A COMPARISON OF
THREE EDUCATIONAL DATA PROCESSING CENTERS

by

Anthonius Padua Hardhono
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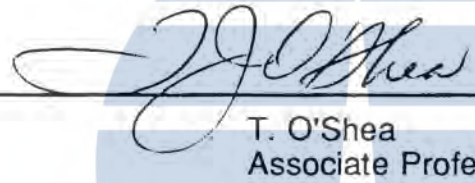
APPROVAL

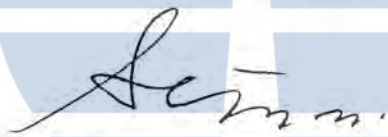
Name:	Anthonius Padua Hardhono
Degree:	Master of Education
Title of Project:	A Comparative Study of Three Data Processing Centers

Examining Committee:

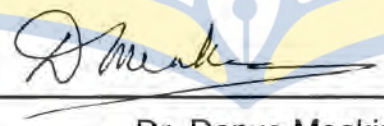
J. Ellis
Senior Supervisor



T. O'Shea
Associate Professor



Setijadi, Rector
Universitas Terbuka



Dr. Denys Meakin
Registrar and Director, Student Services
Open Learning Institute
External Reader

Date Approved October 3, 1988

ABSTRACT

It was the purpose of this study to describe, analyze and compare data processing centers in three educational institutions, the Open Learning Institute(OLI), Douglas College(DC) and Universitas Terbuka (UT) to provide recommendations for improving the operation of UT's data processing center.

Universitas Terbuka, the Indonesian Open University, admitted its first student in 1984 and now carries approximately 130,000 students on its rolls. Active semester by semester enrolment is approximately 60,000. UT relies heavily on data processing to handle registration, student records, examination processing and materials distribution. Evidence derived from students' complaints and internal studies strongly suggests the need for improved data processing procedures. Thus, this study was conducted to develop recommendations which could have useful effects on UT's data processing center and the institution as a whole.

Data were gathered from the three data processing centers mentioned above. Direct observations were made and discussions with personnel who were involved in the three centers were conducted. In each case, areas which were studied were: organization, personnel, physical facilities and equipment, applications software and software development procedures, relationships with users, and operating procedures.

The data provided descriptions of the three data processing centers. The results of these descriptions and the subsequent analyses provided a basis for comparing the three data processing centers in each of the six categories mentioned above. Recommendations for improving the UT data processing center were derived from these comparisons and analyses.

The major recommendations are related to the management of the center. Its organization should more closely reflect its functions and staff members should be provided with clear and up to date job description. Staff training should be provided. Improved software

development procedures should be established together with improved documentation. More attention should be given to user relationships in order to avoid misunderstanding. Finally, a backup schedule should be established and used consistently.

Dedicated to: my wife,
my daughter,
my mother and father, and
my brothers and sisters

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CHAPTER ONE

INTRODUCTION

Problem Statement

Information in the form of data is important in any institution. The way it is processed can provide the institution with information about its current situation. As well it can show progress over certain periods. Finally it can provide a basis for making plans for the future. Data processing in an institution is usually done by its data processing center where computers are used as devices to process the data.

In educational institutions, data processing centers play an important role in student record keeping, instructor record keeping, course record keeping and other types of data which are necessary for the operation of the institutions. Such centers with all their equipment should be able to provide a high level of service to students and to produce a wide variety of information to meet both internal needs, and external needs such as regular reports to government agencies.

When an institution is in its start-up phase, the data processing center usually does not have a large role in the operation of the institution. However, as the institution grows, the role of its data processing grows as well. Eventually, there is a possibility that a very large part of the operation of the institution depends on its data processing center. "The Information Center at Indiana University has truly been an agent of change - affecting the lives of the computing users as well as the lives of the computing staff." (Jonas, 1985) If this happens, obviously, there is a need to manage the center in such a way that the institution's needs for information can be met by the center.

Data processing at Universitas Terbuka(UT) has a short history. Universitas Terbuka, the Indonesian Open University, was established in August 1984 and now has approximately 130.000 students on its rolls. Semester by semester enrolment is approximately 60.000 students. Considering the large numbers, it would be very difficult to process data manually and, thus, since its beginning UT has processed its data by computer. As UT grows, the role of its data processing center will grow as well. Therefore, there is an increasing need to manage UT's data processing center in such a way that

the center will be able to meet UT's growing need for information. It is hoped that this study will contribute to the improved usefulness of data processing at Universitas Terbuka.

The Purpose of the Study

The purpose of the study was to describe, analyze and compare data processing centers in three educational institutions: the Open Learning Institute (OLI), Douglas College (DC) and Universitas Terbuka, in order to provide recommendations for improving the operation of UT's data processing center. The first two centers can be regarded as mature data processing centers and the last one is a young data processing center. Therefore by referring to the two mature data processing centers the final target of this study would be easier to achieve.

Importance of the Study

UT's data processing center plays a role in the following processes: course registration, examination registration, student record keeping, and examination scoring. It is also used in course material

distribution by preparing package labels for shipment. UT relies heavily on its data processing center for these processes. Evidence derived from students' complaints and internal studies suggest the need for an improved data processing operation. Therefore, a study which describes, analyses and compares the three data processing centers mentioned above is likely to result in recommendations which have positive effects on UT's data processing center and the institution as a whole.

Limitation

The study was limited to three data processing centers all of which are in educational institutions. The study did not evaluate the centers, but described, analyzed and compared them. Therefore, this study says very little about efficiency and effectiveness. Another possible limitation is that the first two data processing centers are located in North America, whereas the last one is located in Indonesia. Because of cultural differences, matters which are considered as good things and applicable in North America may not be seen in the same way in Indonesia.

Definition of Terms

The term data processing center in this study has the same meaning as the term information services and computing department which are used by the OLI and Douglas College respectively. The term also has the same meaning with other terms such as, information processing center, computing service center and computer center. These terms refer to a body in an institution where data for the whole institution is processed.

The term data in this study has its normal meaning. However, for the purpose of this study, the term data does not refer to all possible data, but only to data which relate to the operation of educational institution such as student identification, student name, other student personal data, demographic data, course data, enrolment and so on.

Early in their history data processing centers were responsible for almost all aspects of data processing. This included developing computer programs that govern the system which is used to process data, data entry, data validation, running computer programs to process data. Users of data processing centers had very limited responsibility within the data processing

function. Now, users have more responsibility, not only in data preparation but for data entry, and data validation, but even running computer programs to manipulate the data. Ideally, today's users are involved in the development of the computer system which will be used to process their data. It is not impossible for users to develop their own computer programs; this latest case is known as end-user computing. Modern data processing centers remain responsible for ensuring the computer system is running as it is supposed to, making back-up copies for both data and system software, maintaining existing software as well as developing new software as requested by users, and ensuring data security and integrity.

The term community college which is used in the study refers to one of the three types of post secondary educational institution in North America. The other two types are university and institute. Compared to a university, a community college is smaller than a university in terms of programs and degrees offered. However, compared to an institute, a community college has broader purposes and approaches. Usually, a community college offers general academic programs,

university transfer program and a variety of programs requested by residents including vocational, technical and continuing education programs.

The term institute which is used in this study refers to another type of post secondary educational institution with specific limitations in the programs as well as the approach used by an institute. For example, the Open Learning Institute is limited in the way it delivers educational programs. The institute delivers its programs by using distance education methods. Another example is the British Columbia Institute of Technology(BCIT). This institute is limited in the type of programs which are offered to students; it offers technology programs at a non-degree level.

In describing data processing centers, their facilities and equipment, a number of technical terms may be unfamiliar to readers. The table below contains a list of terms which are usually used for describing capacity of a computer and all its peripherals.

Table 1. Descriptions of terms.

No.	Terms	Stand for/ descriptions
1	BPI	Byte Per Inch / magnetic tape density
2	bit	the smallest information unit
3	byte	8 bits
4	baud	transmission speed of a communication device, stated in number of bits per second
5	KB	Kilo byte = 1,Ø24 bytes
6	MB	Mega byte = 1,Ø24 KB
7	GB	Giga byte = 1,Ø24 MB
8	LPM	Line Per Minute; speed of a line printer
9	PC	Personal Computer
1Ø	CPU	Central Processing Unit

Organization of the Study

In Chapter I, the author has introduced the problem being studied by describing the environmental setting of the study, stating the problem, discussing why this study is important to Universitas Terbuka, explaining limitations of the study, clarifying terms which are used in the study, and explaining the organization of this study.

In Chapter II, the author will discuss related materials from the literature, such as trends in the development of data processing centers at colleges and universities of North America and the current status of

distance education. This chapter will conclude with a discussion of why a data processing center is of importance to a distance education institution.

In Chapter III, the author will describe the research procedures used in this study - how data from the three data processing centers were gathered, analyzed and compared.

Chapter IV, Chapter V and Chapter VI will be three parallel chapters. In turn they will describe data processing centers at Douglas College, the Open Learning Institute and Universitas Terbuka respectively. For each data processing center, the following items will be described: an introduction to the organization where the center exists, the organizational structure of the center, personnel, physical facilities and equipment, application software, software maintenance and development procedures and operating procedures. Each of these chapters will end with a summary.

Chapter VII will compare and contrast the three centers in terms of items mentioned above.

Chapter VIII will summarize the study and draw conclusions resulting from the study. A discussion will be provided following the conclusions. The chapter will end with recommendations concerning UT data processing center.

CHAPTER TWO

REVIEW OF THE LITERATURE AND CONTEXT OF THE STUDY

The purpose of this chapter is to look at the emerging trends of data processing practices, especially in college and university environment, to look at the nature of distance education, and, based on this, to emphasize the importance of a data processing center in distance education institutions.

Emerging Trends of Data Processing Practices in Colleges and Universities

In North American colleges and universities, data processing centers have very important roles in supporting the operation of their institutions. Some of them no longer use the term 'data processing center', but prefer to use the term "information technology department", for example, University of Michigan, (Cause/Effect, July 1985 p. 18) Boston College, (Cause/Effect, Nov 1986, p. 25), and Maricopa County Community College District (Cause/Effect, Jan 1987 p. 22). The term "information technology" has a broader

meaning than the term data processing center. It includes computer communication for information exchange, information provider, such as a computerized library, as well as all former aspects of a data processing center.

In general, data processing centers or departments are involved in instructional/academic computing, administrative computing and in computer communications. Instructional/academic computing includes the use of computers for teaching computing science, preparing course materials, research purposes, students' practica, and computerized library systems. Administrative computing includes the use of computers for managing student records, registration, payroll, accounts receivable/payable, inventory and office automation.

There were several issues concerning distributed administrative computing and centralized administrative computing. Issues in this regard can be divided into three categories: centralized data/centralized processing, decentralized data/ decentralized processing and centralized data/ decentralized processing. Centralized data/centralized processing was the traditional way data processing operated.

Decentralized data/decentralized processing was the first solution when the traditional way did not work. Finally, centralized data/distributed processing is the most common current practice today. These issues stimulated other issues related to centralized and decentralized approaches, such as tying together diverse data bases, data security, data integrity, data consistency, data accessibility. The other big issue is concerned with interfacing student information with other internal and external systems.

The idea of decentralized computing has arisen as a result of developments both in user needs and in technology. (Klingenstein & Devine, 1985) According to them, development of user needs was affected by the growth of colleges and universities. As a college or university grows in terms of number of buildings, students, departments, campus sites and so on, the need for distributed computing increases as well.

Relying on a centralized computing center under situations mentioned above is not considered worthwhile. This is because a large number of users, in several locations, must be served by the data processing center. This tends to delay the fulfillment

of departments' needs for information and tends to limit the variety of information which can be produced by the center.

The availability of microcomputers which have considerable computing power and which are not expensive, has led computing trends toward distributed computing. Decentralized computing is considered more effective, efficient and more adaptable to local conditions and needs. It is also more attractive to those who are involved in analyzing data.

Klingestein and Devine (1985) said that the implementation of distributed computing was inspired by the implementation of the concept in industry. Therefore, there are several environmental differences which should be considered in implementing distributed computing in university. The first thing to consider is that, usually, there are more brands and types of computers in a university than in industry. This has the potential to create great incompatibilities when it is required to connect them all. The second factor is that industry has more management control than a university. This makes it possible for industry to impose compatibility requirements. Finally, users in a university tend to have more educational background

than users in industry. This leads to increased motivation and capability which are considered as fitting factors to encourage distributed computing.

Distributed computing was first implemented in academic computing, and later, in administrative computing. Distributed computing runs more smoothly in academic computing than in administrative computing (Klingestein and Devine, 1985) because of differences between academic computing and administrative computing. Firstly, academic computing requires less sharing of data than administrative computing. Secondly, academic computing places emphasis on finding new ways of doing tasks, whereas administrative computing emphasizes doing tasks routinely. Finally, to some extent, academic computing is simpler than administrative computing.

The implementation of distributed computing is not without a number of consequences. These include level of funding, more advanced technological requirements, and loss of management control. Further problems concerning distributed processing are data integrity, data consistency, data accessibility, data ownership, data redundancy and data duplication. For example, suppose that a university implements decentralized

data/distributed processing. Based on that strategy, a number of offices such as admissions, registrar, financial aid, housing, parking and cashier/business each will collect information directly from students. It can be imagined, how much time students will spend in filling out forms for each office. It is obviously clear, that students will write their name, student identification, and other personal and demographic data as many time as the number of offices which require it. It is also clear that there are a number of these offices which maintain the same data from the same student at the same time. This wastes human resources, financial resources and time. Further, data are not integrated and it is difficult to guarantee data consistency. If data are to be centralized, how should it be done ? The following paragraphs will describe how some universities overcome this problem.

Ball State University uses a system called ASAP (Administrative Shared Access Project). ASAP is a data retrieval system for administrators.(Neff, 1986) It is used to maintain the following data: student admission, registration, classroom, faculty assignment, student records, course offerings and so on. The final goal of

the ASAP system is to bring data from the applications mentioned above and make it meaningful for all offices of the university's decision makers.

In the ASAP system, data access is tightly controlled. This is intended to preserve data integrity and consistency. The system implements several procedural and software mechanisms to protect its information. Each new user must submit an access request form. The form then will be approved by an authorized person for particular types of data. For example, an access request form will be approved by system coordinators and the associate director for administrative computing for students affairs, business affairs and academic affairs. Each user is assigned an individual user identification and password. System coordinators will meet the new user before he/she uses the system to explain the responsibilities and legal implication related to the use of data.

Physical security system is also implemented. This means that authorized devices only can be used to access the ASAP and these are located in a secured area; terminals and microcomputers in public areas which are used by students have no means to access ASAP. In addition, especially for confidential

information, there is a warning beep and highlight, to remind the users that the information being displayed is confidential in nature.

In addressing consistency, summary records are created only at the end of terms. Applying the same algorithm at every end of term will guarantee the consistency of summary records across all terms. These summary records are useful tools for analyzing data, for determining trends, and so forth.

Klingenstein and Devine (1985) called the method above a "soft system". According to them, a soft system refers to the "architecture by which campuses hold only replicas of central data base". Usually, during the day time(normal office hours), the central data base mode is read only. Requests for updates are entered and queued and actually performed after the normal office hours. Following the update processes, downloading will be done to provide campuses with copies of the central data base.

A soft system has at least two advantages. Firstly, it stimulates distributed processing without having to distribute the primary data bases. Secondly, it allows several layers of distributed computing where each layer may have different kinds of data.

In addressing data access, Lore Balkan-Vicker (1986) introduced a new strategy in administrative computing. The new strategy tailored on-line access to responsibility. The goal is to create a secured information processing environment through an access control system.

In that system, a person's access to information is tailored to his/her responsibility. Each user has a particular access profile which determines what s/he can do with the information. Is s/he allowed to read and update certain information? The answer to this question is in the user profile.

The system makes it possible for an institution to electronically route documents and have them electronically signed for approval. Because of the importance of documents, the system has provided its users with the possibility of updating them and making an audit trail of every document.

An example of this system usages is as follows. Grade changes are entered by people from the dean's office. The electronic document of grade change, then, is routed to the registrar's office. People in the registrar's office then will verify the document and

put an electronic signature for approval. All documents, wherever they were initiated, will have no effect until they are approved by an authorized person.

One of universities which implements the central data and decentralized processing method is Clemson University. (Gossett & Neil, 1987). Clemson's procedure gives the data processing center more control over data. Data integrity and data consistency are easier to guarantee by assigning data transaction authority (addition, modification, and deletion) to limited numbers of people. However, data manipulation can be done by any office.

Another issue in administrative computing is concerned with automation of student aid processing which is usually limited to financial aid. (John, 1986) There are two important things to consider when developing an automated student aid processing system. The first is the role of the system in the financial aid office. The second is how the system will interface with other, internal and external systems.

An automated student aid processing should include the following main functions: application processing, eligibility determination, benefit calculation, fund disbursement and account reconciliation. In addition

there are some other important functions, such as, changes, tentative award calculation, packaging aid offer and progress reporting.

At the point of interfacing with other systems, the system should be developed in coordination with two other internal systems, the student records system and the financial record system. Such a coordination will make it possible for the three systems to communicate with each other for information exchange. This will speed up the processing for each system when it is required to get information from the other two systems. Ability to communicate between these systems eliminates the need to re-enter the same data into a system when it has already been typed into the other system.

Considering the fact that financial aid often comes from outside universities, it is important to consider what information will be needed by the external agency in their financial aid program. The approach in interfacing internal systems may be implemented in interfacing with external systems. However, if it is not possible, other approaches should be developed to make information exchange possible.

It seems clear that the user involvement in data processing has increased considerably. Distributed processing is one of the obvious indicators of increasing user involvement. In addition, user involvement in the development process is very important. It has a great impact on the acceptance of a computer system which may be developed by the data processing center since many users now have a responsibility in processing their own data. Their involvement in recovery catastrophe planning is also very important. (Ritz, 1987) According to Ritz, a disaster recovery plan will work better if users are given a chance to voice their acceptance.

From the literature reviewed above, it can be seen that the role of data processing center in any educational institution is very important. However, data processing practices vary from one university to another. The important thing to recognize is that the role itself is an extensive one. It has the potential to change the way a university operates. There is an obvious need to manage the data processing center from its beginning.

From the emerging trends described above, it can be summarized that in colleges or universities:

(a) Data processing centers are involved in administrative computing and in academic computing.

(b) Most of them have broad areas of responsibility. Many use the term "Information Technology Department" which has a broader meaning than "Data Processing Center".

(c) User involvement in data processing is increasing.

(d) As institutions grow, and with the introduction of cheaper and smaller computers, there is a trend to distributed or decentralized processing.

(e) The practice of distributed processing was inspired by the emerging concept of "tailoring access to responsibility". The concept was intended to govern management control over data base access in distributed processing environment.

(f) There is a need for communicating with other systems outside the institution such as financial aid agencies, government agencies and other agencies for information exchange.

Overview of Distance Education

Forms of distance education have been implemented for more than a century (Keegan, 1980). However practices of distance education vary from place to place. Besides differences in practice, there are a number of terms which are used to denote activities which have almost similar characteristics to what is called distance education: independent study, home study, correspondence study, external study and so on. Furthermore, there is no standard definition which is accepted by all distance educators. According to Keegan, there are four definitions which are generally accepted by distance educators. These four definitions were devised respectively by Holmberg, Loi, Peters and Moore. (Keegan, 1980)

Holmberg, in 1977, emphasizes in his definition that distance education includes various forms of study which are characterized by the absence of continuous immediate supervision (teacher-learner supervision), but benefit from planning, guidance and from tutorial organization. Loi (1971) defined distance education as a process which does not require the presence of teachers in classroom on a regular basis but only at certain occasions and for selected tasks. Peters (1973)

views distance education as an industrialization of teaching and learning. He defines distance teaching/education as a method of delivering skills, knowledge and attitudes through the application of labor, organizational principles and technical media. This results in the production of high quality learning materials which make it possible to instruct a great number of students at the same period of time, regardless of where the students live. Moore (1973) defines distance teaching as a family of instructional methods in which there is separation between teaching behaviors and learning behaviors, so that two-way teacher-learner communication must be supported by means of print materials, electronic, mechanical and other devices (Keegan, 1980).

