How useful is DSS for school management?

Kang Duk-su *

I. Introduction

Management is a dynamic system which involves constantly changing environments, technologies, and philospohies. Thus the basic function of modern management has become management of disturbance, problem solving, or decision making.

Decision making is the most fundamental function of modern management. As a matter of fact, Herbert A. Simon[1], an eminent scholar of management and Nobel laureate in 1978, states that decision making is synonymous with management. Also, David W. Miller and Martin K. Starr, professors of management at Colombia University and well-known experts in management point out that managers are evaluated on the basis of their performance in decision making. Organization and managers constantly seek ways to be more rational and systematic in making decisions to improve the quality of decision making.

School management is a process by which certain goals are achieved through the use of resources (people, money, energy, materials, space, time). These resouces are considered to be inputs, and the attainment of the goals is viewed as the output of the process as shown in Figure 1.

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* Assistant Professor, College of Education

1) Sang M. Lee., Introduction to Management Science (The Dryden Press. 1983), p. 3.

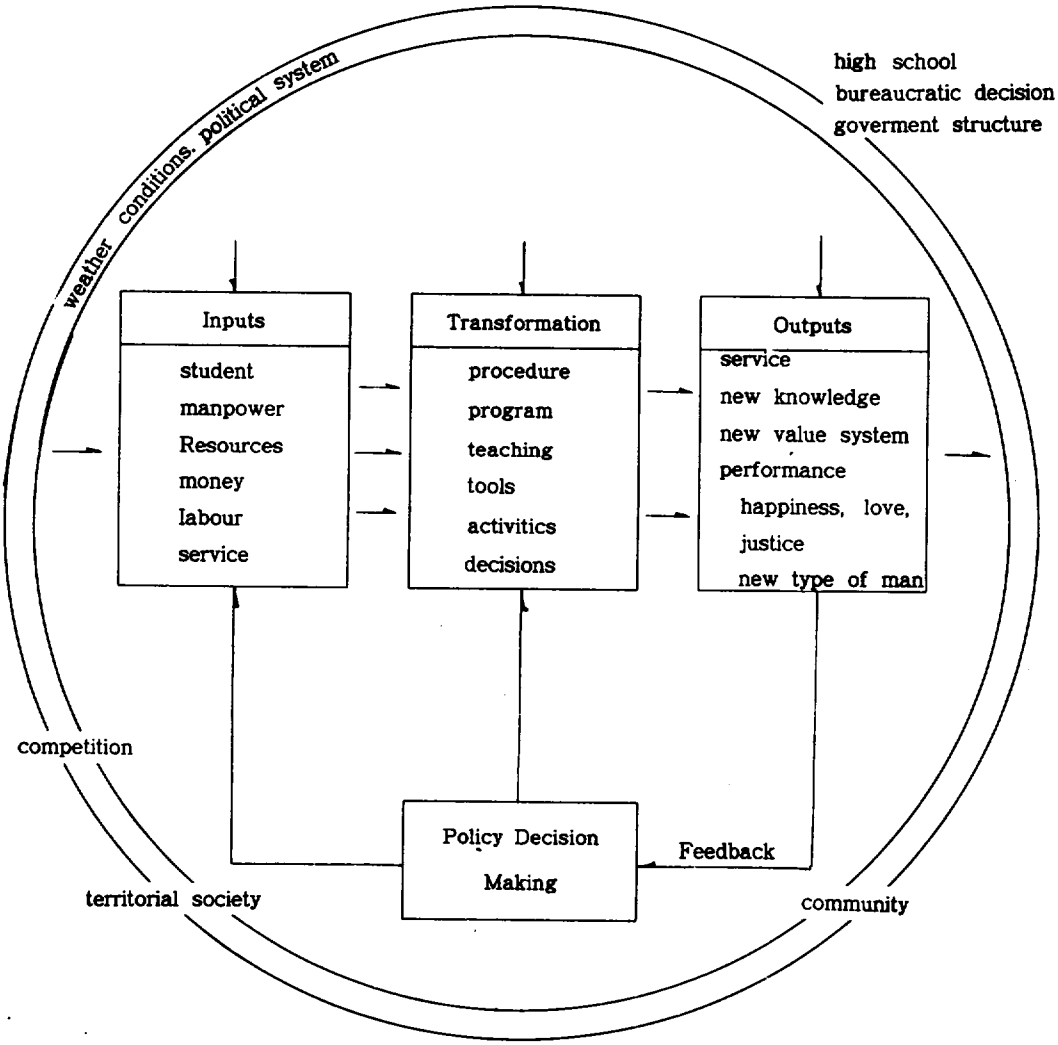


Figure 1. Input—Output Model of a University

The success of management depends on the execution of certain managerial functions like planning, organizing, directing, and controlling.

To carry out these functions, managers are engaged in a continous process of making decisions. However school management operates in changing environment.

