what tasks are not being completed on schedule and which tasks may be completed ahead of schedule; and works as an effective time management tool to assure that multiple project activities are completed on schedule.

The systems development project is not a course assignment that can be left until the last minute. Team members must be able to live within a proposed schedule, to be accountable to their teammates for completing certain tasks within the schedule, and to develop a sense of their individual contribution as well as the total group's performance. Too often in school-based projects students believe that individual expertise will be the key to success, and often it is. However, "real world" projects require the ability to work effectively as a member of a project team. In this project, students have an opportunity not only to demonstrate individual skills but also to coordinate their efforts with others.

Systems Implementation. During the implementation phase of the project, the students are asked to make specific recommendations in the areas of training, testing, and conversion. In the training area, the recommendations may include a training plan, including who should be trained, when training should occur, what materials will be used, etc. A plan for testing the new system may include a discussion of testing procedures, types of test data, testing of application software, as well as effective methods for testing, reviewing and adapting new methods and procedures into the work environment. Finally, students are asked to suggest what conversion method (parallel, dual, pilot) might be most effective.

In summary, the systems development phase of the course is an opportunity for students to learn how to use tools and techniques for systems analysis and design and to apply them to a practical case exercise. In effect, the students not only learn the tools, but also learn how to use the tools. In the process of completing the case, they learn which tools can be most effectively used during various phases of the project life cycle. Often, business criticizes educators for providing too much theory and not enough practice. Educators, in turn, argue that understanding the theory is essential for constructive practical application. By teaching the tools and techniques that can be used by managers and systems analysts as well as the practical application of these tools and techniques, the MIS educator answers the challenge of business to provide meaningful training.

The systems project not only teaches skills and their application, but also trains students to use planning and control techniques to monitor individual and group performance. In the real world, project time and cost overruns can be a source of frustration to both users and computer professionals and both must be prepared to overcome these problems by applying project management techniques.

Finally, one of the greatest values of a project is that both MIS and non-MIS majors work cooperatively on the analysis and the design of the new system. Ineffective coordination and lack of communication between users and systems analysts have been issues which have been consistently reported in the literature and which have impeded the effective development of systems. In the classroom, the MIS students (who serve as analysts) and the non-MIS students (who represent users) are mutually accountable to each other throughout the systems development process. In the actual business situation, the systems analyst and the user must work closely and cooperatively on project teams.

End-User Application Development

The next major topic of the course is end-user application development, including technologies supporting end-user computing and tools and procedures supporting the involvement of end-users. The introduction of application development tools, such as report generators, data base query languages, and application generators has provided new opportunities to improve the productivity of computer professionals as well as to involve users in developing their own applications. However, the proliferation of these tools has brought questions into mind, and these questions need to be partially addressed through the education of both end-users and computer professionals.

One question which is relevant to this course is: how will these new technologies affect the systems development process, and in particular, the role of the systems analyst and the end-user. One view is that the new application development tools will make it possible to create prototypes of systems, and use these prototypes to develop successively better versions of these systems.[13] During this process, both the systems analyst and end-user must be able to work together to specify requirements for the application. During an advanced course in the curriculum, students are given opportunities to design applications with the use of these tools.

Another question relating to the impact of the automated application development tools is whether the structured analysis/design methodologies will be appropriate. A response to this is that the use of application generators automates the coding process, but does not automate the process of analysis and design. Actually, the involvement of users in analysis/design is more important than before. In the past, most of the time and cost of developing systems was spent in detailed design and coding. Now, more attention can be spent on analysis and the development of a good design.

The tools for analysis which should be used in designing such systems are the data flow diagrams--both present and proposed; the logical data dictionary; and the direct immediate access diagrams. The structured design tools of greatest value in documenting application requirements would be structure chart and the output specification. The structure chart could be either a Warnier diagram or a hierarchy chart used in the structured systems analysis and design methodology proposed by Gane and Sarson.

In presenting the topic of end-user application development, the design requirements of these

systems should also be described. These tools are so new that simple applications can be developed within days, instead of months. As a result, many of these applications may be designed without proper documentation, controls, standards, and security precautions. These are all topics which need to be covered in detail in a course in end-user application development. In the MIS course, these topics can be mentioned as important concerns of the manager.