These four definitions compete with each other for acceptance by distance educators. Besides these four accepted definitions there are still more definitions of distance education. Instead of devising a new definition, Keegan has made an analysis of these four accepted definitions. According to him, definitions which are respectively devised by Holmberg, Loi, and Moore, share one thing in common; the separation of teacher and student (Keegan, 1980). However,

implicitly, Peters has also paid attention to the separation of teacher and student in his definition by stating that ".... distance education makes it possible to teach a great number of students at the same time wherever they live" (Keegan, 1980).

Keegan concluded that there are six essential characteristics of distance education. These are "separation of teacher and student, influence of an educational organization especially in the planning and preparation of learning materials, use of technical media, provision of two-way communication, possibility of occasional seminars and participation in the most industrialized form of education." (Keegan 1980).

As was stated earlier the practice of distance education varies from one place to another. This is understandable, because the establishment of a distance education in a particular place usually is a solution to real problems which make it unreasonable to run a traditional institution. The main medium which is always used is printed materials; other supporting media maybe used depending on the availability of public facilities in that particular place.

The establishment of the Open Learning Institute of British Columbia is an example of the case described above. British Columbia (BC) is one of the provinces in Canada. It has a very large area with a small population spread over the province. Data resulting from the 1971 census showed that there were 350.000 BC residents over 15 years of age, approximately 24 % of the age group, who had not finished nine years of schooling. Other individual who might have completed high school were unable to attend campuses by reasons of distance, family responsibility, physical disability and so forth. Therefore, there was a need to deliver educational programs. But the province faced geographical as well as demographic problems; it would be very expensive to provide education by traditional means. This inspired the government to establish the Open Learning Institute of British Columbia in 1978. The institute uses print materials as the main medium in delivering educational program. Telephone tutoring is applied to support tutors and students with two-way communication.

Most distance education institutions have large enrolments. This is because distance education institutions offer great flexibility in delivering

their educational programs. For example, at Athabasca University, there are no entry level requirements or entry selection tests; students are allowed to set their own schedules, both for studying and taking examinations; student can continue their normal living activities while they are taking courses from a distance education institution (Brindley, 1985). This flexibility has attracted prospective students to enroll in courses. Distance education, in brief, provides an additional option for learners who cannot attend conventional institutions for any of a wide variety of reasons.

In summary, there is no one accepted definition of distance education. This is because the establishment of each distance education has specific reasons. It is not surprising that the practice varies from one place to another. However, institutions have similar basic reasons for their establishment, that is, to overcome some sort of limitation. Even though they differ in practices, they have similar characteristics and Keegan has already identified these characteristics which were presented earlier in this section.

Importance of Data Processing Centers in Distance Education Institutions

The need for a data processing center in a distance education institution can be justified from at least five view points. The first is service to students. For students working in isolation, to help maintain motivation, it is important for the institution to provide its students with immediate response or feed back concerning their requests or the procedures they have followed. For example, students are eager to know the results of their registration request or examination.

Most distance education students are unable to come to campus for any of several reasons: disability, working schedules, geographic distance and so on. Thus, it is likely that their requests will be sent by means of mail and telephone. In that case, there is an obvious need to respond to their request in a relatively short time. The ability to serve or to respond to student requests immediately is likely to result in student satisfaction. Since distance education institutions are characterized by a large

student enrolment, it is very difficult to manage student data manually. Therefore, it is important to have a well managed data processing center.

The second view point is Peters' concept of distance education as 'industrialized education' (Keegan, 1980). In his concept, productivity, division of labor, mass production, mechanisation and automation of teaching methodology, planning, and organization are the most important factors. As these factors are important in justifying a data processing center in industry, it is equally applicable to distance education, if one views this as an industrialized form of education.

The third justification concerns institutional management. An on-going institution should base its planning and other decisions on information which is accurate and timely. A well-managed data processing center will be able to provide this. What progress has been made by the institution in specific periods? What has resulted from institutional decisions and what problems have arisen? What are the general trends? Information of these sorts is very important for planning and decision making.

The fourth view point is research and development. It is very important for any educational institution to help its students to succeed in their studies. Distance education, wherever in the world, is characterized by high attrition rates (Brindley, 1985). Success and failure distance education depends on many variables, such as learning habits, and student backgrounds. Thus, if the institution could provide research information which is related to student performance, it would be very useful for both students and the institution. It is also important for an institution to evaluate its own performance. Are course materials well-written ? Are test items well written and organized ? How well does the institution serve its students ? A well organized data processing center is able to play an important role in such research. Results of such research will also provide information for planning and decision making.

The fifth and last justification for a data processing center concerns cost-effectiveness. A large number of students enrolling in distance education institution should make it cost effective but not if data from these students are processed manually. Manual data processing requires many job types performed by a

large number of people. It is more worthwhile to invest funds in establishing a data processing center at the beginning rather than hiring a large number of people who will be displaced by the technology.

In summary, the importance of a data processing center in distance education institutions could be justified on the basis of services to students, industrialized education, institutional management, research needs and cost effectiveness.

CHAPTER THREE

RESEARCH PROCEDURE

For the purpose of the study, the author developed a framework which was used to describe, analyze and compare the three data processing centers mentioned before. The framework has six categories or points: organization, personnel, physical facilities and equipment, application software and software development procedure, users and their applications software, and operations.

Several categories have sub headings. The heading "organization" included the following sub-points: an introduction to the host organization where the data processing center exists, the organization of the data processing center as well as its tasks and functions, planning, and relationship with other data processing in educational institutions. The heading "personnel" has sub-points personnel responsibility, personnel training program, entry level requirements, and number of staff members. The description of physical facilities and equipment includes computer room,

computers, peripheral and communication devices. The heading "operation" includes computing service hours, backup, maintenance, user relationship, resources allocation and monitoring, and the security system.

Data Gathering Procedure

Based on the type of data which was desired, there were three procedures used to gather data. The first was on-site observation. This meant that the author came to the data processing center and saw what was going on. This procedure did not involve an examination of written documents or discussions with data processing personnel. The author prepared a checklist of the data which could be gathered in this way. The list included physical facilities, equipment, and operations.

The second procedure was discussion with data processing personnel in the three data processing centers. The discussion involved at least one representative from each division in the each of centers. The discussions were held at the office of the person involved. At each discussion there were only two

people involved, the author and the representative of each division. This made it possible to have more intensive discussions and to avoid problems in scheduling interviews.

The interview was intended to gain information concerning the informant's experience in running a data processing center and to answer the following questions. How does each of them perceive his/her position in the center? Does each of them have the qualification required for the position? Does each of them have a job description, if so, how does the job description help him/her in doing the job? This latter question was also intended to find out how the informants actually did their job and try to find out why they implemented certain methods in particular cases.

The last procedure was the review of written documents concerning the three data processing centers. Formal statements included the organization chart, statements of tasks and functions of the data processing centers, job descriptions of staff members, annual report if available, and any other documents which were available.

The three procedures complemented one another. This meant that when one procedure was not fully satisfactory, another was used to achieve the needed results. Table 2 on the next page shows the procedures which were used in gathering particular types of data. Data gathering was undertaken as part of the course EDUC-811 Fieldwork in Distance Education. Please refer to Appendix 1 for a detailed data gathering schedule.

Data Analysis and Comparison

Each data processing center was analyzed in terms of items mentioned in the data gathering procedure section. The analysis of data processing centers provided satisfactory descriptions of the three data processing centers. These are provided in Chapters Four, Five and Six. Based on these descriptions, the author cross-compared the three data processing centers and this appears in Chapter Seven. The comparison followed the same order of the items which were used in describing the center. A conclusion from the comparison was provided for each item.

Table 2. Data Gathering Design

Data Needed	Observation	Discussion	Document Study
1. ORGANIZATION			
1.1. Introduction to host organization	-	V	V
1.2. Introduction to data processing center	-	V	V
1.3. Planning	-	V	V
1.4. Relationship with other data processing center	-	V	V
2. PERSONNEL			
2.1. Responsibility	-	V	V
2.2. Training Programs	-	V	V
2.3. Entry level requirements	-	V	V
2.4. Number of staff members	-	V	V
3. PHYSICAL FACILITIES AND EQUIPMENT			
3.1. Computer Room	V	V	-
3.2. Computers	V	V	-
3.3. peripheral and communication devices	V	V	-
4. APPLICATION SOFTWARE AND SOFTWARE DEVELOPMENT PROCEDURE	V	V	V
5. USERS AND APPLICATION SOFTWARE THEY USE	V	V	-
6. OPERATION			
6.1. Computing Service hours	V	V	V
6.2. Backup	-	V	-
6.3. Maintenance	-	V	-
6.4. User Relationship	V	V	-
6.5. Resource Allocation and monitoring	V	V	V
6.6. Security	V	V	-

CHAPTER FOUR

DOUGLAS COLLEGE DATA PROCESSING CENTER

Introduction to Douglas College

Douglas College was established in 1969 as one of the community colleges in British Columbia. The college originally served the communities of New Westminster, Burnaby, Coquitlam, Port Coquitlam, Maple Ridge, Port Moody, Surrey, Delta, Langley, White Rock and Richmond. The college grew from one central campus in New Westminster to a multi-campus operation.

In 1981, the provincial government decided to divide the college into two smaller colleges, Douglas College and Kwantlen College. The new Douglas College serves New Westminster, Burnaby, Coquitlam, Port Coquitlam, Port Moody and Maple Ridge. Kwantlen College serves Richmond and communities which are geographically located south of the Fraser River.

Before Douglas College was divided into two smaller colleges, its student enrolment was about 7000 full time equivalent students. This number represented approximately 12,000 to 13,000 actual students who

enrolled in credit courses. There were approximately 6000 students who enrolled in non-credit courses. After the college was divided, student enrolment was about 3500 full time equivalent students. Now, the number has grown to approximately 5500 full-time equivalent students. Since 1969, a total of 85,000 students have enrolled at Douglas College in credit courses.

Douglas College offers the following programs:

a. First Year and Second Year University Transfer Programs
b. a General Nursing Program
c. a Psychiatric Nursing Program
d. a large variety of music programs
e. English as a Second Language program
f. Adult Basic Education program
g. Vocational/Training/Applied Programs which are related to one-year or two-year certificate programs in areas of business, computing systems, early child education and child care.

In terms of organization, the college has about 400 staff members, 200 of whom are instructors and the remainder support staff, such as, librarians, secretaries, managers, and so on. Please refer to

Appendix 2 for the detailed organizational structure of the college.

Organization of the Data Processing Center

Douglas College's data processing center is formally called the "Systems and Computing Department". In general, the department is responsible for all computer related activities throughout the Douglas College system. From the discussion with the Manager of this department, the department has the following tasks and functions :

(a) provide computing services to all members of the organization, including administrators, instructors and students

(b) deal with outside institutions in computer related work as Douglas College representative

(c) help users in using computers, both microcomputers and the minicomputer

(d) maintain all computers and their peripherals

(e) evaluate and select hardware and software intended for use within the college

(f) provide system feasibility studies and selection assistance to departments within the college

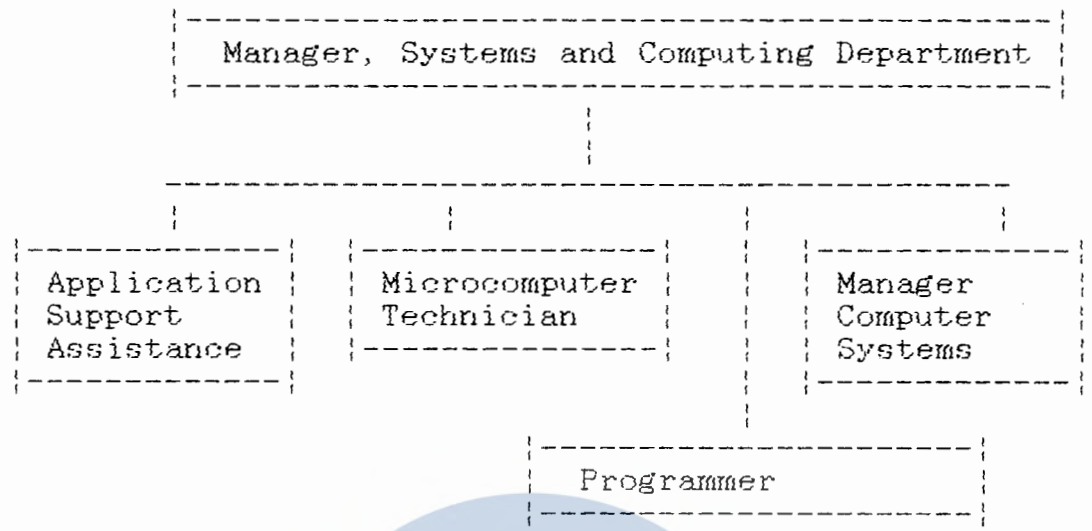
(g) recommend replacement of existing equipment with new equipment or enhancement devices

(h) prepare and monitor the annual budget for the department, and administer the annual computer capital budget for the college

(i) maintain an inventory of common computer supplies, such as, papers, ribbons and so on.

When the data gathering for this study was done, there were only two permanent staff members in the department and one part timer. These were the Manager of Systems and Computing Department, Manager of Computer Systems and part-time microcomputer technician. The Manager of Computer Systems and the micro computer technician report to the Manager of Systems and Computing Department.

At that time, the department was in the process of adding more staff members. There will be three new positions, one for an application support assistant, one for a microcomputer technician and one for a programmer. The first two positions have been agreed to by the management committee of the college, but the third position was being negotiated. The new organizational structure will be as follows:



In terms of planning, the department has two kinds of planning, a five-year plan and shorter term plans which vary from one to two years. The shorter term plans are derived from the five-year term plan. In general, the department's plan is intended to meet all computer requirements of the college.

The plan can be broken down also into three components : administrative component, instructional component and instructional support component. The two major applications in the administrative component are the Student Records and Accounting Systems. These two applications satisfy their users, however, the department has planned to revise some minor

applications. For the instructional system, the department planned to develop the following applications: statistics and modeling system, Computer Assisted Instruction and Computer Managed Learning. Finally, for the instructional support system, the department was assisting the Library Department in a study to find a suitable application for use in the Library.

In terms of relationships with other educational data processing centers, the department interacts with two external user groups. The first group is smaller than the second and is called The Lower Mainland Computer Consortium. This group consists of the data processing managers from six colleges: Fraser Valley College, Kwantlen College, Emily Carr College, British Columbia Institute of Technology, the Justice Institute and Douglas College. The consortium shares two software packages which run on a DEC/Vax computer. These are a Student Records System and an Accounting System. The second group consists of data processing managers from twenty-two colleges and two institutes in the B.C. community. The consortium meets every three to six months to discuss common issues, common concerns and to plan a quotation tendering process for computers and

peripherals. Usually, vendors are invited to the meeting to discuss their products. The consortium has set up an electronic mail system which serves all members.

Personnel

There were only two full time staff members in the Systems and Computing Department, the Manager, Systems and Computing Department and the Manager, Computer Systems. The responsibilities of each of these, as well as the three prospective members mentioned before, are described in the following paragraphs.

Manager, Systems and Computing Department

According to the job description, this position is intended to

> "provide college-wide management system of systems and computing resources and to provide leadership and direction on future development in this area".
>
> (cited from the job description)

Therefore, the position is accountable for the technical and operational aspects of data processing systems, which include the operation and maintenance of all college computer equipment, planning and development of computer hardware and software requirements, and implementation and coordination of hardware of software usage throughout the college. The manager of Systems and Computing Department reports to the college comptroller. The principal duties of the Systems and Computing manager are :

1. Responsible for the conditions of operation and maintenance of all College computer equipment.

2. Responsible for coordinating the purchase of all software within the established budgetary limits and for the inter-department coordination and usage of software.

3. Act as Chairman of the Computer Systems & Resources Advisory Committee which serves as an advisory committee with operational expertise on college data systems and computing services.

4. Acts as a resource person to the Management Committee regarding College equipment requirements.

5. Represents the College on the Lower Mainland Hardware Consortium Committee and other technical committees (internal and external) as required.

6. Responsible for reviewing, developing and implementing computer programs to meet specific departmental requirements, and College objectives.

(cited from Job Description: Manager, System and Computing)

Manager, Computer Systems

According to the job description, the Manager, Computer Systems reports to the Manager, Systems and Computing Department and his/her principal duties are the following:

1. Maintains, repairs and provides basic trouble diagnosis for computer equipment, including micros, printers, and other peripherals, to the extent practicable. If necessary, recommends the repairs be undertaken by outside agencies, subject to approval of the Manager.

2. Organizes, assigns and monitors the network privileges and software required by instructional users on Local Area Networks(LAN's).

3. Maintains an on-going maintenance regime on micro computers and computer peripherals.

4. Occasionally performs programming services on project as directed by the Manager. This includes software design, implementation and testing.

5. Assists in the development and maintenance of User Manuals.

6. Installs, configures and tests computer equipment as required.

7. Provides user support including training on the use of various micro computers, computer peripherals, operating systems and College supported micro computer software.

8. Maintains maintenance records on computer based inventory.

9. Assists in the evaluation of new micro computer equipment and makes recommendations to the Manager on specifications for related equipment and supplies on a College-wide basis.

10. Maintains an on-going technical knowledge of micro computer related equipment, including a proficiency in the use of MS-DOS or PC-DOS, and at least one high level language used by the College.

11. Performs other duties as required.

(Cited from Job Description: Manager, Systems and Computing Department).

Personnel Training Program

There is no formal or routine training program, however, the institution will pay training fees as long as the training program increases staff members capability to do their job better. The department usually takes the opportunity to send its staff members' to training programs offered by Data General Corporation. For example, a staff member has been sent to a training program on computer communication. The department will also pay up to a certain amount when staff members want to take a program in computing science at a university.

Supervisory Practices

Based on what is written on the job description, all System and Computing staff members work under the general supervision of the Manager. The department has

no formal or regular internal meetings. When the Manager wants to talk with his staff member, he just comes without any prior notice. The same thing happens when a staff member wants to meet the Manager. This is understandable, because they are a small group.

Physical Facilities and Equipment

Computer Room

The computer room is located in the first floor of the south building, whereas the System and Computing Department is located in the fourth floor of the same building. The dimension of the computer room are approximately 26 feet X 20 feet X 10 feet, or 520 square feet, or 5200 cubic feet. In that room, all devices which need little people intervention are placed. The room is locked most of the time and is highly secured; very few people are allowed to enter the room. There is not much human activity in the room.

The floor of the room is raised and there is an air conditioner which blows cool air under the raised floor. The air goes up though holes right under the bottoms of devices and keeps the temperature under 20

Celsius. In case the temperature should exceed 30 Celsius, an automatic switch will shut all power lines which go to the room.

There is a power line isolator transformer. This device provides 'clean' power to all devices. There is no Un-interupted Power System(UPS). Considering that the electricity supply in BC is good, the need of an UPS is not crucial.

Computers

There are three computers(excluding micro computers) used by the department. The first computer is Data General MV 15000 Model 10 with 16 MB main memory and approximately 700 MB secondary memory. The second computer is Data General C/330 with 1 MB main memory and 96 MB secondary memory. The third computer is DEC Vax 11/780 with 8 MB main memory and 1.2 GB secondary memory. The MV/15000 is the main computer and it is used for daily operations. It is a 32-bit computer and runs under AOS/VS operating system. (AOS/VS stands for Advanced Operating System with Virtual Storage) The C/330 is a 16-bit computer and runs under AOS operating system. (AOS: Advanced Operating System) The computer is used as a backup

computer which will be used in case something goes wrong with the MV/15ØØØ. The C/33Ø and the MV/15ØØØ are fully compatible in data, but computer programs need conversion in order to transfer from one computer to another. (C/33Ø is a 16-bit computer and MV/15ØØØ is a 32-bit computer) The Vax 11/78Ø is owned by the International Markatech Limited (formerly Canadian Data) in Vancouver. Douglas College shares with other colleges in using that computer for the Student Records System and Accounting System. There are 24 lines which connect terminals and printers at Douglas College to the computer through a high speed modem.

Peripherals and Communication Devices

Peripherals and communication devices which are available in the department and their function are presented in Table 3.