Factors such as technology, information computers, school size, structual complexity, competition, political stability and goverment intervention affect the decision making.

As J. Naisbitt pointed out in his book, we live in the 3rd wave, (information age) here

technological advancement becomes a major determinant of our life-style. We can not achieve the success of management or productivity without concurrent advancement in management systems.

The purpose of this paper is to study how the computer information system helps the school administrator to increase the productivity of their operation.

Ⅱ. School and Its Environment

School is a system which is an organized, unitary whole composed of two or more interdependent parts, components, or subsystems and delineated by identifiable boundaries from its environmental suprasystem.

Kast and Rosenzweig[2] explains that the organization as a subsystem of the society, must accomplish its goals within constraints that are an integral part of the environmental suprasystem.

The organization performs a function for society; if it is to be successful in receiving inputs, it must conform to social constraints and requirements. Conversely, the organization influences its environmental suprasystem.

The technical subsystem refers to the knowledge required for the performance of tasks. The technical subsystem is determined by the purposes of the task requirements. The system is shown in Figure 2.

Kast and Rosenzwing think of the enviroment in two ways : (1) the societal (general) environment : culture, technological, educationla, political, legal, natural resource, demographic, sociological and economic.

(2) the task (specific) environment : customer, suppliers, competitor, socio-political, technological.

2) Fremost E. Kast and James E. Rosenzweig., Organization and Management (McGraw-Hill, 1979) pp. 13-22.