Productivity Tools: Office Automation and Personal Computing

The final topics, office automation and personal computing, are of great importance to the manager and systems analyst. These technologies provide new opportunities to significantly improve the productivity of both managers and administrative support personnel. Today, a manager can use an electronic spreadsheet program to do budget and sales forecasts in a fraction of the time it would take to perform these types of analyses without this tool. A secretary equipped with a word processor and data base management program can automatically merge customer records or personnel records with the text of repetitive, word processor-generated letters and finish mailings of hundreds of letters in hours, instead of days.

However, the real productivity benefits of the office of the future will come from the effective use of communications technologies to integrate existing word, data, video, and voice processing systems. Electronic mail and voice store-and-forward telephone systems significantly cut down the telephone tag which continually frustrates managers. These systems also "open up" organizational communications, both vertically and laterally, so that managers have a greater chance of getting information which is needed for effective planning and control. Communications technologies also support remote workstations and teleconferencing facilities which make it possible for managers to have access to the office information system via their homes, satellite work centers, and remote teleconferencing facilities.[14]

The effective use of these technologies will be a challenge which will directly involve the manager and will affect the role of the traditional systems analyst and computer professional. The effective use of these technologies will depend upon planning, design, and implementation of office systems and micro-computer based information systems. What will be needed here, as in data processing, is a strategic planning process which enables users and office automation professionals to jointly identify office technologies and applications which can most successfully serve the business and its goals.

In addition, the office systems development process will require its own methodology, including tools and techniques for identifying application requirements and analyzing the current organization of work. Office systems design will include the design of technology as well as the design of new jobs, new organizational structures, new reporting relationships, and new work relationships--between manager and secretary and between managers and their subordinates. As a result, the analyst involved in designing the "office of the future" will have to be an expert in the office technologies as well as an expert in organizational design strategies which will make it possible to integrate these technologies into the organization itself. Office systems and personal computers will have a much greater impact on the end-user than the data processing systems of the past, and, as a result, the end-user will have to be closely involved in the systems development process for office automation.

Conclusions

The new era of information engineering has created an increased need for a course in management information systems which is relevant to both future information systems professionals, as well as managers of marketing, finance, accounting and other business disciplines. Such a course must not only include concepts of management information, an overview of hardware and software, and a birds-eye view of the systems development process, but also the opportunity to participate in an actual project. The project experience gives both the MIS and non-MIS majors an opportunity to learn how to use and to apply tools and techniques for systems analysis and design and project management control which will be of value to them in their professional lives.

In addition, new technologies for application development, personal computers, and office technologies are creating a challenge to the future manager to use these technologies effectively. This will mean increased user involvement in planning, application design, and systems implementation. These new technologies will affect the very way in which work is done, in the way people work with each other, and in the way in which the organization is designed. These systems may provide opportunities to improve office productivity, to enhance the effectiveness of managers and professionals, and to increase the effectiveness of the organization as a whole.

Finally, a course in management information systems must provide an opportunity for future information systems professionals and managers to work constructively together. This opportunity will set the stage for future cooperation and mutual accountability. As companies and other organizations evolve into stage five and stage six data processing environments, managers and information systems personnel will be jointly involved in the planning, design, and implementation of information systems supporting a broad range of data, word, image, and voice processing applications.

[1]Richard Nolan, "Managing the Crises in Data Processing", Harvard Business Review, March/April 1979.

[2]Henry Lucas, "Frameworks for Information Systems", Ch. 3, Information Systems Concepts for Management (New York: McGraw-Hill, 1982).

[3]James Senn, Information Systems for Management (Belmont, CA: Wadsworth Publishing Co., 1982). Case Study Module.

[4]Robert Orsey, IBM Corporation, "Business Systems Planning", Paper presented at GUIDE 46, General Session AS-1, May 24, 1978.

[5]John Rockart, "Chief Executives Define their own Data Needs", Harvard Business Review, March/April 1979.

[6]Chris Gane and Trish Sarson, Structured Systems Analysis: Tools and Techniques (St. Louis, McDonnell Douglas Corporation, 1981).

[7]Appendix A-1, Logical Data Flow Diagram: Existing System.

[8]Appendix B-1, Function Chart: Existing System.

[9]Appendix A-2, Logical Data Flow Diagram: Proposed System.

[10]Appendix B-2, Function Chart: Proposed System.

[11]Gane and Sarson, p. 254.

[12]Philip Semprevivo, Systems Analysis: Definition, Process, and Design. Ch. 7, "System Cost Determination", pp. 213-230 (Chicago: SRA, 1982).

[13]James Martin, Application Development without Programmers (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1982).

[14]Harvey Poppell, "Who Needs the Office of the Future?" Harvard Business Review, Nov/Dec 1982.

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