Table 3. DC's Peripherals and Communication Devices

Device	Quantity	Function	Capacity
Disk drive	2 units	I/O devices; data storage	350 MB each
Disk drive	1 unit	I/O device; data storage	96 MB
Tape drive	1 unit	I/O device; data storage	2400 feet; 800/1600 BPI
Printer	20 units	Output device	various
Terminal	88 units	Workstation	Not Applicable
IAC-8; RS-232	4 units	Workstation controller	8 terminals each; 900 feet length
IAC-16; RS-422	4 units	Workstation controller	16 terminals each; 4000 feet length
Gandalf PACX-2000	1 unit	Communication controller	256 lines maximum; 9600 baud
Stat-Mux	1 unit	Communication controller	24 lines maximum; 32000 baud
Power Isolator	1 unit	Electric circuit breaker	Not applicable
Scanner Sentry-300	1 unit	Optical mark reader	300 sheets per hour
Micro computer	150 units	Stand-alone workstation	various
Modem	8 units	communication controller	7 of 300-9600 baud; 1 of 32000 baud
S-Net	1 unit	Local Area Network Controller	12 PCs maximum

Terminals are distributed as follows: 16 terminals in Instructional Lab. 1, 19 terminals in Instructional Lab. 2, 4 terminals for instructors' use, 2 terminals in a Science Lab., 32 terminals for secretarial use, 4 terminals in the Community Programs office, 7 terminals in the Registrar's office, and 2 terminals in Systems and Computing department. Printers are distributed in such a way that users do not have to go far to pick up their printouts.

Stat-Mux (Statistical Multiplexer) is the device which connects 16 terminals and 8 printers (the composition sometimes is changed to meet seasonal

needs) to the Vax 11/780 which is located in Vancouver. Applications which run on that computer are Student Records System and Accounting System.

The LAN connects 12 Personal Computers (PC's). The network is used to share common data and programs such as Word Perfect, Pro Marx, Math Plan, and so on. Advantages of using a LAN are cost saving and computer space saving. This is because the price of software in a LAN version is much less than 12 times the price of individual copies.

Application Software and Software Development Procedure

Application Software

There are a number of kinds of software available in the system. Their names and functions are described in the Tables 4, 5 and 6.

Table 4. Software supplied by Data General Corporation

No.	Software	Descriptions
1.	AOS/VS CLI	Operating System
2.	AOS/VS EXEC	Multi-user environment manager
3.	AOS/VS INFOS_II	Indexed file management system
4.	AOS/VS F5	Fortran 5 Compiler
5.	AOS/VS COBOL	Cobol Compiler
6.	AOS/VS PASCAL	Pascal Compiler
7.	AOS/VS BASIC	Basic Compiler
8.	AOS/VS CEO	Office Automation Software, including: - Word Processing Software - Electronic Mail Software

Table 5. In-house Developed Software

No.	Software	Descriptions
1.	TMGR	Allocates a time-slice for each user using the system, counts down the allocated time, and notifies the user when the time is almost finished up.
2.	QMGR	Manages processes submitted in batch mode to a queue, and assigns queue priority for users each time they submit job.
3.	User1/User2	Produces a statistical report every week. The report contains number of users who are using the system in every 30 minutes. Users are divided into three categories: computing group, instructors and administrators group, and students.

Table 6. Externally Developed Software

No.	Software	Descriptions
1.	SRS	Student Record System with the following facilities : - Student Registration - Student Course History - Course Cancellation - Academic Transcript - Grade Keeping - Student Billing - Student Financial Aid - Class Arrangement
2.	Accounting	Accounting System Software with the following facilities : - Purchasing Order Control - Invoice Entry - Account Payable Processing - Financial Reporting - Vendor Module - Budget Control - Balancing and Audit - Cheque Reconciliation
3.	Word Perfect	Word Processing Software
4.	Power House	A Fourth Generation Language which is used for instructional needs.
5.	SPSS	Statistical Package for the Social Sciences
6.	COMPASS	Software which is used for managing Community Programs and Social Services (non-credit courses)
7.	DBASE III	Data Base Management Software
8.	Supercalc	Spreadsheet Software

Software Development Procedure

When users require software, their requests are submitted formally to the System and Computing department through the Computer System and Resources Advisory Committee. Users' requests then will be evaluated by the committee. When the committee recommends the development of required software, the request is passed to the System and Computing Department. If the required software is available in the market, the department may purchase it. If the software is not available in the market, the department may develop the software by itself or by an outside contractor.

Users and Their Application Software

Various departments have specific software needs. Tables 7 and 8 show the department and the software used.

Table 7. Administrators and Software They Use

No.	User/Department	Software used
1.	Registrar Office	Student Record System SPSS, Word Perfect
2.	Accounting Office	Accounting System Word Perfect
3.	CPSS Office	COMPASS, Word Perfect
4.	Library	SPSS, Word Perfect
5.	Personnel	Word Perfect
6.	English	Word Perfect
7.	General Nursing	Word Perfect
8.	Psychiatric Nursing	Word Perfect
9.	Music	Word Perfect
10.	Social Science	Word Perfect, SPSS
11.	Publicity	Word Perfect
12.	Humanity	Word Perfect

Table 8. Instructors/Students and Software They Use.

No.	User/Department	Software used
1.	Computer Information System	All compilers : PL1, Cobol, F5, F77, Pascal Assembler, Basic. Packages: DB-III, Math-Plan, Supercalc Power House.
2.	Business	Cobol, DB-III Supercalc.

User Relationship

It appears that relationships between computing people and users group are friendly and informal. Users are able to come to the System and Computing department at any time. They ask questions concerning the computer

problems they are facing. Usually users know what they want; their only problem is in knowing how to solve their problem.

There is a clear line which separates users' responsibility and the System and Computing department's responsibility. Users are responsible for the data, whereas the System and Computing department is responsible for ensuring that all hardware and software is running well and that there is back up for all software and data.

Operations

Computer Service Hours

In general, the system is available 24 hours per day, seven days a week. The computer is not shut down regularly; it is shut down only in cases which force a shut down. The system is also unavailable when backup processes are running. However, backup is done late at night when there is little or no use of the system.

Backup

The department does two types of backup: differential and total backup. Differential backup is done only to files which have been modified since the last backup. The backup copies of data from disk to disk is done daily late at night. Total backup is done to all files regardless of the time when the last backup was done and it is done weekly. This backup copies data from disks to tapes. There are two sets of tapes which are used alternately. The backup tapes are stored off campus.

Resource Allocations and Monitoring System

Computer resources are allocated in such a way that each user has the same opportunity to use the system. Each user is given the same "computer-priority" to use the system. This policy is to guarantee that each user will get the same response time. There are two modes for users to use the system, batch mode and on-line/interactive mode. Batch mode is intended to be used in processes which do not need any user's intervention such as compiling processes. The interactive mode is used in processes which require a

user's intervention such as retrieving specific information from data base, word processing, entering students data and so on.

There are two computer programs which are used to help in managing the computer resources. The first is Time Manager (TMGR). The functions of this program are to allocate a time-slice for each user, counting down the allocated time and notifying each user when the time is almost up. The second is Queue Manager(QMGR). The function of this program is to manage batch traffic and assign batch-priority for every job submitted in batch mode. When a user submits a job in batch mode for the first time, the QMGR will assign batch-priority 151; for the second time, the QMGR will assigns 153, for the third time, it will assign 155 and so on. In other words, the batch priority will be reduced two levels every time a user submits job in batch mode.

Each user of the system is given a certain amount of disk space. The number varies from one user type to another type. System and Computing staff members are given 20,000 block spaces. Instructors and students who are using the system for programming are given 2000 block spaces. Instructors who are using the system for

running SPSS are given 20,000 block spaces. Finally, administrators are given 10,000 block spaces for word processing.(1 block = 512 bytes)

Security System

There are five types of security techniques which are implemented in the system. The first is the most common security technique in which each user is given a unique User-ID and a password. By means of this, there is no user entering the system without having User-ID and password.

The second technique is that users are divided into three different groups (mentioned before) and each group is given common privileges. The privilege defines what members of the group can do and cannot do. To distinguish one group from another, there are specific codes in User-ID's. User-ID's with double dollar signs ($$) (for example, $$Marsh) means that the user belongs to the Systems and Computing group. User-ID's with single dollar sign($) (for example, $Admhar) means that the user belong to the instructors/administrators group. User-ID's with no dollar sign means that the user is a student.

The third security technique is "hard connection". By means of this, certain application software can be run only from certain terminals. For example, the Student Records System cannot be run from terminals outside the registrar's office, Accounting System cannot be run from terminals which are not in the accounting office.

The fourth security technique is disabling unauthorized users from issuing some crucial CLI commands, such as, ACL, DELETE (CLI= Command Line Interpreter, ACL= Access Control List) The ACL command is a command which is used to define users and type of access of files. Common files should be accessible for all users. Preventing unauthorized users issuing the ACL command means guaranteeing that all common files are accessible for all users. This technique prevents the possibility of data being lost through unintentional deleting.

The last technique is dial back which is intended to prevent an unauthorized person from entering the system. What the system does is that when there is a call, the system records the caller's phone number, User-ID, and password. The system then, disconnects the

link and checks a data base to determine whether the caller is eligible or not. If the caller is eligible, the system will dial back.

Documentation

Documentation is not a major task in the System and Computing department. This is because most software development is done by outside contractors. Data processing is the users' responsibility, therefore, the department does not have to make documentation of what processes have been done to data. The only documentation the department does are procedures related to hardware and software installation and administration.

Summary

From the above description, Douglas College's System and Computing Department can be summarized as follows:

1. The department has the function of providing college-wide user services to instructors, administrators and students. Most departments at Douglas College use the system at least for word processing and electronic mailing. Most of them

appear to be satisfied with quality of services offered by the department though this impression was not tested systematically.

2. The department appears to be under-staffed compared to the type and the volume of work it does. This weakness may increase the department's dependency on outside contractors for both software development and training. However, the department has plans to add new staff members.

3. The department has a very powerful computer. The MV/15000 is a high class mini computer. It is understandable that the use of the computer is less than 50 percent of its capacity. The computer was installed in Spring 1987 and, thus, it has surplus capacity for future growth.

4. The operation is run smoothly and is well secured. This results from well-allocated and monitored resources. The use of the TMGR and QMGR optimize resource allocation, whereas, the five security techniques guarantee that the system is secured from being damaged.

CHAPTER FIVE

OPEN LEARNING INSTITUTE DATA PROCESSING CENTER

Introduction to the Open Learning Institute

The Open Learning Institute (OLI) of British Columbia (B.C.) was established in June 1978. The purpose of its establishment was to deliver educational programs to B.C. residents who could not enrol in conventional programs for any of a variety of reasons. To accomplish this goal, OLI delivers its programs by using distance education method.

The main medium which is used to deliver its programs is print material. Audio cassettes are also used as integral parts of certain courses. OLI students study from these materials. The institute provides its students with tutorial services. Telephone tutoring is a two-way communication between students and their tutors. Students are not charged for telephone use.

In order to support its students the institute has four regional centers. They are located in Kelowna, Prince George, Victoria and Richmond. Functions of these regional centers are to provide OLI's students

with the following advising services: career and educational planning, initial transfer credit evaluation, study techniques and other study-related problems, course changes and selection, applications for financial aid, special needs for disabled students and problems affecting students' studies.

Commencing in 1986, there was an effort to merge the OLI and the B.C. Knowledge Network into a new organization which is called the Open Learning Agency (OLA). OLA will consist of Open College, Open University, and the Knowledge Network. When the study was done the enabling legislation for this change was not yet approved by the Provincial Legislature of British Columbia. However, the institution has already operated as it was stated in the proposed legislation.

The Open University offers the following programs: Bachelor of Arts Degree, Bachelor of Arts in General Studies, and the Bachelor of Arts in Administrative Studies. The Open University has also the function of coordinating distance education courses which are offered by Simon Fraser University, University of British Columbia and University of Victoria. The Open College offers certificate programs in the following areas: Business Management, Dental Assisting, Office

Administration, Graduate Nurse Refresher, Office Management, Construction Supervision, Electronic Industrial Supervision, and Secondary School Completion Programs (Grade 10 and Grade 12 Completion Program). The Knowledge Network provides the Open College and the Open University and the other universities with facilities to broadcast their programs by using a television network.

According to the new legislation, the OLA organization is headed by a President who reports to a Board of Directors. There are four vice-presidents responsible for Administration, the Open University, the Open College and the the Knowledge Network. The Director of Information Resources Department report to the Vice President, Administration. This study describes this department and compares it with data processing centers in the other two institutions, Douglas College and Universitas Terbuka. Please refer to Appendix 3 for a detailed OLA organizational chart.

Organization of OLI's Data Processing Center

The OLI data processing center is formally called the Information Resources Department. The department is managed by a Director and is under the general supervision of the Vice President, Administration. The department serves the institution's need for data or information resources management and communication. Data or information resources refers to data, text, image, processes, strategies, philosophies, policies, standards, and the technology associated with them . Data entry, data collection and data manipulation by using the system are excluded from the responsibility of the Information Resources Department. They are the users' responsibility, because they are the owners of the data. Communication includes services of telephone, facsimile, telex, computer communication and other communication media. The department is expected to provide the entire institution with tools to produce information which can be used to manage the institution's operation. Therefore, the department should be responsive to its users and student needs and changes in the operation of OLI's operational environment.

The department is headed by the Director of Information Resources who reports to the Dean of Administration. The Director is responsible for the operational effectiveness and efficiency of the Information Resources. This responsibility is divided into two broad areas: advisory and supervisory. Advisory includes assisting users in the following areas:

* system specifications
* information collection, transmission and entry
* source document storage and security
* procedure documentation
* staff training
* system implementation.

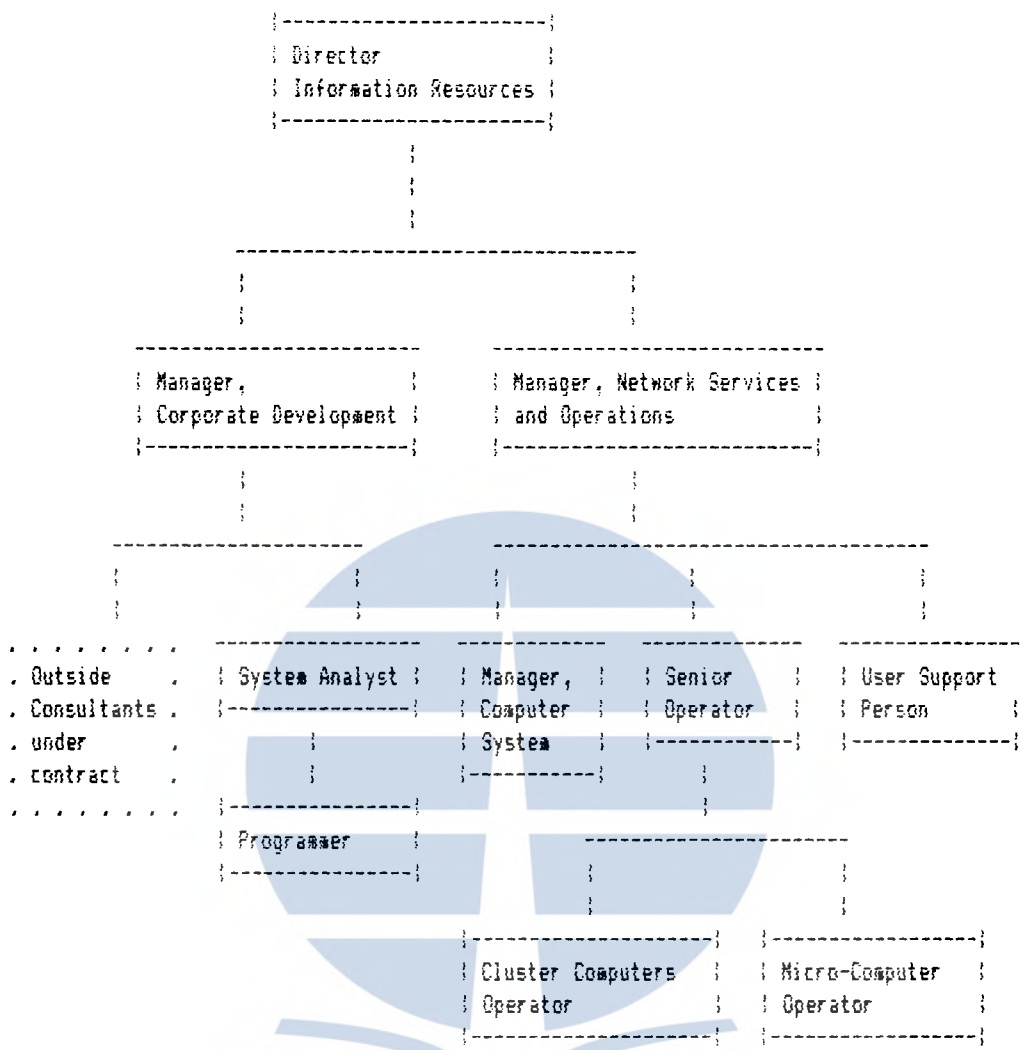
Supervisory areas includes the following areas:

* information resources professional staff, including contracting, hiring, supervising and training.
* hardware operation and security
* hardware acquisition
* system design
* software operation and security
* software development and acquisition
* system documentation
* machine readable data security
* performance measurement.

The department is divided into two divisions, the Corporate Applications Development, and Network Services and Operations. Each of these divisions is headed by a manager. The two managers report to the Director of Information Resources.

Corporate Applications Development division is responsible for all system studies, system analysis and design, and software development at the corporate level. The Network Services and Operations division is responsible for all network-related work and operations of the cluster computer and all its peripherals.

There is a systems analyst who reports to the Manager of Corporate Application Development. The systems analyst supervises the work of a programmer. There are three people who directly report to the Manager of Network Services and Operations, The Manager of Computer System, Senior Operator and User Support Person. The senior operator supervise the work of the cluster computers operator and micro computer operator. The organizational chart of the department is shown in the figure below.



In terms of planning, the director of Information Resources, the Manager of Corporate Applications Development and the Manager of Network Services are responsible for setting up strategic long term plans. The system analyst, the computer system manager, the

senior operator and the user support person are responsible for setting up tactical short term plans. The programmer and the two operators are responsible for planning day-to-day basic operations.

Personnel

Responsibility, Tasks and Functions

There are eleven staff members in the department of Information Resources. Each of them has different responsibilities. Instead of using the term 'job description', the department uses the term 'performance objectives'. Each staff member has his/her own performance objectives which describes his/her responsibility, tasks and functions in great detail.

Performance objectives are subject to change and are intended to adapt to current needs. Performance objectives may cover time periods from approximately four months to one year. The intention of providing staff members with performance objectives is to give them directions as clearly as possible as to their responsibility, tasks and functions. This is intended to lead to higher staff performance.

The performance objectives for all members of the department mentioned above are presented in Appendix 4. This will provide readers with an opportunity to see how much detail is provided to each staff member.

Personnel Training Program.

In order to increase departmental productivity, the department supports its members with two kinds of training programs. The first is intended to increase the members' skills so that they can do their jobs in more effective and efficient ways. The second is a training program which is intended to increase the members' knowledge in areas which are required for moving up in the job rank as for example, in moving from operator to programmer.

The training programs may take various forms. A staff member may participate in a computer conference which relates to his/her job. It is possible to take courses which are offered by computer suppliers or manufacturers on topics such as computer system management. It is also possible for a staff member to take computer-related courses from recognized institutions. OLI pays for training fees.

Supervisory Practices

There is a bi-weekly meeting of the Network Services and Operations Division. This normally involves sharing and discussing the latest issues and problems. There is also a regular consultation between the Manager of Network Services and Operations and each of his staff members. This consultation is held every Wednesday and it is used to monitor the progress which has been made during the week and to set up a plan for the following week.

In the Corporate Applications Development which consists of only three members, meeting is not a big problem. It is easier for members to see one another informally without having to arrange the time in advance. The intention of the meetings is the same as for the other division. Obviously, different topics will be discussed.

There is a monthly meeting for the entire department which is usually held on the second Thursday of the month. The meeting is used to share institution wide issues, policy changes, planning development information, problems and experiences. Meetings between the Director and the two Managers are usually held on a need basis.