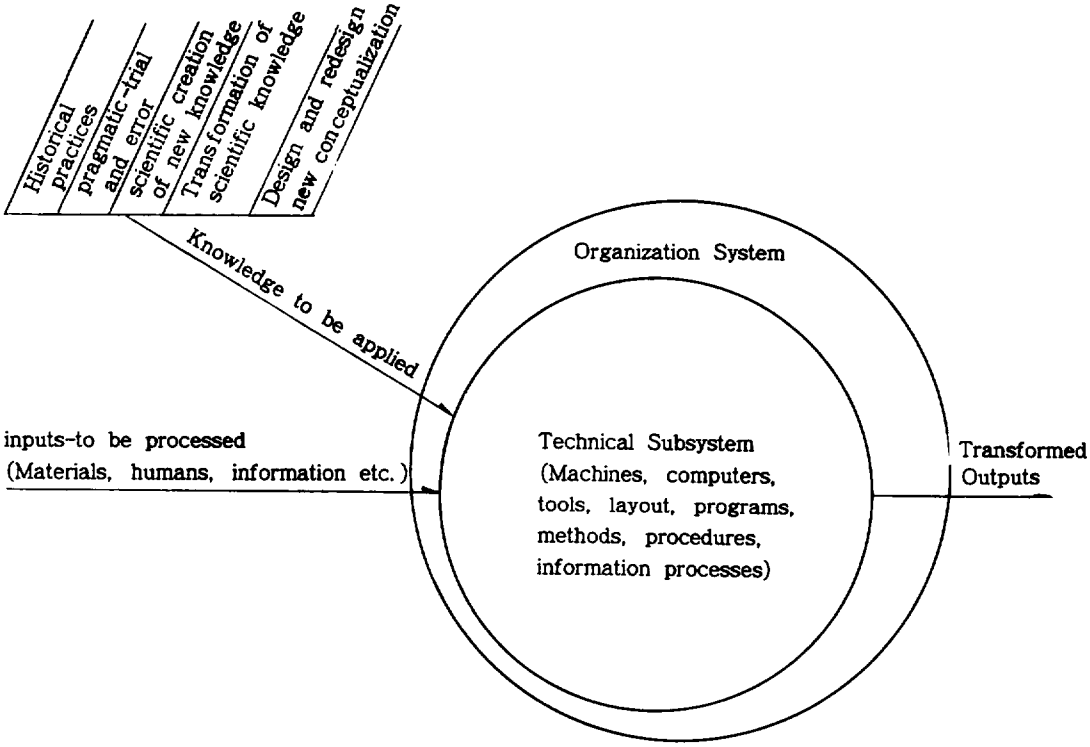


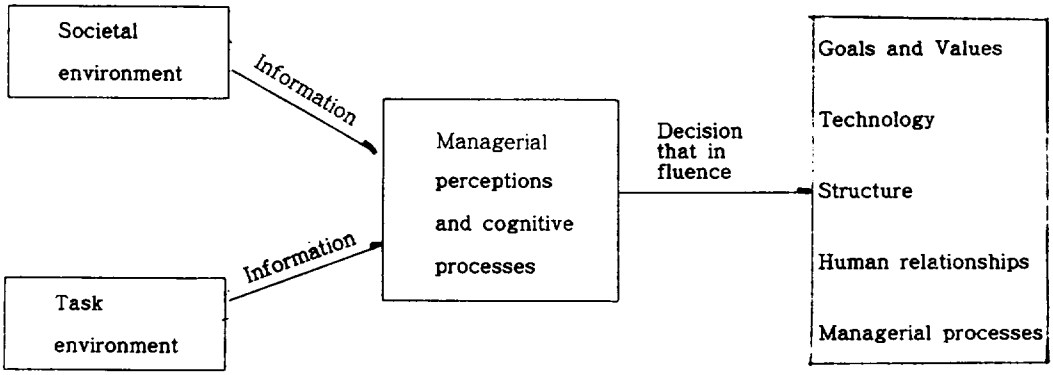
Figure 2. SOURCE : Fremost E. Kast/James E. Rosenzweig., *Organization and Management* (McGraw—Hill. 1979) pp. 178.

The task enviroment has an impact on the goals and values, structure, technology, human relationships and managerial processes within organizations. But the cause seffect relationship is not simple or clear scut.

The "objective" or factual characteristics of the environment affect organizations, but the perceptions and beliefs of internal members, particularly managers as decision makers, are equally important. Information from the outside is passed through perceptive and congnitive (thinking) processes that result in detisions affecting internal characteristics of the organization.

Figure 3. illustrates this process.

In the most general sense, technology refers to the application of knowledge for the more effective performance of certain tasks or activities. By organizational technology we mean the techniques used in the transformation of inputs into outputs. When we talk about a change in the technology of the organization and its impact on the structure and human relationships, we do not discuss only the impact of such mechanical devices as



Figuere 3. SOURCE : Fremont E. Kast/James E. Rosenzweig., *Organization and Management* (McGraw-Hill, 1979). pp. 135.

computers but also consider changes in the nonmechanical technical system. The university receives inputs of students transforms them through some process of eductaional technology, and then returns them to the broader society. This view of organizational technology is also illustrated in Figure 2.

Ⅲ. How have computerized decision tools evolved?

We used computers as aids to support managerial decision making for over last two decades. We can group the computerized tools into five categories as below.