Physical Facilities and Equipment

Computer Room

The dimensions of the computer room are approximately 20 feet X 18.5 feet X 10 feet. The available space seems too small to place the cluster computers and all their peripherals. The air conditioner is not powerful enough to compensate for this situation. Hardware malfunctions which occurred lately have given the indication that the room is not adequate to place all devices. The room is highly secured, no one is allowed to enter the room without permission from the operator on duty.

Computers

There is a cluster system which consists of four Vax computers: one Vax 11/780 with 16 MB main memory, two Vax 11/750 with 8 MB each, and a Microvax. This cluster is linked to a Local Area Network(LAN) using an Ethernet system. The LAN includes a Xerox computer and several IBM and Macintosh microcomputers. By using intelligent disk/tape drive controllers and cluster controllers , the Vax 11/780 and the two Vax 11/750's

are connected and make up a cluster computer. Connecting the cluster with the Ethernet backbone cable makes all devices in the cluster system accessible from every computer which is connected to the network.

Peripherals and communication devices

Peripheral and communication devices which are available at OLI's Information Resources Department are presented in the Table 9.

Table 9. OLI's Peripherals and Communications Devices

No.	Device	Quantity	Capacity	Functions/ Description
1.	DEUNA	3 units	N/A	Controllers which are used to connect Vax 11/780 and two Vax 11/750's to the Ethernet backbone cable
2.	C1780	1 unit	N/A	Controller which is used to connect Vax 11/780 to SC008
3.	C1750	2 units	N/A	Controllers which are used to connect two Vax 11/750's to SC008
4.	SC008			Cluster System Controller
5.	HSC50	1 unit		Intelligent Disk/Tape Controller
6.	TA81	1 unit		Tape Drive
7.	TU80	1 unit		Tape Drive
8.	TK50	1 unit		Tape Drive
9.	DEQNA	1 unit		Controller which is used to connect Microvax to the Ethernet Backbone cable
10.	DELNI	1 unit	8 ports	Terminal Connection; it is used to number of connection points on the Ethernet Backbone Cable
11.	DEMPR	1 unit	8 ports	To enable Ethernet communicates with other cabling system
12.	DECSERVER 100	2 units	8 lines	Terminals Server
13.	DECSERVER 200	2 units	8 lines	Lines controller
14.	SMUX	3 units	varies	1 of 16 lines; lines for the Knowledge Network at OLI end 1 of 4 lines; lines for the Knowledg Network at UBC end 1 of 12 lines; Lines for the Knowledge Network at Knowledge Network Office
15.	LDM409A	4 units	32000 baud	High Speed Modem
16.	Workstations	80 units		
17.	Printers	12 units	varies	They are Laser printers, line printers and dot matrix printers
18.	RD54	2 units		Disk storage
19.	RA81	4 units		Disk Storage, 387 MB each
20.	XEROX STAR Terminals	6 units		are used for publication
21.	XEROX LASER Printer	1 unit		is used for publication
22.	XEROX FILE Server	1 unit		
23.	Microcomputers	30 plus		There are IBM-AT, Rainbow, DecMate and IBM-XT and Macintosh

Application Software and Software Development Procedure

There are a number of software programs which are available at OLI's Information Resources Department. Many software packages which run in the cluster system are controlled by Access Control Utilization Monitor (ACUM). ACUM is used for second level protection to prevent unauthorized persons from running certain applications software. Student Records System, Finance, Inventory are examples of applications software which are controlled by ACUM. Below is the list of applications software which is available.

1. Inventory System
2. Student Records System
3. Finance
4. Tutor Payroll System
5. Knowledge Network Broadcast Scheduling System
6. Electronic Mail
7. Word processing
8. Spreadsheet

In addition, a wide variety microcomputer software is available.

Software Development Procedure

The Information Resources Department uses a standard procedure for developing software. The standard is called the 'system development life cycle'. The cycle contains seven steps, which are: initiation, system survey, detailed analysis, system design, system construction, system testing and system implementation. All these activities are described in the following paragraphs.

Initiation

Initiation is the first step in which the department studies and roughly analyses users' requests in terms of cost and benefit. Users or requestors are involved heavily in this step, because they should convince the developer that the requested software is needed and justifiable from a cost and benefit perspective. All activities which are conducted in this step are well documented. At the end of this step, there will be a recommendation as to whether further activities will be undertaken or to reject the user's request.

System Survey

The second step is the system survey which is intended to analyse the user's requests in more detail. This is done by conducting a high level investigation of the current system, identifying problems with the current system, identifying requirements for the new system, identifying and prioritizing the project's objectives, examining possible implementation schemes and developing a plan for the rest of the project. Examining the request from cost and benefit perspective will be done also in this step. Users still have an important role at this stage.

Detailed Analysis

The third activity is detailed analysis. It is intended to analyze logical requirements of the proposed system, including data, rules and regulations needed for performing the intended process. This step ends up with a system specification. The user's role in this step is critical.

System Design

The fourth activity is system design which is intended to develop physical implementation of the logical requirements which were stated in the previous step. This step ends up with a complete set of computer program specifications. The specification describes manual processes, data files, input forms, report layout, on-line display layout, program flowchart and anything else which is needed to build up the system. User involvement in this step is less than in the previous step. Their involvement is limited to specifying layouts.

System Construction, System Testing, and System Implementation

The fifth, the sixth and the seventh steps are System Construction, System Testing and System Implementation respectively. In these steps, computer programs are coded , tested and installed. During the testing and implementation phases, opportunity should be given for user testing and training. Also, as part of the implementation process, the Information Resources Department will provide operation manuals.

Overall, of the application software packages which are available in the OLI Information Resources Department, fifty percent of them are developed in-house, twenty-five percent are supplied by the computer manufacturer, and the other twenty-five percent are developed by outside contractors.

User Relationships

The computer operators are the department's receptionists. Users initiate contact with the department through these operators, both the cluster computer operator and the microcomputer operator. Service requests are also sumitted to the department through these operators. The operator then forwards the request to the senior operator. The senior operator will fulfill the request if it is within his or her capacity . Otherwise, the senior operator will consult the user support person. The user support person will analyze the request and will fulfill the request as long as it does not have a major impact on the existing operational environment. Otherwise, the user support person will forward the matter to the Corporate Application Development division who will take care of the request, consulting as needed with the user.

There is a clear line which separates users' responsibility and the Information Department's responsibility. User departments are responsible for data preparation, data entry and data manipulation by using the system. The Information Resources Department is responsible for the integrity, security and availability of the information/data which is stored in the computer. This includes the operation and maintenance of all devices, software development, backup and all other aspects of Information Processing Center.

Operations

The OLI's Information Resources Department maintains a set of operations standards. In brief, these standards consist of four items which relate to dealing with users' questions, printout distribution, department policy about 'supplier' and 'customer' and prioritizing users' requests. Each of these will be described in the following paragraphs.

The first standard says that when there is a user request to an operator, the operator should give the answer if he/she knows, otherwise, he/she should tell the user that he does not know, and promise the user

that he/she will look for the answer from someone in the department and will go to the user as soon as he/she gets the answer. The user should not wait more than one hour for the answer. Even when the answer is not found, the operator should let the user knows that he/she has passed the question to someone in the department and will call back as soon as the answer is found. The operator should apologise for this delay as well.

The second standard says that the operator should make sure that all printouts leaving the printers are of the best quality. The operator should look for the missing parts of letters, streaks, faded printing and the print positioning. When the operator sees printing problems which are caused by printers, he/she should re-print the copy. When the problem is not caused by the printers he/she should let the appropriate user know about the problem. Finally, the operator should distribute printouts into designated shelves, so that users wait no longer than one hour for their printouts.

The third standard states the department's policy regarding relations with users. According to this standard all department members should regard the department as a 'supplier' which offers services, and

user departments as 'customers'. Therefore, as a supplier, each member of the department should value and keep all user departments happy.

The fourth standard guides all department members in prioritizing help given to their users. The first priority is given to users who cannot continue their jobs unless the department helps them in solving the problems they are facing. The second priority goes to the problems which are urgent. The last priority is time: first come first served.

Computing Service Hours

Computing service hours are twenty-four hours per day and seven days a week. However, operators are on duty only from 8:00 until 21:00. There is no regular schedule to shut down the system.

Backup

The department does two types of backup, daily backup and monthly backup. Daily backup is done every morning at 5:00 a.m. for all files which have been modified during the previous day. The timing is intended to avoid any user being on the system when the

backup is running. If a user was on the system when backup is done, backup tapes would not represent the user file.

The procedure of the above backup is to copy all files which have been modified during the previous day to a certain directory on the disk. Then, the operator's first task in the morning is to copy all files in this directory onto tapes. There are tapes for each day of the month. These tapes are stored at Security Computer Data Limited (SCD Ltd). These tapes are brought to the department when they are needed. The SCD comes to the department two times a week, Tuesday and Friday, to drop off any requested tapes, pick up tapes to go to storage and pick up a list of requested tapes for the next delivery.

Monthly backup is done on the weekend closest to the fifteenth of each month. This backup copies every file on the disk onto tapes regardless of whether or not updates have been done on the files. There are tapes for each month in the year and these are also stored at SCD Ltd. Therefore, prior to this backup, the operator requests the correct set of tapes to SCD. This backup takes a fairly long time, about 8 hours, during

which the system is shutdown, so the operator will notify all users two weeks in advance by using electronic mail and welcome messages.

Following the monthly backup, the department does a disk rebuild. The purpose of doing this is to have all files on the disk in contiguous format which results in better system performance. This disk rebuild is done by using a utility program which was supplied by the computer manufacturer.

System Allocation and System Monitoring

The Department of Information Resources allocates its resources so that all users have the same opportunity to use the system. Of course, this does not mean that everyone is given the right to access everything, but there should be some consideration of the nature of data which are stored in the system; is it confidential data ? The access rights of a user reflects his/her responsibility.

System monitoring is done by the operator at various times in a day. First in the morning, the operator makes sure that at least 100,000 blocks of disk space are available in each disk. Second, the operator reads messages from the last night, if any,

and takes action on what is requested. Finally, the operator checks the printing queue to see if there is a printing job which needs a special form and takes the necessary actions.

At various times during the day, the operator reads messages appearing on his/her consoles and makes sure that all printing requests are done within one hour. The operator also checks computer response time. When he/she finds computer response time is seriously deficient, he/she lets the system manager know.

Security System

OLI's Information Resources Department has implemented several security policies. These policies are intended to prevent OLI from losing its valuable data for any reason, and being accessed by unauthorized people. The department implements administrative security, physical security, software security, hardware security, data security and user security. Administrative security means all data and programs are copied to tapes and stored off-site. Physical security means all hardware is placed in secured places. For example, there is no terminal which is placed in a public area, but every terminal is placed in the user's

office; the computer room is always locked when operators are not on duty and no one is allowed to enter the room without permission from the duty operator. Hardware security means preventing information from being accessed from unauthorized terminals or other hardware. Data security means that to access particular data one must have authorization to do so. If not, the system will deny access. User security means using multi-level system user names, passwords, access codes and identification numbers to make it difficult for an unauthorized person to access confidential information. This policy is supported by an audit trail technique which records what files have been accessed, accessed by whom, at what time and from which terminals.

Documentation

The Department maintains a very good documentation system. Almost everything which relates to jobs is well documented. Administration Manual, Job Description, Operations Manual, Software Development, Data Dictionary, Computer Program Documentation/History, and User Manuals are well written in great detail. These documents are always kept up to date.

Summary

From the above description, the Open Learning Institute Information Resources Department can be summarized as follows:

1. In general, the department has two main functions, as information resources manager and as communication agent.
2. The department offers computing services to all departments at OLI.
3. The department divides tasks and functions given to it by the institute among members in accordance with their positions and abilities.
4. The department has very powerful computing facilities.
5. The department has a good software development procedure.
6. The department maintains all its resources very well.
7. The department keeps a good documentation system; everything which relates to the department is well documented.

8. The department seriously secures all its assets, both from being physically damaged, lost, or stolen and from being accessed by unauthorized persons.
9. The user department's responsibility and the Information Resources department's are well defined.

CHAPTER SIX

UNIVERSITAS TERBUKA DATA PROCESSING CENTER

Introduction to Universitas Terbuka

Universitas Terbuka (UT), the Indonesian Open University, was established in 1984 as a government university. The first objective of its establishment was to give more opportunities to recent senior high school graduates to access higher education. The second objective was to train growing numbers of senior high school graduates so that they are ready to enter the labor market. The third objective was to provide teachers with in-service training to obtain a full teaching degree. In delivering its programs, UT uses distance education methods.

In serving its students throughout the country, UT has 32 regional offices (UPBJJs), approximately one in each province; there are 27 provinces in Indonesia. Each UPBJJ is responsible for students services, tutorials and supervision of examination in its region. UPBJJs are also places for student to read announcements and buy learning materials. There are 84

examination centers throughout the country. These are under the supervision of the closest UPBJJ. There are about 240 post offices used by UT for selling UT registration forms and they are also used to display UT's announcement concerning the results of registration and examination.

Within its four faculties, UT offers three kinds of programs, which respectively lead to S1 Degree, Diploma D3, and Diploma D2. S1 programs consist of 144 to 160 credits course, D3 programs consist of 110 to 120 credits course and D2 programs consist of 80 to 90 credits course. There are 20 programs of study and below is the complete list of them.

Table 10. UT's Programs of Study

Code	Name of the program of study
10	D2 Teacher Education for Indonesian Language
11	D2 Teacher Education for English
12	D2 Teacher Education for Natural Science
13	D2 Teacher Education for Social Science
15	D2 Teacher Education for Mathematics
16	D2 Teacher Education for Pancasila Morale
30	D3 Taxation
50	S1 State Administration
51	S1 Business Administration
52	S1 Development Administration
53	S1 Economic and Development Study
54	S1 Management
55	S1 Mathematics
56	S1 Applied Statistics
57	S1 Teacher Education for Indonesian Language
58	S1 Teacher Education for English
59	S1 Teacher Education for Biology
60	S1 Teacher Education for Physics
61	S1 Teacher Education for Chemistry
62	S1 Teacher Education for Mathematics

(Cited from Guidances for Registration and Examination, third edition, August 1987)

In terms of organization, Universitas Terbuka is headed by a president who is formally called Rector. There are three vice rectors, Vice Rector I for Academic Affairs, Vice Rector II for Administration and Vice Rector III for Student Affairs. There are four faculties, Faculty of Mathematics and Natural Sciences, Faculty of Economics, Faculty of Social Science and Politics and Faculty of Education and Teacher Training. Each of these faculties is headed by a dean. All vice

rectors and deans above report directly to the Rector. There are two bureaus under the Vice Rector II, Bureau for General Administration and Bureau for Academic Administration. There are three centers, the Examination Center, Research Center and Center for Educational Media Production and Informatics. The last center includes the library and the data processing unit. However, for the time being, the data processing unit is not in that center. The unit is under the direct supervision of the Rector and is called a 'Task-unit' for Data Processing. There are three other units: Task-unit for Communication, Task-unit for Learning Material Development, and Task-unit for Learning Materials Distribution.

Since its establishment, UT has changed its system operations two times. The first system of operation centred on packaged courses. It meant that all students in the same program and year took the same package of courses. Problem arose in this system of operation when students failed in one or more courses in the package, because they had to re-take those courses. There was no means to do this, therefore, UT decided to develop a new system of operations which was intended to serve students individually.

UT developed the new system of operation which had the following characteristics: (a) students have freedom to choose courses and examinations, (b) course materials are centrally located and shipped, (c) students are allowed to register three times in a year, (d) post office service is used to send course materials to students, (e) course registration is separated from examination registration. The design itself was good and fulfilled the need to serve students individually, but it did not work well because it was too complex. It was not understood by a large portion of UT's staff members and by UT students. This resulted in large numbers of student complaints, so many that they could not be answered quickly. Problems which arose were: incorrect registration data, delayed course materials delivery, unsuccessful course materials delivery due to bad address information, and slow communication between UT and students.

Based on that experience, the system was revised. The revised system of operations has the following characteristics: (a) course materials delivery system through local bookstores and regional centers(UPBJJs),

(b) first examination registration for a course is attached to the course registration, (c) twice a year registration.

In terms of enrolment, UT has approximately 130,000 students with approximately 60,000 semester enrolments. Like other distance education institutions, UT faces a high attrition rate.

Introduction to UT's Data Processing Center

UT's data processing center is formally called "Satuan Tugas Komputer" or "Task-Unit for Computing". For the time being, the head of the unit is the Rector of the university. However, for the daily operations, there is one member of the unit who is in charged with coordinating all activities.

There has been a big shift in the tasks and functions of the unit from its beginning until now. Formerly, the unit was responsible for all aspects of data processing such as, data preparation, data validation, data manipulation, computer operations, system design and software development, backup and maintenance. Right now, the unit is only responsible for system design and software development, backup,

maintenance, computer operation and assisting users in computer related work. Data preparation, data validation and data manipulation are the responsibility of the user departments. There was no formal statement which led to the above shift. The shift occurred as a result of the computing unit having too much work to do; some of it was shifted to the users.

The unit has played an important role in the development of UT's system operation. The members of the unit participated with users in the design process, and in the process of developing system software which was used in the implementation of the system operations.

Organization of UT's Data Processing Center

There is no formal statement of how the unit should be internally organized. However, the members of the unit have made an 'informal' internal organization. Members are arranged in groups, each of which has the same kind of tasks but in different areas of responsibility. Each group is responsible for the system design and software development in its area of responsibility. In addition to that kind of working group, there are also working groups of programmers,

operators and hardware people. All members of the unit report to the head of the group, and all heads report to the coordinator of the task-unit for computing as shown in the following figure.

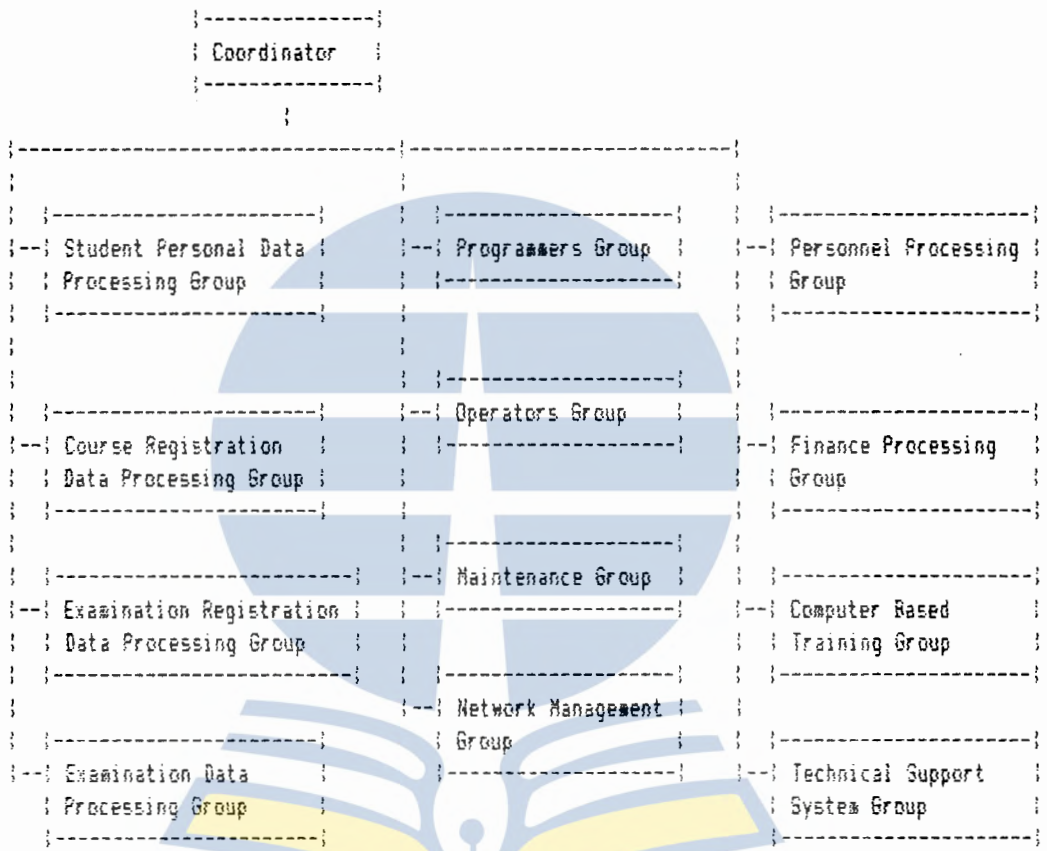


Figure 3. Organizational Chart of UT's Data Processing Unit

Task and Functions

The task-unit for computing has the main task of providing computing facilities to user departments. User departments are Registration Department, Examination Center, Finance Department, Personnel Department, and the four Faculties. Its services are to process registration forms (personal data, course and examination registration), examination answer sheets, student billings, personnel data, and course management data. Data for registration and examinations are input to the computer by using computer readable forms. Please see Appendix 5 for examples of these forms. Other data are keyed into the computer by operators of appropriate user departments.

There are two major steps in processing. The first is data preparation and data validation. This is based on the assumption that the raw data is not ready to be processed right away and requires "cleaning".

Data preparation includes arranging data forms in batches, making records to identify batches, scanning data where the result is stored on tapes, and finally copying data from tape to disk file. The scanning program also has the capability of rejecting incomplete data and the operator can make corrections on the

incomplete data. However, it has no capability of checking the correctness of data; this requires validation.

Data validation includes running a program which verifies data and produces an error report, making corrections on the reported incorrect data by matching the report and the original forms, and based on this correction, updating the data on the computer.

The second step is processing which is done according to the type of the data. For example, course registration data is used to produce lists of students registered in the current session, lists of examinees, statistical reports and so on. Processes involved with examination data are item analysis, scoring, grading and other appropriate statistical reports. In addition to the routine reports, the unit also has the responsibility to make ad hoc reports concerning data/information which is stored in the computer.

Relationship with Other Data Processing Centers

UT's data processing unit is a member of the UNInet network. The network is for state universities and is supported by the Director General for Higher Education. The network is used by its members for

information exchange or sharing which is supported by electronic messaging and an electronic forum. For the time being, the center of the network is in the Computing Science Center at the University of Indonesia. This center is a gateway for accessing worldwide computer networks. UT accesses this center once in a day, usually in the morning, to send and to pick up messages from the day before.

Personnel

There are twenty-one staff members in the unit. Eleven of them are university graduates all of whom have their major in mathematics. Nine of them are senior high school graduates and the final one is a secretary academics graduate. None of the staff graduated in computing areas. Most of them had no adequate computer literacy when they first joined the unit. Some of them had experience in FORTRAN programming. The university graduates who joined the unit since 1984 were trained in the University of Indonesia computing center. The newer staff members have been trained by the old members. The training program covered topics such as, COBOL programming,

System Management, Operating System, System Design, and topics which are important in running a data processing center.

Personnel Responsibility

There are no job descriptions for staff members. The nature of the tasks were not highly structured and this made it difficult to provide job descriptions. Fortunately, the 'informal organization' appears to have been effective. At least, the unit's tasks have been performed, though not always with the greatest smoothness. The tasks of the unit could be better distributed among its members.

During April and May of 1988, an effort was made to develop job descriptions for every UT staff member including the computing unit. Staff members were asked to complete a questionnaire which described their jobs. The result of this survey showed that in the computing task unit there is uncertainty or confusion about positions, main tasks and additional tasks, reporting structure, rights and responsibilities.

Personnel Training Program

There is no formal and routine personnel training program. However, there is 'informal' training in the unit; new members are grouped and trained by an older member of the unit. Usually, new members are trained by doing the real tasks. It is expected that the training will make the new members able to relate the obtained computer knowledge and its usage in the real situation. In addition to this, and when there is opportunity, the unit sends its members to training programs or seminars which are offered by PT. Infodata, the representative of the Data General(DG) Corporation in Indonesia. The training programs could be in programming, computer system management and use of other DG software.

Supervisory Practice

Tasks are distributed by the coordinator to members who have no current tasks and have the ability to do the tasks. Supervision is performed in terms of tasks completion, assistance in doing assigned jobs and in administrative areas.

Physical Facilities and Equipment

The physical facilities and equipment will be described under three headings: computer room, computer, and peripherals and communication devices.

Computer Room

The dimensions of the computer room are approximately 8 meter x 7.5 meter x 3 meter. In addition, there are special rooms for printers, scanners, fire extinguisher, UPS, tapes and for staff offices. These rooms are close one to another. Computers, disk drives, tape drives, and scanners are put in a room which has a raised floor.

The room is serviced with the following devices. There are two units of Un-interruptible Power System (UPS). The first one has 40 KVA capacity and is able to supply power for 40 minutes at the maximum load when the electricity is out. The other one has 5 KVA capacity and is able to supply power for 15 minutes. The latter is used as a back up UPS when the former does not function properly. There is a fire extinguisher system, halon gas system, and there are three air conditioners, one of 12 KVA and two of 5 KVA.

Computers

There are a number of computers in the unit. The biggest one is a supermini computer, Data General MV/15000 Model 20 with 8 MB main memory. This computer was installed in April 1988. It can handle up to 1024 processes. The second computer is Data General MV/4000 with 6 MB which was installed in 1985. This computer can handle up to 256 processes. These two computers run under Advanced Operating System/Virtual Storage. By ensuring that the two system run under the same version in all their software, one hundred percent compatibility of the two systems is guaranteed. Finally, there are four PC compatible units.

Peripherals

Peripherals which are available are described briefly in Table 11.

Table 11. UT's Peripherals and Communication Devices

No.	Device	Quantity	Function	Capacity
1.	Disk drive	6 units	I/O devices; data storage	350 MB each
2.	Disk drive	5 unit	I/O device; data storage	596 MB each
3.	Tape drive	3 unit	I/O device; data storage	2400 feet; 800/1600 BPI
4.	Printer	2 units	Output device	800 Lines Per Minute
5.	Printer	2 units	Output device	1600 Lines Per Minute
5.	Terminal	40 units	Workstation	Not Applicable
6.	IAC-8; RS-232	1 unit	Workstation controller	8 terminals each; 900 feet length
7.	IAC-16; RS-232	3 units	Workstation controller	16 terminals each; 4000 feet length
8.	Scanner Sentry 7000	2 units	Optical mark reader	2500 sheets per hour
9.	Scanner Sentry-300	1 unit	Optical mark reader	300 sheets per hour
11.	Modem	3 units	communication devices	300-1200 baud
12.	Surge Protector	32 pairs	Protection against lightening	up to 200 Volt

The use of the three modems is as follows. One modem is used by Uninet software as a line-out to access the Uninet network. The other two modems are planned to be used as line-ins for the UT-UPBJJ network.

Application Software and Software Development Procedure

There are a number of applications software available in UT's Data Processing Unit. There are three groups of applications software: software supported by DG Corporation, Software supported by the Director General for Higher Education (DGHG), and in-house developed software. The system software and applications software, and the brief description of each is presented in Table 12, 13 and 14.

Table 12. Software Supported by DG Corp.

No.	Software	Descriptions
1.	AOS/VS	Operating System
2.	AOS/VS CLI	Command Line Interpreter
3.	AOS/VS EXEC	Multi-user environment manager
4.	AOS/VS INFOS_II	Indexed file management system
5.	AOS/VS SQL	Data Base Management System
6.	AOS/VS F77	Fortran 77 Compiler
7.	AOS/VS COBOL	Cobol Compiler
8.	AOS/VS S/M	Sort/Merge Utility
9.	AOS/VS EDUCATOR	Computer Base Training Software
1Ø.	AOS/VS SWATAOS/VS SWAT	Program Debugger
11.	AOS/VS PROXI	Cobol Program Generator

Table 13. Software Supplied by DGHG.

No.	Software	Descriptions
1.	UNINET	Network software which consists of: - Electronic Messaging - Electronic Forum - File Transfer Facility

Table 14. In-house Developed Software

No.	Software	Descriptions
1.	SRSUT	Student Records System for UT, this system consists of approximately one hundred computer programs. It is used mainly to process registration and examination data.
2.	APL_UANG	Finance Applications software which consists of 5Ø computer programs
3.	APL_PEGAWAI	Personnel applications software which consists of 2Ø computer programs
4.	APL_TAPE	Tapes management system software
5.	Ad Hoc reports	It is a group of various computer programs which produce ad hoc reports for the use someday in future
6.	APL_TU	Is an application to file UT policies.

Software Development Procedure

The software development procedure in UT's Data Processing Unit is not clearly defined. In particular, there is no clear procedure for deciding what software or computer program needs to be developed. There is no requirement that a feasibility study be conducted before software development is undertaken. Most development has been undertaken in a rush and the given system was developed on a trial, error and revision basis. An example of the above can be found in the development process of the first, second, and the final system operations described earlier. All computer programs which support these system operations are in-house developed. In-house development has obvious advantages. It is cheaper, changes can be made inexpensively, customized to UT' needs and it avoids dependency on outside suppliers.

Users and Their Applications Software

The two biggest users are the Registration Unit and the Examination Center. They are considered as big users because they use the system almost everyday and the number of terminals in their units are greater than in other units. There are eleven terminals in the Registration Unit and another four will be added soon.

In the Examination Center, there were formerly five terminals. However, these were damaged by lightning. Replacement of these terminals is being done with associated installation of surge protectors which will protect terminals from being damaged by lightning and other surge sources.

Smaller users are the Finance Department and the four faculties. For the time being, the Finance Department keys in student billing into diskettes by using PCs. Software for this use was developed by the computing unit. The data which has been keyed into diskettes is then transferred to the file in the computing unit and is used as a reference in verifying student payment.

The four faculties are using the SRSUT application to maintain course files. Information regarding the course number, course name, and other data are stored in this file. This file must be kept up to date, because it will be used for reference in verifying student registration. In addition, the faculties could use the system to get in touch with their students.

Finance Department, Course materials inventory management and Personnel are potentially big users. Applications software for the use of these units is

being developed. Some is finished and ready to use. Use is suspended because of lack of terminals. Another prospective user is the Facility Department. The department head has already indicated her willingness to computerize the department's work. Finally, in accordance with the development of UT's Management Information System, all departments within UT will become users of the computing unit.

User Relationship

The relationship between UT's Data Processing Unit and its user departments can be described as follows. The data processing unit is responsible for the operation of computers, peripherals and all the supporting devices, development and maintenance of applications software, making backups of applications software and all data, keeping track of hardware maintenance and training users to use computers and all available facilities. The user departments are responsible for data preparation, data validation and data manipulation.

Formerly, this division of responsibility was unclear. This led to misunderstandings between the data processing unit and user departments. The division is

now much clearer, but this was not a result of a formal written decision. It was the consequence of growing computing needs which forced the responsibility of data preparation, data validation and data manipulation onto user departments.

Operations

Computing Service Hours

The regular service hours are from 8.ØØ am until 16.15 pm, six days a week, Monday to Saturday. Over-time service is given in peak periods such as the last days of registration or close to the deadline of examination processing. At times, the computer runs for six days without down time. Other than during service hours, the computer system is shut down.

Backup

Each member of the unit has the responsibility to make backup copies of their own directory. There is a weekly backup schedule for directories of user departments. Backups of these directories are made as scheduled or under the request of the person who is in

charge of the security of these directories. Operators have the responsibility for making backup copies of user departments' directories.

Resource Allocation and System Monitoring

The unit allocates its resources so that all users have the same opportunity to use the computing facility. Each of them is given the same computer priority to use the system. The slogan 'first come, first served' is implied. Exceptions are made occasionally in special cases.

Regular system monitoring is done everyday by using SYSLOG utility which was supplied by Data General Corp. as a part of the operating system software. The SYSLOG report contains a list of users who used the system in a day, the duration of terminal connection, the CPU time used, number of pages printed, and the number of I/O blocks. The report contains a summary of device malfunctions as well.

Computer system operators are asked to make daily operations records. The records contain: (a) time when the computer is up and is shut down, (b) device malfunction during the operation, both for hard error and soft error, (c) time and duration of electricity

power failure (d) and anything else which is necessary to note. The operators are also asked to monitor the computer response time. When the response time is poor, operators request users to reduce the number of on-line processes.

Security System

The unit uses two security techniques. The first is the common procedure of giving each user a unique User-ID and password. No one can enter the system without having a User-ID and a password. User-IDs are given to only a limited number of people. Other users are given operator codes and a kind of password. However, they cannot use the computer system as UT's executives do. The second technique is applied to users who are not executives. Terminals for operators in user department are disabled from ordinary logging on to system. These terminals are activated by a terminal in data processing unit which directly runs applications which are appropriate to the department such as Student Records System (SRSUT) in the Registration unit and the Examination center. Every operator is required to have an operator code and a password to use the SRSUT. Each operator is tied to certain applications. He/she cannot

use facilities other than those which have been specified. For example, an operator in the registration unit cannot use facilities for examination processing.

Documentation

It appears that the unit does not maintain a satisfactory documentation system. Most computer programs are not documented, or at least, if there is documentation is not kept up to date. Moreover, processes which already complete are not documented. For example, there is no note which summarizes when backup is done and what files have been backed up.

Summary

Based on the description above, the Universitas Terbuka's data processing unit can be summarized as follows:

(a) The organization could be regarded as a young organization; it is now in its fourth year. Its problems are those of an organization growing from a "baby" to become "an adult".

(b) The unit faced difficulties in setting up standards and procedures. Many policy changes placed members of the unit in a frustrating situation. It happened particularly in the period when the computer software was being developed to support UT's system operations.

(c) The data processing unit serves limited numbers of users. This is because the computing unit has concentrated on the Student Records System and the Examinations System. However, other applications are now being developed such as personnel, finance and the Management Information System.

(d) There are weaknesses in the unit especially in the distribution of staff responsibility, staff members' ability in communications, adequate management knowledge and skills, system software development procedure, backup schedule, documentation system, training, and user relationships.

CHAPTER SEVEN

COMPARISON OF THE THREE DATA PROCESSING CENTERS

Having provided descriptions of the three data processing centers in the three previous chapters, it is now time to compare them. The comparison will be made in terms of subjects which were described before. These subjects will appear in the same sequence as they appeared in the descriptions.

Organization

Comparison between the three data processing centers from an the organizational view point will be made in terms of the age of the host organization and its implications for the data processing center, the position of the data processing center in the host organization, the organization of the data processing center, tasks and functions, and how tasks and functions of the data processing center are distributed to all its members.

In terms of age, DC is the oldest of the three centers at nineteen years , UT is the youngest at four years, and OLI is in between at ten years. For the

purposes of this discussion, it will be argued that, an organization which is ten years old has reached maturity while one which is younger than five years is still in its infancy. Thus, UT is considered an infant organization, whereas DC and OLI are considered as mature organizations.

The implication of the age difference in the three organizations can be seen directly in the descriptions which have been provided in the three previous chapters. In short, DC and OLI have more stable conditions, more structure, more standardized procedures and smoother operations than UT. This is because there is a higher level of understanding from those who are involved, students, administrators and intructors. Moreover, structures, standards and procedures have been tested and verified in real situations.

Other implication of age can be found in the nature of change occuring in the three organizations. At OLI and DC on one hand, since they are more mature organizations, there is more stability and less drastic changes. On the other hand, UT is young and has not

settled to a stable operation. As a result, there are frequent, often major, changes, which have a profound effect on the computer department.

In terms of position in the host organization, the OLI and DC centers are formally positioned at the third level down from the top. At UT, the center is different from this; it is positioned at the fourth level down from the top in accordance with the Ministry Decree. However, this is misleading because UT's data processing center is under the direct supervision of the Rector of the university and is really at the second level in the organization.

In terms of tasks and functions, all the three data processing centers were designed to serve all departments in the host organizations with computing services. At OLI the center was also given the responsibility to provide institute wide departments with communications services. In this respect, OLI's center is far better than the other two centers. It provides institute wide user departments with a full range of computing services which directly meet the needs for computing in all departments. DC's data processing center, at the second position, provides college wide user departments with computing services,

but for some departments, computing services are limited only to word processing services. UT's data processing center provides computing services to only a limited number of user departments. In the DC case, the inhibiting problem was the lack of a powerful computer system before the computer DG MV/15000 was installed in Spring, 1987. Whereas the case of UT was because of its infant status; the center has been looking after the needs of the high priority units and has not had time for the others.

In terms of the internal organizational structure, the UT and DC data processing centers have a flatter organizational structure than OLI. There are only two layers at UT and DC compared to OLI which has four layers. It seems that OLI takes advantage of its structure to distribute different types of jobs to different levels of employees. Higher layers have more concerns in management aspects, whereas lower layers are more concerned with operational aspects. At DC with only three staff members, it would be impossible to make the organizational structure taller. At UT, because there was so much parallel work which had to be finished in a relatively short period, a flatter organizational structure was more suitable. At both UT

and DC, the possibility of mixed job, management and operational assignments is greater than in the OLI case.

In terms of the way these centers distribute tasks and functions, DC uses Job Descriptions, OLI uses Performance Objectives and UT uses 'uncertain forms'. The first two are written documents whereas the third is unwritten or spoken. At UT, even though there is uncertainty, the center works. However, it is difficult to see whether or not the tasks and functions have been distributed well in the absence of a written document as reference. As well, this creates difficulty in making improvements. The case at DC and OLI is different. Job descriptions and performance objectives are written and they are subject to change over a period in order to adapt to changing needs.

Personnel

Comparison between the three data processing centers will be made in terms of number of staff members, entry level qualifications which include academic backgrounds in computing and management, personnel training programs and supervisory practices.

In terms of number of staff members, DC data processing center has the smallest number, UT data processing center has the largest number and OLI data processing center has a number in between the other two. However, in terms of entry level qualification, DC and OLI have standards which applicants must meet before they were eligible to occupy certain positions. UT is far different from this. There are no entry level qualifications in computing and management. At DC and OLI, applicants for certain positions must have an academic background in computing or at least must have equivalent experience.

In terms of personnel training program, DC and OLI are more supportive than UT. They have a regular budget to send their staff members to take training programs, or to enrol in a computing course in a recognized university, or to take a seminar of interest. The condition in UT is much different from this; training funds are very limited and the center must compete with other programs. There is no regular training budget. Only a few members of UT's data processing center have been sent to training programs.

In terms of supervisory practices, OLI data processing center appears to be the most professional. Their supervisory procedures include, department wide meetings, division wide meetings and individual meetings between managers and those who are under their direct supervision. The closest supervision is the third one, in which the manager supervises intensively by referring to performance objectives, achievements for the previous two weeks and plans for the coming two weeks. DC and UT data processing centers have no such supervisory practice. DC's data processing center which has only three staff member considers that it is unnecessary to set up a regular meeting; individual meetings are more appropriate for them. At UT supervision is limited only to ongoing tasks. There are no regular meetings. Meetings take place on the basis of needs.

Physical Facilities and Equipment

Comparison between the three data processing centers will be made in terms of computer room, supporting devices and computing power.

In terms of computer room, UT data processing center has the best physical space for computers and all peripherals. The room is large, it has a raised floor and is air conditioned. DC's computer room is fairly large, it has a raised floor, and air is conditioned as well. OLI's computer room is too small for the computer and peripherals and the air conditioner is not powerful enough to compensate for this weakness. DC's computer room and OLI's computer room are highly secured, no one is allowed access to computer or peripherals, including printers. UT's computer room is not highly secured. This is because the scanning machines, which are computers as well, are placed close to the computer room and have the same entrance door.

In terms of supporting devices, all the three centers have all the supporting devices which are necessary for the operation of the system. All have automatic fire extinguishers, air conditioner and power stabilizer. UT has Uninterruptible Power System which is neccessary for the operations because of the low quality of electricity services. There is often down

time and blackouts. DC and OLI data processing centers do not require a UPS because of better quality electricity services.

In terms of computing power, all the three data processing centers, have adequate computing power to perform their given tasks. UT and DC both have Data General MV/15000 computer, but UT has the Model 20, whereas DC has the Model 10. In addition UT has another Data General MV/4000 whereas DC has a Data General C/330 and uses a computer owned by outside company. OLI has one DEC Vax 11/780, two DEC Vax 11/750. It appears that the three data processing centers have sufficient computing power to perform given tasks. For example, UT has now approximately 130,000 students with 60,000 student semester enrolments. OLI has a smaller number of student but it uses its computers for publishing purposes. DC has almost the same number of students as OLI, but does not use its computers for publishing purposes. However, it serves students doing the computing assignments.