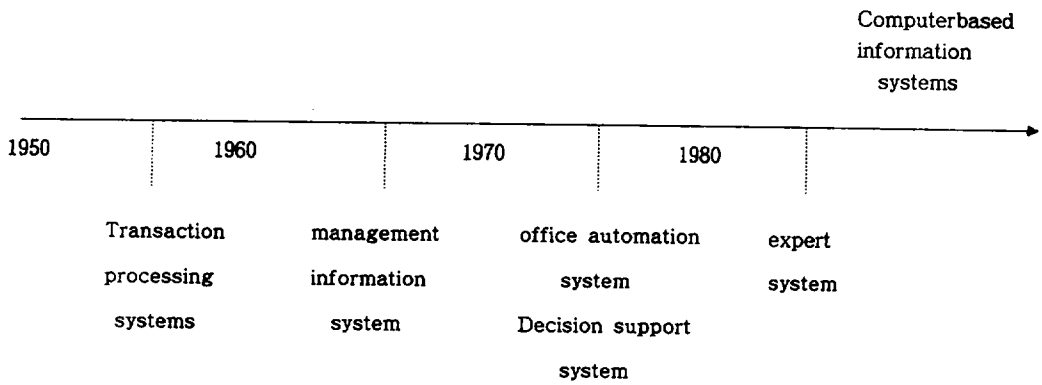
The evolution of computer-based information system(CBIS) may be drawn as below. Effrain Turban classified the attributes of computerized systems in several dimensions as shown in Figure 5.

An unstructured problem is one in which none of the three phases is structured. Decisions where some, but not all, of the phases are structured are referred to as semistructured by Gorry and Scott-Morton.[3]

3) Peter G. W. Keen and Mochael Scott Morton,, Decision Support Systems : A Organizational Perspective (Addison-Wesley. 1978) p. 87.

Phase	Description	Examples of Tools
Early	compute, "crunch numbers", summarize, organize	Calculators; early computer programs; statistical models simple operations research models
Intermediate	Find, organize, and display decision-relevant information	Data base management system, MIS, filing systems
Current	Perform decision-relevant computations on decision-relevant information, organize, and display the results. Query-approach. "What if" analysis	Financial models, spreadsheets, trend exploration, operations research models, CAD system, decision support systems
Just beginning and the future	Interact with decision makers to facilitate formulation and execution of the intellectual steps in the process of decision making	Expert systems

Figure 4. (source : Effrain Turban., Decision Support and Expert System : MacMillan. pp. 14.)



Dimension	Transactions Processing Systems (TPS)	Management Information System (MIS)	Decision Support System (DSS)	Expert System (ES)
Applications	Payroll, inventory, record Keeping, Production and Sales information	Production control, sales forecasting, monitoring	Long-range Strategic Pianning, Complex Integrated Problem areas	Diagnosis, Strategic plannning, internal Control planning, maintenane Strategies. Narrow domain
Focus	Data Transactions	Information	Decisions, flexibility, user-friendliness	Interencing, Transter of expertise
Database	Unique to each application, batch updata	Interactive access by programmers	Database management systems, interactive access, factual Knowledge	Procedural and facdtual Knowledge; Knowledge base (facts, rules)
Decision Capabilities	No decision, or simple decision models	Structured routine problems using conventional operations research tools	Semistructured problems, integrated OR models, blend of judgment and structured support capabilities	The systems makes complex decisions, unstructured; use of rules (heuristicis)
Manipulation Type of Information	Numerical Summary reports, operational	Numerical Scheduled and demand reports , structured flow, exception reporting	Numerical Information to support specific decisions	Symbolic Advice and Explanations
Highest organizational level served	Submanagerial, low management	Middle management	Top management	Top management and specialists
Impetus	Expediency	Efficiency	Effectiveness	Effectiveness and expediency

Figure 5. source : Efraim Turban., Decision Support and Expert Systems. (1988) pp. 16

Type of Decision \ Type of control	Operational control	Managerial Control	Strategic Planning	Support Needed
Structured	Accounts receivalble, order Entry Inventory reordering	LP for manufacturing budget analysis, short-term forecasting, personel reports, make or buy analysis	Plant location financial management(investment) warehouse location Distribution system	clerical EDP or MS models transaction processing
Semistructurd	Bond trading production scheduling inventory control	Setting market budget for consumer product, Credit Evaluation budget preparation plant layout project scheduling reward systems design	Capital acguisition analysis, Building new plant managers and acquisitions New product planning compensation planning Quality assurance planning	DSS
Unstructured	Selecting a cover for magazine, Buying software, approving loans	Hiring Managers, Negotiating recruiting an executive, buying Hardware Cobbying	R & D planning New technology development, social respodsibility planning	DSS ES Human intuition