Application Software and Software Development Procedure

Comparasion between the three data processing centers from the applications software view point will be made in terms of the variety of software which is available in the main computers (not micro computers) and the parties who developed the software.

In terms of variety of available software, OLI has the most complete variety. The center has developed software both internally and externally for many years. DC has more applications software run on its main computer than UT has. This means that the center can serve more user groups than UT's center.

In terms of parties who developed applications software, UT has the highest percentage of applications software developed internally. In fact, almost all applications software at UT was developed internally. This has made the UT data processing center less dependent on outside software houses. OLI has approximately fifty-percent of its applications software developed externally. However, it has been realized by the Manager of Corporate Development that developing applications software externally has some disadvantages. According to him, the disadvantages are (a) the expertise of developing applications software

goes to the developers, (b) it creates a dependency on outside software house, especially when the developed applications software needs to be revised because of policy changes and (c) it can be very expensive in the longer run. Therefore, UT and OLI now have the same approach to software development. Most applications software available in the DC data processing center was externally developed because the center is understaffed. Therefore, the center is highly dependent on the services of outside software houses. Actually, the manager of the DC data processing center has the same idea as UT and OLI and is trying to add a programmer. However, he is having difficulty in convincing the personnel department of the need for this position.

Software Development Procedure

Comparison of software development procedures will be made in terms of activities undertaken. OLI has the best software development procedure among the three data processing centers discussed in this study. The seven activities or steps undertaken in the procedure involve in depth analysis and evaluation, and are used to guarantee that all applications software which are

developed are really needed, will improve the existing situation, are well developed, are tested and properly installed.

DC and UT data processing center have no such formal software development procedure. However at DC, because all applications software which need to be developed have to be passed by the College Computing Advisory Committee, the needed review to ensure a solution or improvement of an existing situation can be guaranteed. The development, testing and installation aspects are entrusted to outside software house. At UT, there is also such a committee, but it does not work as well as expected. The in-depth analysis and evaluation are often left undone for some reason such as time constraints. In certain cases, applications software was not well developed because the need itself was not well defined, and because there was no in-depth analysis and evaluation of existing needs or problems.

User Relationships

Comparison among the three data processing centers from the user relationship view point will be made in terms of the variety of users the centers serve and the roles of the two parties, users and centers, as partners in the relationship.

In terms of users whom the centers serve, OLI and DC data processing centers serve the entire institution, whereas UT users are limited to certain departments. However, as with the other two, the UT data processing center is expected ultimately to serve the entire university. There is a major difference between OLI and UT on the one hand and DC on the other. At OLI and UT, there are no students who are customers of computing services. In DC, students are a big customer group and have a great impact on how to keep secured all files and data in the computer system. However, critical systems are housed separately on the external computer.

In terms of the role of parties who are involved, users and data processing centers, the three institutions are almost the same with minor variations. This is because the maturity level of users of the three centers are different. In short, the role of the

centers is to provide computing facilities, whereas the role of user departments is processing the data by using computing facilities developed by the centers.

Operations

Comparison between the three data processing centers in operations will be made in terms of computing service hours, backup, resource allocation and monitoring system, security system and documentation.

In terms of computing service hours, OLI and DC data processing centers have a very long period, almost twenty-four hours per day. Computing services are available even though there is no operator or data processing staff member on duty. At UT, computing services are not available when there is no operator and data processing member on duty.

This major difference results from difference in the operating environment. On one hand, OLI and DC are in Canada where there is a good electricity service and less frequency of lightning. These conditions provide good operating conditions and allow their computers to run without operators on duty. On the other hand, UT is in Indonesia where the electricity service is not so

good; there are frequent power interruptions every day, especially on rainy days. Moreover, UT's office is in an area which the frequency of lightning is high. These disadvantageous operating conditions provide no possibility of running the computer without an operator on duty. In addition to this, it is difficult to find people at UT who are willing to work late at night. In short, it is impossible to offer computing services of twenty-four hours per day on a regular basis.

However, sometimes the computing services are available for twenty-four hours. This usually happens when there is job which must be finished as soon as possible and which cannot be finished in normal office hours such as at times close to the deadline for examination result announcements.

In terms of backup, OLI and DC make backup copies of their disk contents consistently as scheduled. UT makes backup copies of disk contents as well, but this is not regularly scheduled. The center used to have a backup schedule, but because of various constraints it was discontinued. Backup copies are made on a need basis. OLI appears to be the best among the data processing centers in this study in making backup copies. OLI uses an outside company to store its

valuable backup copy. People from the company come back and forth two times a week to drop tapes which will be used and to pick up the finished tapes. UT also has backup copies stored outside the computer center, but they are stored in another area on the UT campus.

In terms of resource allocation, the comparison will be made in the following items: terminals and printers allocation, disk space allocation, connection time and priority setting. In allocating terminals, the three centers use very similar procedures. Terminals are placed in users' offices for their convenience in using the computer. In allocating printers there are some differences. DC has no centralized printers, but printers are placed in certain areas so that users do not have to go far to obtain their printouts. OLI places printers in each floor for printing jobs which use a general printing form. Printing jobs with special printing forms are handled centrally and printed in printers in the computing room. UT has no printers which are placed in users' offices; all printouts are produced centrally.

In terms of monitoring systems, OLI and UT data processing centers have similar procedures; during normal office hours, there is an operator on duty who

works in the computer room. In the DC data processing center there is no operator who regularly works in the computer room. At OLI and UT the operator in the computer room monitors special printing jobs, monitors computer response time and takes necessary actions when it is too slow. At UT the presence of an operator is important because certain users need operator help to install data tapes as the result of the scanning process. At DC, monitoring is not important because the DC data processing center reduces the number of real time jobs by forcing some types of jobs, such as compiling and SPSS jobs, into batch mode. Computer response time is affected by the number of active jobs; the less the number of active jobs, the better or faster the computer response time. At OLI, the decision as to whether a job is in real time mode or in batch mode is given to users. It is advised that they submit jobs in batch mode when the result is not urgently needed.

In terms of security systems, especially those which relate to procedures for logging on to the computer, DC applies the largest variety of security techniques. This is good, especially in the university or college environment, where students constitute a big

group of users with the possibility that some of them are computer hackers. Such a security system is important as well for a system which is open to the outside world, and can be entered by using a telephone line. Therefore, hard connection, dial back, and disabling some operating system commands are important to keep secured the most valuable application, such as finance applications and student records systems.

OLI secures its highly valuable applications by using software security techniques in which there a password to get on the system, another password to use certain application software. This forces operators to invoke a password each time they want to use an application. These passwords are subject to change over a certain period. It is another good way to prevent unauthorized poeple from entering valuable applications.

UT secures its valuable applications by making it impossible for users to use all operating system commands. Every application run in user offices is menu driven, and is controlled by the master console in the data processing center. In addition, all users'

terminals are disabled to ordinary logging on. They are available for use only if activated by the master console in the data processing unit.

Documentation

OLI's data processing center does the best job of documentation. Almost everything is well documented, including documentation in the following areas: organization, personnel, process, development, testing, installation, history of software maintenance, and operations manual both for externally developed and internally developed applications software. UT and DC do not keep a good documentation system. There are fewer documented or written resources in these units. UT's data processing center maintains documentation of computer program, backup, but these are not well kept up to date.

Summary

From the above comparisons it could be summarized that OLI's data processing center gains positive marks in almost every category, DC's center receives positive marks in many categories and UT's center gets positive marks in some categories.

CHAPTER EIGHT

SUMMARY, CONCLUSIONS, DISCUSSION AND RECOMMENDATIONS

In previous chapters, the author has presented the problem of the study, related literature, research design, descriptions of three data processing centers and comparisons between them. This chapter provides a brief summary of what has been presented, it provides conclusions and a short discussion, and finally it concludes with recommendations for UT's data processing center.

Summary

One of the purposes of the study was to describe, analyse and compare the three data processing centers at DC, OLI, and UT. This has been achieved. Descriptions, analyses, and comparisons were made in terms of organization, personnel, physical facilities and equipment, application software and software development procedure, user relationships, and operating procedures. Data gathering procedures were direct observation, serial discussions with people who work in the three centers and the review of available documents.

Conclusions

Based on the descriptions and comparisons in the previous chapters the following conclusions can be derived for each institution:

(a) Douglas College data processing center, even with a small number of staff members appears to be satisfying its users. Even though the center is not the best of the three centers studied in every category used in the study, it does a very good job with most crucial aspects of data processing. The center runs the computer system well, keeping everything secure both from physical damage (backups and installation security devices) and from access by unauthorized people (dial back logging-on technique and hard connection technique). The center appears to have three major weaknesses. First, it is dependent on outside software house services in developing new applications software and maintaining existing applications. This dependency could be very costly in the long run. Second, the center is understaffed considering its work load. Finally, the center does not keep a good documentation system.

(b) Open Learning Institute data processing center appears to be the best center among the three centers in this study. It has a positive value in almost every category used in this study. In short, the center is well organized, well-staffed, well-managed, well-planned and developed, the computer system is running well and everything that happens in the center is well documented. These strengths reflect the philosophical grounds which all members appears to believe. These are: first, all members should think of the center as a company which sells services to customers; all members should consider all user departments as their customers and make them happy with the center; members should realize that everything they do is for students - students are the reason the center exists.

(c) UT data processing center, even in its 'infant' stage has proven that it can develop a complex application software which directly supports UT system operations. However, the center has weaknesses in some of the categories which were used in this study. Members of the center have

adequate computer knowledge to develop applications software but this all is not enough to run a data processing center. Major weaknesses of the center are in management aspects. There are weaknesses in organization, personnel management, facilities management, software development procedure, user relationships and some aspects of operations such as backup and documentation. In these aspects, the UT data processing center ranks lower than the other two centers.

Discussion

UT's data processing center operates in a more disadvantageous environment than OLI and DC. OLI and DC operate in an environment which is characterized by standard services and the familiarity of its society with these services. These standard services simplifies analytical and operational tasks for people in a data processing center.

The above environment is much different from UT's. UT must develop its own operations network. For example, UT had to set up new procedures for registration, examination, student billing and course materials shipment. Because there is nobody in UT with

experience in these matter, trial and error approaches have occured. It is not surprising that some procedures work and some procedures do not work. Procedures have had to be tested in real situations which were unstructured and lacked standardization. It is much more difficult to deal with these situations, especially since computerization requires structure and standardization.

Recommendations

Considering the weaknesses of the UT data processing center which have been identified, the practices in the DC and OLI data processing centers, and the literature on data processing centers, the following recommendations are suggested:

(a) The management of UT data processing center should be improved. The following aspects of management must be taken into consideration: organization, planning, direction, leadership and control. (Calahan, 1983, p. 3). Organization means choosing an appropriate organizational structure for the data processing center, determining levels and positions, command paths and reporting paths of all positions. Planning means defining tasks in advance

of what is going to be done and preparing to do this. For example, work load projections, hardware and software, staffing needs and so on, all need to be considered. Direction means having a broad view of all activities, progress and problems which are carried out through command and reporting paths. Leadership means implementation of the right leadership style in the right situation. A leader of a data processing center, ideally, should have both technology and management knowledge backgrounds. Control means determining the efforts needed in achieving goals in relation to staffing, hardware and software, budget and so on.

(b) In setting up the organizational structure of the data processing, the four principal functions of a data processing center should be remembered: applications development, operations, technical support and management staff. (IBM, p. 4)

(c) In brief, UT data processing center could be organized as follows. The center is divided into three divisions. These are Division of Applications Development, Division of Operations and Technical Support, and Division of User Support. The function of the first division is to develop applications

software. This includes performing system study, generating system, implementing the system and documenting each step taken in the development process. The second division's function is to operate the computer and all its peripherals, make backup copies of computer programs and data, and to provide technical support for use of the main computers and microcomputers. The last division's function is to support users using applications software which is available in the main computers and microcomputers. This includes keeping all documentations produced by the first division, running training programs for users based on the above documentations and other publications. Indirectly, the last division performs the functions of quality controller of the center's products before they are used by users. For the effectiveness and efficient of performing their functions, each division could be divided into sub-divisions which have more specific and concentrated areas of work. Furthermore, the head of the center and the head of the three divisions, then, could concentrate on developing long term plans and managing efforts to achieve goals stated

in the plan. The head of the sub-divisions could deal with shorter term plans.

(d) The filling of newly generated positions should be based on applicants' interests and qualifications for these positions as well as the interests and qualifications of existing staff.

(e) Considering the fact that existing members have little or no knowledge background in management, training programs in management should be offered. This should result in a better organized and better managed UT data processing center.

(f) Job descriptions should be prepared for each staff member. Sperling has identified the value of job descriptions program. According to her,

> A well-thought-out, thoroughly researched job description is the back-bone of a totally integrated human resources or personnel function.
>
> (Sperling, 1985, p. 7)

Sperling (1985, p.10) reports the result of a survey on the use of job descriptions in 244 companies. The four most frequent uses of job descriptions are:

(1) to clarify job responsibility, reported by 220 companies (90 percent),

(2) to obtain data for job classification and salary administration, reported by 192 companies (79 percent),

(3) to provide a basis for setting standards of performance, reported by 110 companies (45 percent),

(4) to provide a basis for setting goals and objectives, reported by 80 companies (33 percent).

Considering these results, it could be realized how important job descriptions are in managing human resources. The UT data processing center should develop such job descriptions.

(g) The UT data processing center should implement a better software development procedure which includes the following activities: study of the existing system, study of the proposed system, the benefit of the proposed system, the implications of proposed system on personnel, budget and so on,

computer program writing, testing, installation, user manual preparations and documentation of all these activities.

(h) Considering the importance of documentation, the center should develop a better documentation system. Documentation should contain enough detail, be clear and be kept up to date. It is necessary to document all activities, including, job descriptions, operations manual, backup processes, operations log book, device installation, software development and maintenance, user relationships and so on.

(i) User relationships must be clearly understood by members of the data processing center and members of user departments. To avoid misunderstanding, this understanding should be placed in written documents. These documents then should be used as the basis for dealing with departments within UT.

(j) Considering the possibility of failure to recover damaged files due to disk drive malfunctions, or any other causes, the center should set up a backup schedule and consistently follow it as it is scheduled.

(k) Considering the number of users who are allowed to access UT's data bases, it is time for the UT data processing center to upgrade all its applications with the objective of 'tailoring access to responsibility'. This concept is useful in tracing back the history of data records in data bases: who accessed, modified, deleted or something else.

(l) In order to build consistency into statistical reports, UT's data processing center could use the 'soft systems' concept as at other universities, and apply the same algorithm across time in preparing statistical reports. This should also reduce the time spent in real time processing in producing the same report.

(m) Considering the size of the UT organization and the geographic area where UT operates, it might be useful for the UT data processing center to start thinking of distributed data processing. This should be well prepared and thoroughly analyzed before implementation. It could be started with the simplest applications such as installing IBM-PC compatibles, which can be used by UPBJJs as tools in answering students inquiries regarding their

enrolment in UT. These PCs should contain copies of student information for appropriate UPBJJs. This would speed up the student service cycle.

Some of the above recommendations, especially those which have broader scope, should be studied and evaluated by senior staff at UT and particularly the Rector who, at present, is the computing center's senior officer. It is the author's firm belief that if all or most of his recommendations were implemented, they would have a positive effect on the center's operations and general usefulness to UT.

APPENDIX 1.

DATA GATHERING SCHEDULE

DATA GATHERING SCHEDULE

Douglas College Data Processing Center.

October 26, 1987 - November 20, 1987, twice a week, Tuesday and Friday.

Open Learning Institute Data Processing Center.

October 5, October 6, November 26, and December 2, 1987.

Universitas Terbuka Data Processing Center.

March - April 1988.

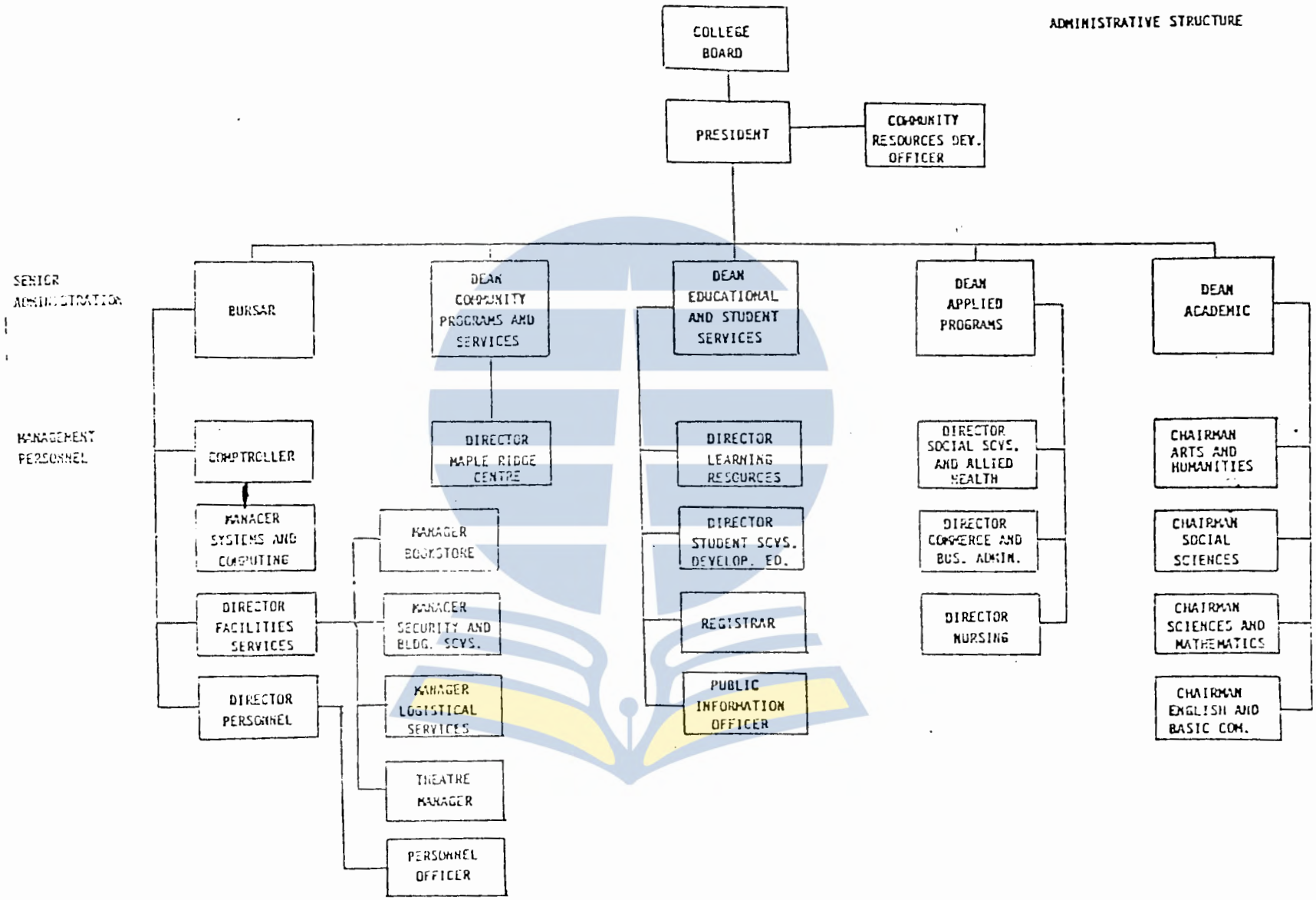
APPENDIX 2.