Figuere 6. Decision Support Frame Work

Why do we use a DSS? We can identify several major characteristics and benifits of DSS, some are based on Alter's observations.[4]

1. Abilitity to support the solution of complex problems.
2. Fast response to unexpected situations that result in changed input.
3. Ability to try several different stratigies under different configurations, quickly and objectively.
4. New insights and learning.
5. Facilitated communication.
6. Improved management control and performance.
7. Cost savings.
8. Objective decisions.
9. Improving managerial effectiveness.
10. Support for individuals and/or groups.

Hogue and Watson[5] conducted a survey and identified six main reaons why major corporations started large-scale DSS as below.

Factors	cited by (percent)
Accurate information is needed	67
DSS is viewed as an organizational winner	44
New information is needed	33
Management mandated the DSS	22
Timely information is provided	17
Cost reduction is achieved	6

4) Steven L. Alter., Decision Support System : Current Practice and Continuing Challenges(Addison-Wesley, 1980), pp. 95-107.

5) Hogue, J. T., and J. J. Watson, "Management's Role in the Approval and Administration of Decision Support Systems." MIS Quarterly (June, 1983)

Ⅳ. What is a Decision Support System(DSS)?

A DSS was defined by many scholars such as Alter, Moor and Chang, Bonczek, Holsapple, Whinston and Keen.

However, a classical definition of DSS by Keen and Scott Morton is as follows :[6] DSS couple the intellectical resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a cmputer-based support system for management decision makers who deal with semi-structured problems.

A still more specific use of DSS describes it in terms of a number of characteristics or attributes. For instance Sprage and Carlson[7] identify four such characteristics.

1. They tend to be aimed at the less well-structured, underspecified problems that upper level managers typically face.
2. They attempt to combine the use of models or analytic techniques with traditional data access and retrieval functions.
3. They specifically focus on features that make them easy to use by noncomputer people in an interactive mode.
4. They emphasize flexibility and adaptibility to accommodate changes in the environment and decision-making approach of the user.

Similary, King[8] has identified the typical DSS to be an integrated system that is made up of various subsystems :

1. Decision models
2. Interactive computer hardware and software
3. A data base

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6) Peter G. W. Keen and Michael Scott Morton., Decision support System : A Organizational Perspective(Addison-Wesley, 1978), pp. 57-59.

7) Ralph H. Sprague, Jr., and Eric D. Carlson., Building Effective Decision Support Systems (Prentice-Hall, Inc, 1982), pp. 25-39.

8) William R. King., "Achieving the Potential of Decision Suport Systems", Journal of Business Strategy 3(1983), pp. 84-91.

4. A data management system
5. Graphical and other sophisticated displays
6. A user friendly modeling language

Anthony and Simon's taxonomies are combined in a nine-cell decision support framework(see Figure 6).

The right-hand column indicates the information system and other tools needed to support the various decisions. Gorry and Scott Morton suggested that for the semistructured and unstructured decisions, the conventional MIS and management science approaches are insufficient. They proposed the use of a supportive information system, which they called decision support system(DSS).

A fully structured problem is one in which all these phase whose procedures are satandardized, the objectives are clear, and the input and output are clearly specified.

V. Application to University Management

Sang M. Lee and Edward R. Clayton[9] applied goal programming model for academic resource allocation.

Allen G. Greenwood and Laurence J. Moore[10] described the design, construction and implementation of a comprehensive computer based decision support system that serves as an on-line interactive decision-making environment for tuition and fee analysis at a major state university, Virginia Polytechnic Institute and State University. The DSS provides the administration with a rational and traceable, yet flexible, means to analyze and establish tuition charges.

Wesleyan University competed with other universities for the very best students, coupled with the budgetary strains. The university rethink its policies and procedures regarding financial aid.