DOUGLAS COLLEGE ORGANIZATIONAL CHART

DOUGLAS COLLEGE

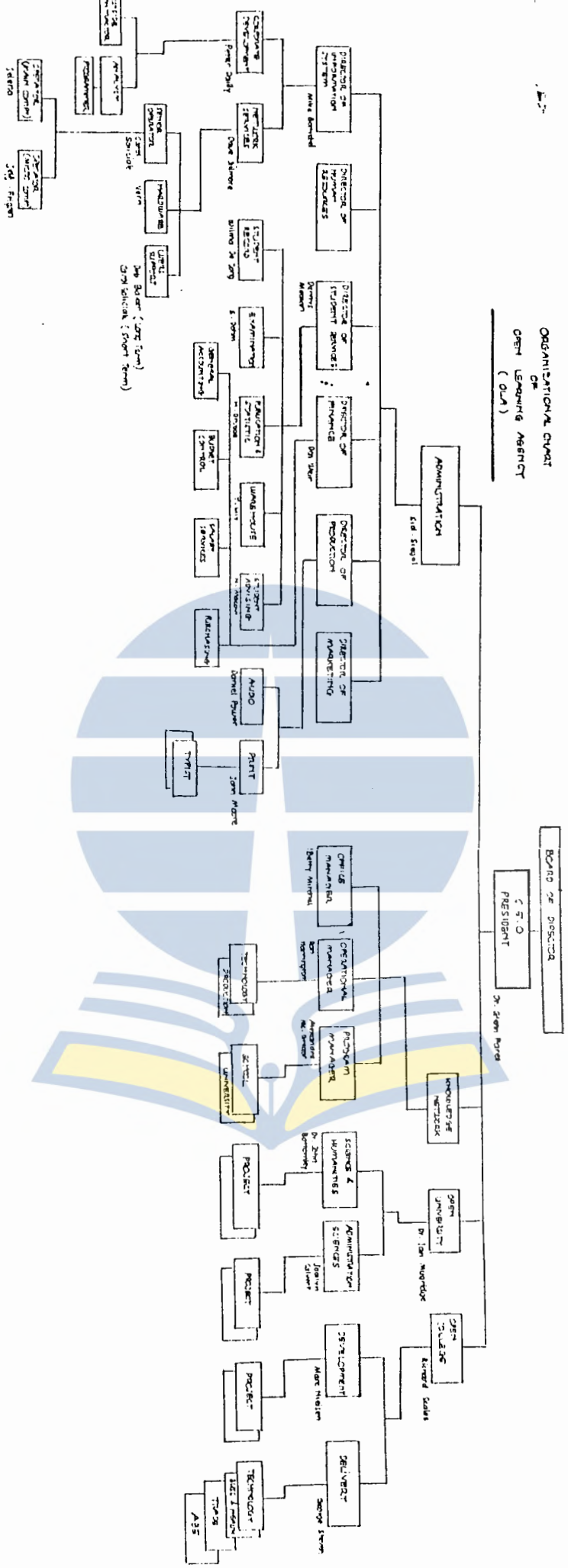
A.1

ADMINISTRATIVE STRUCTURE



APPENDIX 3.

OPEN LEARNING AGENCY ORGANIZATIONAL CHART



APPENDIX 4.

OPEN LEARNING INSTITUTE DATA PROCESSING CENTER: POSITION DESCRIPTIONS, JOB DESCRIPTIONS AND PERFORMANCE OBJECTIVES

My Position Director of Information Resources

Job Duties

Note: For brevity, information resources as used in this document refers to data, text, image and voice, and the processes, strategies, philosophies, policies, standards, and technologies associated therewith.

Develop plans to ensure that organizational goals are achieved through effective use of information resources

Develop policies with regard to information resources

Provide advice and counsel to the Vice-President and the Executive Council

Represent the interests of the OLA at meetings and conferences of professional associations.

Ensure the efficacy of information resources investments

Provide leadership in the strategies of managing information resources

Ensure that the OLA has the information resources needed to fulfill its mandate

Negotiate joint ventures with private sector representatives and representatives of public sector bodies.

Communicate with representatives of the educational community for the purpose of negotiating joint ventures and other agreements

Provide direction and focus for information resource planning

Direct the development and operation of information resources.

Select staff to manage Departmental Divisions

Provide leadership and motivate staff

Ensure that staff operate at high levels of effectiveness and efficiency

Identify professional development needs and provide appropriate training.

Ensure that OLA policy is faithfully translated to directives, processes and procedures.

Ensure that the OLA's information resources are secure

Communicate with industry leaders to discuss information resource management policies and strategies.

Develop strategies for development and production of instructional materials.

Ensure that the quality of instructional materials developed by the OLA is consistent with the needs of our clients

Ensure that Department funding levels are consistent with expected outcomes.

Direct the preparation of Division budgets

Direct the review and analysis of spending and performance trends

Establish and review performance targets for operational divisions

Communicate with executives in the information-related industry sector to exchange ideas, plans and forecasts.

~~Position B~~ Manager, Corporate Applications development.

Job Duties

Responsible for the coordination, planning, development, operation, efficiency, and effectiveness of the OLA's applications systems and services. This includes software and systems developed internally, by contractors or purchased from third parties.

Develops long term plans for the evolution of information resource development

Develops and maintains an applications development plan

Consults and communicates with representatives of the educational community.

Undertakes joint ventures with members of the educational community

Prepares budget estimates

Ensures that funds are properly allocated and that the budget is not over-spent

Ensures that information resources provide integration and long term compatibility

Develops and maintains an information architecture plan

Ensures that resource development is consistent with developed plans and long-term strategies.

Evaluates performance of staff against stated objectives

Defines standards and guidelines to be used in development projects

Selects appropriate staff

Identifies training needs and provides training opportunities to staff

Ensures the effective use of staff

Ensures the quality and effectiveness of information resources

Communicates with other managers to identify potential applications development projects.

Monitors developments in the industry to ensure that up-to-date techniques are used in applications design.

Identifies needs and sets priorities within the Division

Develops programs and policies to meet needs and priorities

Ensures that needed procedures and processes are in place

Ensures the security of information resources

Requirements

Ten years info systems experience at least five of which are in a management capacity.

Position A

Job Duties

Responsible for the coordination, planning, development, operation, efficiency, and effectiveness of the OLA's information network services. This includes computer and communications equipment, communications links, and related software and support services.

Develops long term plans for the evolution of information network services 5

Develops and maintains a network architecture plan 5

Consults and communicates with representatives of the educational community. 5

Undertakes joint ventures with members of the educational community

Prepares budget estimates 3

Ensures that funds are properly allocated and that the budget is not over-spent 10

Ensures that network components provide integration and long term compatibility 2

Ensures that acquisitions are consistent with developed plans and long-term strategies. 5

Evaluates performance of staff against stated objectives 5

Develops plans for effective use of the information network 5

Selects appropriate staff 2

Identifies training needs and provides training opportunities to staff 5

Ensures the effective use of staff 10

Ensures that the information network is consistent with the long term needs of the OLA 5

Ensures that up-to-date techniques are used to plan and evaluate information network services 2

Establishes standards and guidelines for the acquisition and use of information network components 3

Identifies needs and sets priorities within the Division 5

Develops programs and policies to meet needs and priorities 10

Ensures that needed procedures and processes are in place 5

Ensures the security of information resources 2

Requirements

Ten years info systems experience at least five of which are in a management capacity.

OPEN LEARNING INSTITUTE

POSITION DESCRIPTION

ADMINISTRATIVE AND ACADEMIC ADMINISTRATIVE POSITIONS

POSITION TITLE: Systems Analyst DEPARTMENT: Data Processing and Ancillary Services

GRADE: A - 2 VII DATE: ~~November 29, 1980~~ APRIL 1, 1986

REPORTS TO: SENIOR SYSTEMS ANALYST

PURPOSE OF THE POSITION

The Systems Analyst provides the Institute with analysis and design services to ensure optimum use of the computer systems.

GENERAL RESPONSIBILITY

The Systems Analyst reports to the Director of Data Processing and is responsible for systems analysis and design; preparing computer programs or modifications to existing programs; ensuring data security and integrity; and providing an advisory service to systems users. The analyst is concerned with the development of EDP applications that are consistent with Institute goals and objectives. ~~that will be used by management for program decision making. Decides and selects appropriate EDP methods and output formats to enable senior officers to effectively manage programs.~~ Requires judgment in implementing systems development methodologies. Requires frequent contact with senior officials of the Institute and with officials of other levels of government, and with representatives of software contractors. Performs under general supervision. Responsibility is defined in terms of departmental or program objectives. Most assignments are performed independently, guidance is received only where methods or procedures depart from established policies, procedures or guidelines. This position differs from the position of Senior Analyst in the amount of supervision recieved and the complexity of assignments. Supervises the work of clerical personnel, data processing clerks and other administrative support personnel. Due to the nature of these duties has effective access to all financial, personnel and student information.

TYPICAL DUTIES

a. Systems Analysis and Design Services:

Initiates and conducts surveys and feasibility studies with the object of making specific recommendations for new or modified EDP applications.

Consults with Institute management in the analysis of current or proposed EDP applications.

Develops specifications for proposed systems, software requirements, manual processes and procedural flows.

Coordinates system implementation; ensuring that both the necessary user and machine resources are present for successful systems implementation.

Prepares and maintains reference manuals for systems users, describing data preparation requirements and systems operation.

Sponsors and participates in post-implementation reviews of EDP systems.

Safeguards the security, integrity and confidentiality of computer based information.

b. Computer Programs and Modifications to Existing Programs:

Prepares system specifications to be used in the software development process.

Writes software or supervises code development by EDP consultants under contract.

Prepares software documentation and amendments for reference manuals to ensure an understanding of system operation by authorized users.

Reviews new or revised software developments from vendors and other sources to assess and recommend on their applicability and value in meeting current or future requirements.

c. Advisory Service to System Users:

Instructs new users in the operation of data terminals and other input devices which may be configured, and in the use of relevant operating system software.

Replies to user queries regarding the operating system and hardware operation.

Identifies causes of operating errors and discusses prevention of same with users.

Recommends and implements changes to application software on basis of errors made by users.

d. General

Studies and keeps abreast of Institute publications and papers so as to be cognizant of current developments and changes in policy and program development.

Receives specialized training in manufacturer's specific operating systems and programming language.

Performs other related duties.

KNOWLEDGE AND SKILLS

Knowledge of the operating principles and capabilities of a time sharing on-line computer system.

Knowledge of operating system utilities.

Ability in the strategies and techniques of problem solving and systems analysis and in the presentation of plans and proposals for new systems. Experience in the critical analysis of programs and the development of program alternatives. Good oral and written communications ability.

Up to date knowledge of current developments in the fields of system analysis and computer technology. Ability to relate to professionals in a number of fields.

Ability to work independently.

Continuing study of a wide variety of texts and journals, publications and reports relating to the fields of computer science and systems management.

Thorough Knowledge of the ~~Basic-2~~ VAX BASIC computer language as well as the ~~RSTS~~ VMS operating system and RMS file management. The ability to interpret and modify programs written by others and a knowledge of the methods utilized in accurately documenting new applications and modifications.

or other high level languages

Completion of a certificate program in computer programming and systems analysis, or comparable training, at an Institute of Technology or University.

PERFORMANCE OBJECTIVES
Job Objectives of Vern Crouch
Systems Analyst - OLI Computer Department

01-Apr-86 to 30-Oct-86

KEY DIMENSION = Management of System Operations

PERFORMANCE =

1. Establish and implement operational policies and procedures to ensure the provision of an effective, timely and secure computing service to the Institute.

2. Develop a backup capability to critical functions of the DP Operations unit.

3. Coordinate and supervise the activities of staff in the Operations unit.

4. Monitor the system and act on existing or potential problems.

5. Provide a high level of morale and motivation to Operational staff.

KEY DIMENSION Analyze System Performance

PERFORMANCE

1. Analyze, identify and implement proactive and reactive procedures to ensure 99% availability on the computing equipment and system software during the period 0800 - 1700 weekdays..

2. Analyze disk utilization ensuring adequate disk space is available at all times.

3. Analyze system performance ensuring a 2.00 response time index is available at 100% utilization.

4. Consult with Digital Personnel and other sources on the operational characteristics of OLI's computing equipment to ensure maximum performance.

KEY DIMENSION = Analyze and Design System Performance Tools

PERFORMANCE =

1. Analyze and identify key performance metrics concerning the operation of OLI's VAX Computer Cluster and associated peripherals.

2. Design a monitoring system capable of producing regular reports on the performance metrics identified above.

3. Design and implement a trend line analysis process capable of projecting data accumulated from point 2 above for a period of 24 months

KEY DIMENSION = Institute Awareness and Contact

PERFORMANCE =

1. Prepare a seminar on Operations procedures for presentation to OLI staff.

2. Attend Institutional or Departmental meetings.

3. Seek out and maintain an awareness of Institute policies and actions to identify opportunities and maximize the utility of information systems.

KEY DIMENSION = Professional Awareness and Contact

PERFORMANCE =

1. Attend at least one course on a topic related to the performance requirements of the job.

2. Review magazines, articles, journals and other sources of professional information relating to the job.

3. Maintain contact with other professionals in the field.

KEY DIMENSION = Technical Support

PERFORMANCE =

1. Recognize and recommend programming methods to the development staff that optimises programs on the computer.

2. Perform the job of watchdog to ensure that important considerations are not overlooked in the initial design phase.

3. Provide any necessary technical documentation and/or arguments favouring a certain method to the development staff.

PERFORMANCE OBJECTIVES
Job Objectives of Selena Loeffler
Computer Operator II - OLI Computer Department

August 24, 1987 to December 31, 1988

KEY DIMENSION = Operations Support

PERFORMANCE =

1. To ensure that all time-sensitive duties are done at the appropriate times.
2. To identify hardware/software problems and place calls when necessary.
3. To assist in maintaining a useful and informative operations manual.
4. To become familiar with DCL both as a user and as an operator, and to understand the use and writing of command procedures.
5. To become familiar with the idiosyncracies of each printer on-site, both as an operator and user.
6. To maintain computer room in an orderly manner.
7. To become familiar with tape drives for use in backup and retrieval of files.

KEY DIMENSION = User Assistance

PERFORMANCE =

1. To develop a familiarity with system utilities (such as MAIL, PHONE, and DCL) in order to assist the users successfully.
2. To determine errors in program "logs" and troubleshoot Mass-11 documents on a required basis.
3. To assist users on a required basis in a friendly, concise manner.

KEY DIMENSION = System Performance Monitoring

PERFORMANCE =

1. To be able to understand system performance and how and when to influence it.
2. To become familiar with system crash procedures, and shutdown and startup of the system.
3. To monitor the system on a daily basis in order to improve the performance of the system.

KEY DIMENSION = Administrative Duties

PERFORMANCE =

1. To maintain sufficient level of computer supplies - i.e. ribbon, paper, etc.
2. To maintain the tape library in an organized manner.
3. To update operations related paperwork and maintain such in an organized manner.
4. To produce all supplies and downtime reports on a monthly basis.
5. To attend departmental meetings.
6. To review all magazines and articles associated with the job.

DUTIES OUTLINE

1. PRINTERS

- develop familiarity with idiosyncrasies of each printer
- know when to call technician
- ribbon and paper changing
- cleaning and minor repairs

2. DCL

- document printing
- troubleshooting documents
- terminal recovery
- determine errors in program "logs"
- DCL questions
- familiarity with application programs
- MASS-11

3. SYSTEM PEFORMANCE MONITORING

- show system reading
- monitor utility
- sys$batch monitoring
- system crash procedures

4. SYSTEM INTEGRITY

- Starting STUREG
- DTR jobs
- Data file protections

5. COMMAND FILES

- understand the use of them
- use manuals and HELP utility when needed

6. TAPE LIBRARY AND PAPERWORK

- organize tapes on racks and in boxes
- label tapes when needed
- keep files organized and updated (ie Computer Operations Log books, SCD order forms, parts and supplies order forms, etc.)

7. PRINTERS

- develop familiarity with idiosyncrasies of each printer
- know when to call technician
- ribbon and paper changing
- cleaning and minor repairs

8. TAPES

- backup
- recovering files
- use of copy command
- familiarity with tape drive

OPEN LEARNING INSTITUTE

JOB DESCRIPTION

JOB TITLE: Programmer DATE: February 15, 1982

JOB CLASSIFICATION:

GRADE: V

DEPARTMENT: Data Processing & Ancillary Services

REPORTS TO: Director, Data Processing

DESCRIPTION OF WORK

General Statement of Duties: The Programmer provides the Institute with programming services to ensure optimum use of the computer systems. Duties are often complicated or involved. There is opportunity for considerable independent judgement and initiative in activities such as preparing or modifying programs, deciding appropriate programming methods, providing advice to system users and solving problems. Performs other related duties as required.

Supervision Received: Performs under general supervision. With the approval of a Supervisor, may initiate and carry out action that does not follow established procedures or policies. Work is not checked against specifications to ensure the quality and quantity of work meets departmental standards.

Supervision Exercised: May be required to assist in training other employees in use of computer facilities and be responsible for flow of work and assignment of duties for supporting positions.

TYPICAL RESPONSIBILITIES

Prepares system specifications to be used in the software development process.

Writes software or supervises code development by EDP consultants under contract.

Prepares software documentation and amendments for reference manuals to ensure an understanding of system operation by authorized users.

Reviews new or revised software developments from vendors and other sources to assess and recommend on their applicability and value in meeting current or future requirements.

Ensures data security and integrity.

Instructs new users in the operation of data terminals and other input devices which may be configured, and in the use of relevant operating system software.

Replies to user queries regarding the operating system and hardware operation.

Identifies causes of operating errors and discusses prevention of same with users.

Recommends and implements changes to application software on basis of errors made by users.

Studies and keeps abreast of Institute publications and papers so as to be cognizant of current developments and changes in policy and program development.

Receives specialized training in manufacturer's specific operating systems and programming language.

Maintains confidentiality of information.

QUALIFICATIONS

Required Knowledge, Skills and Abilities:

Ability to exercise considerable independent judgement and initiative.

Ability to plan and perform somewhat difficult and responsible programming work.

Comprehensive and thorough knowledge of operating system utilities.

Experience in the critical analysis of programs and the development of program alternatives.

Up-to-date knowledge of current developments in the fields of programming techniques and computer technology. Ability to relate to professionals in a number of fields.

Ability to communicate verbally, clearly and effectively with people at various levels.

Ability to work independently.

Knowledge of the Basic computer language or similar high level language as well as the VMS operating system and RMS file management. The ability to interpret and modify programs written by others and a knowledge of the methods utilized in accurately documenting new applications and modifications.

Completion of a certificate program in computer programming and systems analysis, or comparable training, at an Institute of Technology or University.

APPENDIX 5.

COMPUTER READABLE FORMS USED BY UNIVERSITAS TERBUKA

K-01 BIARKAN

K-02 NOMOR INDUK MAHASISWA

K-03 N A M A

K-04 ALAMAT PENGIRIMAN

K-05 KODE TEMPAT

PROPINSI | KAB/KODYA

K-06 KODE POS

K-07 TANGGAL LAHIR

TGL | BLN | THN

K-08 TEMPAT LAHIR

PROP | KAB/KODYA

K-10 JENIS/JURUSAN

K-11 THN IJAZAH

K-12 PR. STUDI YG DIPILIH

KHUSUS UNTUK PROGRAM STUDI KEPENDIDIKAN

K-13 PERNAH/AKAN PNS

0 BELUM/TIDAK

9 SEDANG/TELAH

K-14 GURU

0 SMTP

9 SMTA

K-15 KANTOR POS TEMPAT PENGUMUMAN (KPTP)

K-16 KODE UPBJJ

K-09 AGAMA / KEPERCAYAAN THD TUHAN Y.M.E.

ISLAM | KRISTEN KATOLIK | KRISTEN PROTESTAN | BUDHA | HINDU | LAIN-LAIN

K-17 JENJANG PENDIDIKAN TERAKHIR

SMTA | D-1 | D-2 | D-3 | S-1 | S-2 | S-3

K-18 JENIS KELAMIN

WANITA

K-19 KEWARGANEGARAAN

WNI | ASING

K-20 STATUS PEKERJAAN

BEKERJA | TIDAK BEKERJA

K-21 STATUS PERKAWINAN

KAWIN | TIDAK KAWIN

DEPARTEMEN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS TERBUKA

FORMULIR DATA PRIBADI MAHASISWA

F1B

KECUALI DIDALAM KOTAK PERNYATAAN, JANGAN MEMBUAT CORETAN ATAU TULISAN APA PUN DI HALAMAN INI

PERHATIAN DALAM MENGISI FORMULIR

- Hanya boleh memakai **pensil 2 B saja.**
- Setiap isian harus **sehitam mungkin** dan seluruh bulatan harus **terisi penuh.**
- Jika isian **akan diganti, hapuslah isian yang salah** dengan karet penghapus **sampai bersih,** kemudian **hitamkan isian yang benar.**
- Formulir ini **tidak boleh kotor, robek, terlipat** atau **basah.**

PETUNJUK PENGISIAN FORMULIR DATA PRIBADI MAHASISWA (F1B)

K-01 dan **K-02**
NOMOR INDUK MAHASISWA Anda sudah tercetak di K-01 dan K-02, jangan **menambah** ataupun **mengubah** yang sudah tercetak dalam kotak ini.