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9) Sang M. Lee and Edward R. Clayton., "A Goal Programming Model For Academic Resource Allocation." (Management Science. Vol. 18, No. 8, April, 1972)

10) Green Wood, A. G. and C. J. Moore., "A Computer-Based Decision Support System for University Tuition and Fee Policy." (Joint National Meeting of TIMS/ORSA, Boston, Mass, April. 1985)

A five-year budget forecast predicted a potential financial crisis if this policy were to have continued. As a result, a detailed financial aid model was developed using a DSS to assess alternation strategies that could prevent the crisis. The DSS was constructed in 1979 to solve the problem. A DSS generator specifically designed for use in universities, called EFPM, was used.[11]

Resource planning in university management by goal programming by Roger G. Schroeder also provides a new look at university resource-management problem.

Alber H. Rubenstein, in a paper titled "Integration of Operations Research into the Firm" discusses the relationship of operations research to staff groups to operating groups in the universities, and predicts a pattern emerging.[12]

Simulation was beginning to gain momentum and was carried out at several levels and in several types. Richard Judy and Jack Levine[13] at the University of Toronto used their "Campus" simulator to simulate university operations as a function of time, combining the structure, level of activity, staffing, space, materials and money.

The object to prodict the way in which enrollment was going to affect the space or manpower of the school. This was one of the key institutional research problems, and this simulator was the first heuristic computer model.

Ⅵ. Implementation and Future of DSS in University.

Turban identified 9 success factors of implementation which are frequently interrelated : external environment, organizational support, user involvement and training, process and structure, change management, human factors, data factors, technical factors and project related.

If we pay special attention to the following three key issues, we can increase the

11) Oliff. M. D., "Fast Decision Support." (Procedings of the Decision Sciences Institute, national Meeting, Toronto, Canada, Nov, 1984)

12) Roger G. Schroeder., "Resource Planning in University Management by Goal Programing." (Management Science, 1973)

13) Judy, Richard W. and Levine, Jack B., "A New Tool for Educational Administrators", A report to the Commission on the Financing of Higher Education, University of Toron to Press, Toronto, Canada, 1965.

probability of successful implementation of an MIS.[14]

1. Gaining management and user commitment to the project.
2. Gaining user commitment to any changes necessitated by the new system.
3. Assuring that the project is well defined and plans are clearly specified.

Rockart[15] did a research about the changing role of the information systems executive in nine companies. He revealed several critical success factors : Top management education and communication, retaining trained, high quality personnel, reliable, high quality information system service, support from Top Management, decentralization of MIS Function and effective, efficient systems.

The above success implementation factors gives us good teaching when we apply DSS to school.

The microcomputer revolution and the advent of personal computers may be the most important factors in increasing the acceptance of DSS. Whereas a decade ago computers were viewed by the majority of people as a machine to be not accessible and possibly even feared, today computers have become so familiar that even elementary schools teach computer programming.

For example, IBM personal computer or compatible becomes very cheap and its performance is very good. Computer industry develops software to provide data for micro-based decision support applications.

As Davis and Olson[16] said that there will be more pressures for decentralized control system due to availability of low-cost technology, backlog of development work, user control over operations and organizational behaviour, decentralized control system will take place in university in the future as shown in Figure 7.

We should know that there are major limitations to DSS in the distant future. Dreyfuses[17] identified 19 statements of shortcomings of computer in their book titled "Mind over Machine."

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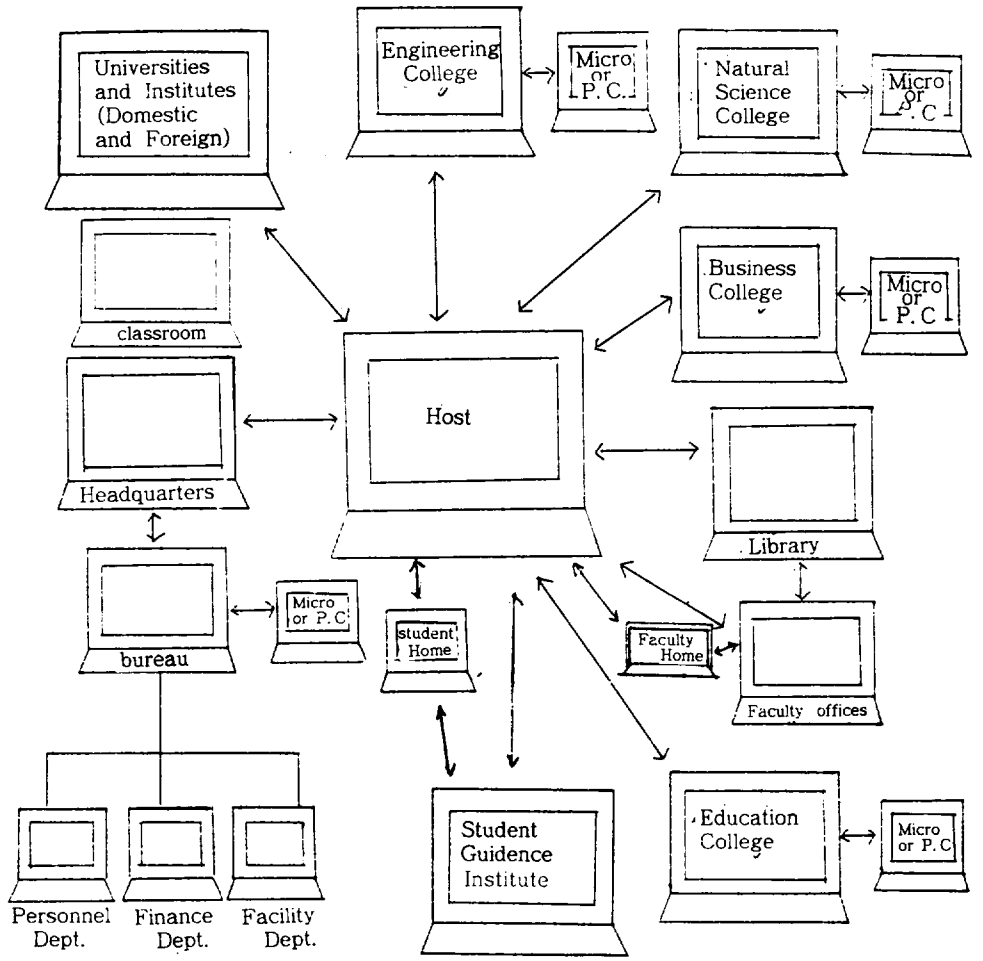
14) M. A. Ginzbegg, "Key Recurrent Issues in the MIS Implementation Process," MIS Quarterly, S : 2, June 1981, pp. 47-60.

15) John F. Rockart., "The Changing Role of the Information Systems Executive : A Critical Success Factors Perspective." (Sloan Management Review)

16) Gordon B. Davis and Margrethe H. Olson., Management Information Systms 2nd Edition (McGraw-Hill, 1985). p. 635.

17) Dreyfus, H. and S. Dreyfus., "Why Computers May Never Think Like People.", Technology Review (Jan, 1986).

However, it is worth bearing in mind Keen's[18] implication that DSS is a base for learning, not for solutions, and encourages looking at more alternatives, experimenting, and probing, although the benifits of DSS can be hard to quantify, but not necessarily to recognize.



Figuere 7. Integrated Information Flow Diagram of University in the Future.

18) Peter G. W. Keen, "Decision Support Systems : Translating Analytic Techniques into Useful Tools." Sloan Management Review, Spring, 1980.

MINI CASE

T university began to start as a community college about 40 years ago and became a national university around 10 years ago. The university was equipped with a Vax super micro computer. Before the school had the computer several years ago, the students in the dept. of busi. educ. could not use computer in their studies, although they studied 20 credit hours computer subjects according to their curriculum. Now the students are very glad to use the computer in their learning. However, the dept. students found it very hard to know how to operate the vax computer. Fortunately, a millionaire donated PCs to the school several years ago. The PC room was always crowded with students. It is hard even for professors to use the PC in the room.