K-03
Isilah NAMA Anda sesuai dengan yang tertulis di **Ijazah/STTB,** Akte Kenal lahir atau surat keterangan lain yang legal. Apabila nama lengkap Anda (yang tertulis di Ijazah) lebih dari 20 huruf, buatlah penyingkatan NAMA sehingga sesuai dengan kotak yang tersedia.

PERNYATAAN

Dengan ini saya menyatakan bahwa data yang diisikan dalam formulir adalah benar. Apabila dikemudian hari ternyata data tersebut tidak benar/palsu maka saya bersedia dikeluarkan walaupun sudah diterima sebagai mahasiswa, dan bersedia jika tidak sesuai dengan peraturan perundang-undangan yang berlaku.

..... 19
Tanda Tangan

.....

Tanda tangan jangan melewati kotak yang tersedia !!

K-04
Isilah ALAMAT PENGIRIMAN Anda **sejelas mungkin** untuk dicapai pelayanan Pos.

K-05
Isilah K-05 dengan KODE PROPINSI dan KODE KABUPATEN/KODYA dari alamat pengiriman Anda (Kode lihat Lampiran 5 dari Buku Petunjuk).

K-06
Isilah KODE POS alamat pengiriman Anda (Kode dapat ditanyakan pada Petugas Pos yang bersangkutan).

K-07
Isilah TANGGAL, BULAN dan TAHUN kelahiran Anda (masing-masing dua angka).
Contoh : Anda lahir 17 Agustus 1967

Dalam kotak Tuliskan | 1 | 7 | 0 | 8 | 6 | 7 |

K-08
Isilah KODE PROPINSI dan KABUPATEN/KODYA tempat Kelahiran Anda (Kode lihat Lampiran 5 dari Buku Petunjuk).

K-09
Hitamkan satu bulatan yang sesuai dengan AGAMA atau KEPERCAYAAN yang Anda anut.

K-10
Isilah kode JENIS/JURUSAN pendidikan terakhir Anda (Kode lihat Lampiran 7 dari Buku Petunjuk).

K-11
Isilah dengan dua angka terakhir TAHUN IJAZAH terakhir Anda.
Contoh : Tahun Ijazah Anda adalah 1982

Dalam kotak tuliskan | 8 | 2 |

K-12
Isilah kode PROGRAM STUDI yang Anda pilih (Kode lihat Lampiran 8 dari Buku Petunjuk).

K-13 dan **K-14**

Kolom ini hanya diisi oleh calon mahasiswa yang memilih Program studi Kependidikan.

K-13 Khusus diisi oleh calon mahasiswa yang memilih **Program Studi Kependidikan D2 (IPA)** dan **S1 (Kimia, Fisika, Biologi.).**
Hitamkan **salah satu bulatan**
- bulatan **O** bila Anda **belum/tidak** mengikuti penataran Pemantapan Kerja Guru (PKG), atau
- **bulatan 9** bila Anda **sedang/telah** mengikuti penataran PKG (untuk lebih jelasnya bacalah Buku Petunjuk).

K-14 Hitamkan **salah satu bulatan**
- bulatan **O** bila Anda mengajar pada SMTP atau yang sederajat.
- bulatan **9 bila Anda mengajar pada SMTA atau yang sederajat.**

K-15
Isilah dengan Kode KANTOR POS tempat Anda ingin melihat PENGUMUMAN (Kode lihat Lampiran 4 dari Buku Petunjuk).

K-16
Isilah kode UPBJJ Anda (Kode lihat Lampiran 6 dari Buku Petunjuk).

K-17
Hitamkan satu bulatan yang sesuai dengan JENJANG PENDIDIKAN TERAKHIR Anda. Lampirkan **Ijazah/Diploma terakhir** (fotocopy yang dilegalisasi).

K-18
Hitamkan satu bulatan yang sesuai dengan JENIS KELAMIN Anda.

K-19
Hitamkan satu bulatan yang sesuai dengan KEWARGANEGARAAN Anda.

K-20
Hitamkan satu bulatan yang sesuai dengan STATUS PEKERJAAN Anda.

K-21
Hitamkan bulatan yang sesuai dengan STATUS PERKAWINAN Anda.

PENTING

Sebelum mengisi Lembar Jawaban Ujian ini BACA DENGAN TELITI PETUNJUK PENGISIAN JAWABAN DI HALAMAN SEBELAH.

Nama : .....

Tanda tangan : .....

Nama Matakuliah : .....

.....

DEPARTEMEN PENDIDIKAN DAN KEBUDAYAAN

UNIVERSITAS TERBUKA

LEMBAR JAWABAN UJIAN

40088.pdf

F 5

KODE MATAKULIAH

NOMOR INDUK MAHASISWA

TANGGAL LAHIR

TGL	BLN	THN

PROGRAM STUDI

KODE UPBJJ

KODE TEMPAT UJIAN

MASA UJIAN

TAHUN	MASA

KODE NASKAH

1. A B C D	21. A B C D	41. A B C D	61. A B C D	81 A B C D	101 A B C D
2. A B C D	22. A B C D	42. A B C D	62. A B C D	82 A B C D	102 A B C D
3. A B C D	23. A B C D	43. A B C D	63. A B C D	83 A B C D	103 A B C D
4. A B C D	24. A B C D	44. A B C D	64. A B C D	84 A B C D	104 A B C D
5. A B C D	25. A B C D	45. A B C D	65. A B C D	85 A B C D	105 A B C D
6. A B C D	26. A B C D	46. A B C D	66. A B C D	86 A B C D	106 A B C D
7. A B C D	27. A B C D	47. A B C D	67. A B C D	87 A B C D	107 A B C D
8. A B C D	28. A B C D	48. A B C D	68. A B C D	88 A B C D	108 A B C D
9. A B C D	29. A B C D	49. A B C D	69. A B C D	89 A B C D	109 A B C D
10. A B C D	30. A B C D	50. A B C D	70. A B C D	90 A B C D	110 A B C D
11. A B C D	31. A B C D	51. A B C D	71. A B C D	91 A B C D	111 A B C D
12. A B C D	32. A B C D	52. A B C D	72. A B C D	92 A B C D	112 A B C D
13. A B C D	33. A B C D	53. A B C D	73. A B C D	93 A B C D	113 A B C D
14. A B C D	34. A B C D	54. A B C D	74. A B C D	94 A B C D	114 A B C D
15. A B C D	35. A B C D	55. A B C D	75. A B C D	95 A B C D	115 A B C D
16. A B C D	36. A B C D	56. A B C D	76. A B C D	96 A B C D	116 A B C D
17. A B C D	37. A B C D	57. A B C D	77. A B C D	97 A B C D	117 A B C D
18. A B C D	38. A B C D	58. A B C D	78. A B C D	98 A B C D	118 A B C D
19. A B C D	39. A B C D	59. A B C D	79. A B C D	99 A B C D	119 A B C D
20. A B C D	40. A B C D	60. A B C D	80. A B C D	100 A B C D	120 A B C D

DEPARTEMEN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS TERBUKA

LEMBAR JAWABAN UJIAN F 5

JANGAN MEMBUAT CORETAN ATAU TULISAN APA PUN DI HALAMAN INI

PERHATIAN DALAM MENGISI JAWABAN

- Hanya boleh memakai **pinsil 2B saja.**

- Setiap jawaban harus **sehitam mungkin** dan seluruh bulatan harus **terisi penuh.**
- Jika jawaban **akan diganti, hapuslah jawaban yang salah** dengan karet penghapus **sampai bersih,** kemudian **hitamkan jawaban yang benar.**
- Formulir ini **tidak boleh kotor, robek, terlipat atau basah.**

CONTOH PENGISIAN

SALAH			BENAR		
1	2	3	1	2	3
✓	X	●	●	●	●

PETUNJUK PENGISIAN LEMBAR JAWABAN UJIAN (F 5)

Nama Mahasiswa
Tuliskan nama sesuai dengan Kartu Mahasiswa Anda.

Tanda Tangan
Khusus untuk tanda tangan harus menggunakan **ballpoint** atau pulpen dan **tidak boleh melewati kotak** yang tersedia.

Nama Matakuliah
Tuliskan Nama Matakuliah yang akan Anda ikuti ujiannya (lihat Sampul Naskah Ujian) dan tidak boleh meliwati kotak yang tersedia.

Kode Matakuliah
Tuliskan Kode Matakuliah yang Anda ikuti Ujiannya (lihat Sampul Ujian) .

Nomor Induk Mahasiswa (NIM)
Tuliskan NIM Anda, **harus tepat sama** dengan 9 (sembilan) angka yang terdapat dalam Kartu Mahasiswa Anda. Penulisan NIM **jangan sampai salah,** karena NIM sangat penting sebagai identitas Anda.

Tanggal Lahir
Tuliskan tanggal lahir sesuai dengan Kartu Mahasiswa Anda.

Program Studi
Tuliskan Kode Program Studi Anda.

Kode UPBJJ
Tuliskan Kode UPBJJ Anda.

Kode Tempat Ujian
Tuliskan Kode Tempat Ujian dengan mengisi kode kota tempat Anda mengikuti Ujian.

Masa Ujian
Tuliskan Masa Ujian yang sedang Anda ikuti ujiannya.

Kode Naskah
Tuliskan Kode Naskah Ujian (lihat Sampul Ujian).

Jawaban
a. Tempat jawaban adalah bulatan A,B,C, dan D yang tersedia dari nomor 1 sampai dengan 120.
b. Nomor jawaban harus sesuai nomor soal.
c Setiap nomor soal hanya ada satu jawaban yang benar.
d. Hitamkan salah satu bulatan yang merupakan jawaban Anda.
e. Bila jawaban **lebih dari satu** dianggap salah.

K-01

NAMA MAHASISWA : .....

.....

.....

ALAMAT PENGIRIM : .....

.....

.....

KODE POS

UPBJJ : .....

.....

K-02

NOMOR INDUK MAHASISWA (NIM)

K-03

TANGGAL LAHIR

TGL	BLN	THN

K-04

PROGRAM STUDI

K-05

KODE TEMPAT UJIAN

K-06

MASA UJIAN

K-07

JUMLAH MATA-KULIAH

K-08

SETORAN UANG UJIAN ULANG (DLM RATUSAN RUPIAH)

K-09

TANGGAL MENYETOR

TGL	BLN	THN

K-10

KODE MATAKULIAH

K-10

KODE MATAKULIAH

K-10

KODE MATAKULIAH

K-10

KODE MATAKULIAH

K-10

KODE MATAKULIAH

K-10

KODE MATAKULIAH

K-11

KPTP

K-12

KPR

PERNYATAAN

Dengan ini saya menyatakan bahwa semua data yang diisikan dalam formulir adalah benar. Apabila dikemudian hari ternyata ada data yang tidak benar dan menyebabkan pendaftaran ujian ulang saya tidak dapat diolah atau terjadi kelambatan dalam penyelesaiannya maka hal tersebut sepenuhnya menjadi tanggungan saya.

.....19

Tanda Tangan

.....

Tanda tangan jangan melewati kotak yang tersedia !!

DEPARTEMEN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS TERBUKA

FORMULIR PENDAFTARAN UJIAN ULANG

F3B

JANGAN MEMBUAT CORETAN ATAU TULISAN APA PUN DI HALAMAN INI

PERHATIAN DALAM MENGISI FORMULIR

- Hanya boleh memakai **pensil 2 B saja.**
- Setiap isian harus **sehitam mungkin dan seluruh bulatan harus terisi penuh.**
- Jika isian **akan diganti, hapuslah isian yang salah** dengan karet penghapus **sampai bersih,** kemudian **hitamkan isian yang benar.**
- Formulir ini **tidak boleh kotor, robek, terlipat** atau **basah.**

PETUNJUK PENGISIAN FORMULIR PENDAFTARAN UJIAN ULANG (F3B)

K-01

Tuliskan NAMA, ALAMAT PENGIRIMAN dan NAMA UPBJJ Anda sesuai dengan yang tercantum pada **Kartu Mahasiswa** dan gunakan huruf **Kapital.** Jangan lupa mengisi KODE POS dari alamat Anda.

K-02

Isilah NIM Anda, harus tepat sama dengan 9 (sembilan) angka yang terdapat pada Kartu Mahasiswa Anda. Penulisan NIM **jangan sampai salah,** karena NIM sangat **penting sebagai identitas Anda.**

K-03

Isilah TANGGAL LAHIR sesuai dengan Akte Kenal Lahir, Kartu Mahasiswa atau Surat Keterangan lain yang legal.

K-04

Isilah dengan kode PROGRAM STUDI yang Anda pilih (kode lihat Lampiran 8 dari Buku Petunjuk).

K-05

Isilah dengan kode TEMPAT UJIAN, yaitu tempat Anda ingin mengikuti ujian ulang (kode lihat Lampiran 10 dari Buku Petunjuk).

K-06

Isilah dengan kode MASA UJIAN yang akan Anda ikuti (kode lihat Tabel 2.2 dari Buku Petunjuk).

K-07

Isilah JUMLAH MATAKULIAH yang akan Anda daftarkan ujian ulangnya.

K-08

Isilah dengan perkalian Rp.100,- untuk sejumlah uang yang Anda setorkan pada Kantor Pos (uang pendaftaran Ujian ulang).

Contoh : Anda mengikuti **ujian ulang sejumlah 3 matakuliah,** maka uang yang Anda setorkan pada Kantor Pos sebesar 3 X Rp.2.500,- = Rp.7.500,-

Dalam kotak tulis | 0 | 7 | 5 |

K-09

Isilah dengan TANGGAL Anda MENYETOR sesuai dengan tanggal stempel pos pada Gir-5 ujian ulang yang Anda gunakan.

K-10

Isilah KODE MATAKULIAH yang akan Anda daftarkan ujian ulangnya.

K-11

Isilah kode KANTOR POS tempat Anda ingin **melihat Pengumuman** (kode lihat Lampiran 4 Buku Petunjuk).

K-12

Isilah dengan kode KANTOR POS REGISTRASI (KPR) yaitu Kantor Pos **tempat Anda menyetorkan uang** untuk **pendaftaran ujian ulang** (kode dapat ditanyakan pada Petugas Pos bersangkutan).

K-01

NAMA MAHASISWA : .....

.....

.....

ALAMAT PENGIRIMAN : .....

.....

.....

KODE POS

UPBJJ .....

.....

K-02
NOMOR INDUK MAHASISWA (NIM)

K-03
TANGGAL LAHIR

TGL | BLN | THN

K-04
PROGRAM STUDI

K-05
MASA REGISTRASI

K-06
KODE TEMPAT UJIAN

K-07
JUMLAH

MK | SKS

K-08
UANG SETORAN (DALAM RIBUAN RUPIAH)

SPP | PRAK.

K-09
TANGGAL MENYETOR

TGL | BLN | THN

K-10
KODE MATAKULIAH/ KODE PAKET

SKS

K-10
KODE MATAKULIAH/ KODE PAKET

SKS

K-10
KODE MATAKULIAH

SKS

K-10
KODE MATAKULIAH

SKS

K-10
KODE MATAKULIAH

SKS

K-10
KODE MATAKULIAH

SKS

K-11
KPPF

K-12
KPR

PERNYATAAN

Dengan ini saya menyatakan bahwa semua data yang diisikan dalam formulir adalah benar. Apabila dikemudian hari ternyata ada data yang tidak benar dan menyebabkan registrasi saya tidak dapat diolah atau terjadi kelambatan dalam penyelesaiannya maka hal tersebut sepenuhnya menjadi tanggungan saya

..... 19

Tanda Tangan

.....

Tanda tangan jangan melewati kotak yang tersedia !!

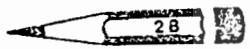
DEPARTEMEN PENDIDIKAN DAN KEBUDAYAAN
UNIVERSITAS TERBUKA

FORMULIR REGISTRASI MATAKULIAH

F2B

JANGAN MEMBUAT CORETAN ATAU TULISAN APA PUN DI HALAMAN INI

PERHATIAN DALAM MENGISI FORMULIR

Hanya boleh memakai **pensil 2 B saja.** 

Setiap isian harus **sehitam mungkin** dan seluruh bulatan harus **terisi penuh.**

Jika isian akan diganti, hapuslah isian yang salah dengan karet penghapus **sampai bersih,** kemudian **hitamkan isian yang benar.**

Formulir ini **tidak boleh kotor, robek, terlipat** atau **basah.**

PETUNJUK PENGISIAN FORMULIR REGISTRASI (F2B)

1

...skan NAMA, ALAMAT PENGIRIMAN dan NAMA UPBJJ ANDA dengan ...tu Mahasiswa. Bila Anda **pindah alamat, isilah alamat terbaru sesuai ...gan arsip Kartu Perubahan Data Pribadi Anda.** Jangan lupa mengisi **...de POS** Anda.

2

...n NIM Anda, harus tepat sama dengan 9 (sembilan) angka yang terdapat ...a F1B atau Kartu Mahasiswa Anda. Penulisan NIM **jangan sampai salah, ...ena NIM sangat penting sebagai identitas Anda.**

3

...n **TANGGAL LAHIR** sesuai dengan Akte Kenal Lahir, Kartu Mahasiswa ... Surat Keterangan Lain yang legal.

4

...dengan kode PROGRAM STUDI yang Anda pilih (kode lihat Lampiran 8 ... Buku Petunjuk).

K-05

Isilah dengan kode MASA REGISTRASI (kode lihat Tabel 2.1 dari Buku Petunjuk).

K-06

Isilah dengan kode TEMPAT UJIAN yaitu tempat Anda ingin mengikuti ujian (kode lihat Lampiran 10 dari Buku Petunjuk).

K-07

Isilah kotak ini dengan jumlah Matakuliah dan SKS yang Anda ambil.

Contoh : Anda mengambil **4 matakuliah** (mk) dengan perincian 2 mk dengan 4 SKS dan 2 mk dengan 5 SKS, maka jumlah SKS adalah :

2 x 4 sks = 8 sks
2 x 5 sks = 10 sks
jumlah = 18 sks

Dalam kotak tulis | 4 | 1 | 8 |

K-08

Isilah dengan perkalian Rp. 1.000,- untuk sejumlah uang **SPP** dan **PRAKTIKUM** yang Anda setorkan pada Kantor Pos.

Setoran uang SPP didasarkan atas 2 kategori :
- Sampai dengan 12 sks Rp. 40.000,-
- 13 s/d 18 sks Rp. 60.000,-

Setoran biaya **PRAKTIKUM** didasarkan atas jumlah SKS matakuliah yang mewajibkan praktikum.. Biaya praktikum adalah Rp. 3000,- per SKS.

Contoh : Anda mengambil matakuliah seperti **K-07** dan ada satu mk dengan 5 SKS yang mewajibkan praktikum, maka uang yang harus anda setorkan :

- **SPP** untuk 18 sks = Rp. 60.000,-
  Dalam kotak tulis | 6 | 0 |
- **Praktikum** untuk 5 SKS =
  5 x Rp. 3.000,- = Rp. 15.000,-
  Dalam kotak tulis | 1 | 5 |

K-09

Isilah dengan TANGGAL anda MENYETOR sesuai stampel pos pada potongan Giro Pos Anda.

K-10

Isilah KODE MATAKULIAH/KODE PAKET yang akan Anda ikuti kegiatan belajar dan ujiannya(dalam mengisi K-10 ini gunakan buku **Daftar Matakuliah yang ditawarkan** dan **jangan** gunakan sumber lain).
Isilah tiap kotak SKS dengan SKS tiap matakuliah atau paket yang Anda registrasikan.

K-11

Isilah kode KANTOR POS **tempat Anda membeli berkas Formulir** yang Anda gunakan (kode lihat Lampiran 4 dari Buku Petunjuk).

K-12

Isilah dengan kode KANTOR POS REGISTRASI, yaitu Kantor Pos **tempat Anda menyetorkan uang** untuk SPP dan PRAKTIKUM (kode tanyakan pada Petugas Pos bersangkutan).

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