Few qualified computer scientist work for the maincomputer center. The center began to deal with basic transaction data such as reporting grade, student names, pay roll and simple class schedule.

Ex prexy did not know about computer and was not interested in investing money in the computer center. The university elected the first prexy by democratic election in its general faculty meeting. The new prexy was very much interested in the center and said in his inaugural address that he will strenghten the role of the computer center, promising that he will install BITNETT system in the university to assist professor to study and teach. BITNETT system is a kind of computer network which enables us to communicate with domestic or foreign schools or institutions with the terminal. It's very good news to the facuties. Because faculties can communicate with world famous scholars in the U. S. even in his office very quickly with their computer terminal.

Because the university is a local school, the faculties and students are lack of information. Finding a job is very hard and competitive in Korea. Because of labour disputes and inflation in Korea, companies do not like to invest. So job opportunities is relatively scarce. Some universities' computer center in Seoul have a great store of information about companies. Students can utilize the data to find a good job. The computer based information system is very helpful to the student.

A very nice and modern building has been built as a main library recently in the school.

The library may make use of the computer center for its effective administration.

To become a good university, the university has to recruit good pupils in the community. So the university needs data about the high schools especially in the local community.

Each colleges may want to have their own computing system in the future. But there is budget limitation at this time. The price of micro computer or PC has been very reasonable and their performance has improved a lot due to technology development. Especially high-tech industries spend enormous amount of money to develop new technology.

Korean govn't also encourages companies to invest a lot of money in developing new technology, giving several incentives in R & D expenditures.

In the future the school authority will be encountered with sophisticated administrative problems. Because society is changing so fast. In other words, the environment in which managerial decisions must be made continues to be ever changing and ever more complex.

〈要約〉

의사결정지원시스템은 학교경영에 어떻게 유용한가?

Decision Support System(DSS)의 개념은 1970년대 초에 미국 MIT大의 Michael Scoft Morton 敎授가 經營決定시스템(Management Decision System)이라는 용어를 처음 사용한 이후로 교수들과 경영실무자들의 연구와 응용을 통해 현재의 DSS의 개념으로까지 발전해 왔다.

DSS의 役割은 당면한 문제에 대한 最適解을 自動的으로 제공하는 것이 아니라 意思決定者로 하여금 여러 代案들을 비교 검토하고 실험해 보도록 하는 등 意思決定을 支援하여 주는 시스템이다.

이러한 DSS의 개념은 주로 영리추구를 목적으로 하는 기업에서 사용되어 왔으나 본 논문은 날로 복잡해져가는 大學管理에 DSS 개념을 응용해 보면 어떨까 하는 것에 관한 연구이다.

현실적으로 미국대학에서는 (버지니아주립大, 네브라스카大, 미네소타大 등) 등록금 결정과 대학의 자원배분등에 Goal Programming 모형이 사용되고 있고, 학부모와의 의사소통을 증진시키기 위해서도 DSS가 활용되고 있다.

초기 단계에 있는 大學의 電子計算所도 기초적인 去來資料를 자동처리하는 기능만을 수행하는 단계를 극복하여 앞으로는 最高經營層(예컨데, 총장, 학장, 처장, 관리국장 등)의 戰略的 意思決定이나 학생지도, 교수의 연구와 강의 등을 支援할 수 있어서 총체적인 大學의 生産性을 향상 시키는데 까지 기여하여야 할 것이다.

많은 돈을 들여 구축한 DSS는 大學組織의 人力과 분위기의 변화를 일으키며 또 반드시 성공적으로 활용될 수 있는 것만은 아니므로 최고 경영층은 항상 問題點들을 발견하고 개선시켜 나가야 될 것이다.

최근에 와서는 마이크로컴퓨터의 가격이 매우 싸지고 또 성능은 오히려 놀라울 정도로 더 좋아지기 때문에 中央統制(centralized control) 시스템에서 점차적으로 分散統制(decentralized control) 시스템으로 바뀌어 가고 있는 것에 유의할 필요가 있다.

* 師範大學 助敎授