DAM 382: INFORMATION SYSTEM MANAGEMENT

NATIONAL OPEN UNIVERSITY OF NIGERIA

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Introduction

Introduction to Information System Management is a one-semester, 3-Unit, 100 level core course available to students registered for the B.Sc and B.Sc (Hons(in Communications Technology and Computer Science.

This course ill consist of twenty-one (21) unit of lectures organized into 6 modules. This course deals with the management of information technology (IT) as it is being practiced in organizations today. Successfully managing IT has become crucial for several reasons:

- It is now a strategic asset that is being used to mould competitive strategies and change organizational processes.
- The situation in which organizations are applying IT have increased in complexity, including more interroganizational environments.
- The capabilities of IT and the complexities of using the technologies are also growing at an accelerating rate.
- As IT and its uses become more complex, developing strategies and systems to deliver the technology has become more difficult.

This course requires you to gain some practical experience in how to organize and manage systems, as well as the interrelated concepts of information and technology. To achieve this, you will have to perform various practical exercises in each of the lectures. You should endeavour to do these exercises, in addition to the tutor marked assignments (TMAs) that you are required to submit for marking during this course. Some of the exercises will also require you to use micro-computer software, for which basic skills in computer operation is required. You should have obtained the required level of skill in the computer Fundamentals course, which is a pre-requisite for this course.

This course guide tells you briefly what the course is about, what course material you will be using, and how you can work your way through these materials. It suggests some general guidelines for the amount of time you are likely to spend on each unit of the

course in order to complete it successfully. It also gives you some guidance on your tutor-marked assignments (TMAs)

You will be required to attend some tutorial classes that are linked to the course. Details of times and locations of and tutors for, the tutorials will be communicated later.

What you will learn in this course

The overall aim of introduction to Information System Management is to introduce the basic principles underlying information system and technology. During this course, you will learn about various information systems within which data are created and managed and about practical methods for organizing systems and management of informations.

COURSE AIMS

The aim of this course can be summarized as follows: this course aims to give you an understanding of the principles of information technology and how the principles are applied to the management of information.

This will be achieved by aiming to

- Introduce you to basic concept relating to data, information and management.
- Develop ability of disaster recovery for information system;
- Enable you to appreciate the significance of data management as a core activity of information systems, etc.

COURSE OBJECTIVES

To achieve the aims set out above, the course sets overall objectives. In addition, each unit also has specific objectives. The unit objectives are always included at the beginning of a unit, you should read them before you start working through the unit. You may want to refer to them during your study of the unit to check your progress. You should always look at the unit objectives after completing a unit. IN this way, you can be sure that you have done what was required of you by the unit.

Set our below are the more specific objectives of the course as whole.

By meeting these objectives you would have met the aims of the course as a whole. On completion of the course, you should be able to:

- Describe the important features and roles of information system management in information technology.
- Explain the nature of and relationships between data, information systems, knowledge, information management, data management.
- Describe the processes involved in the creation of new information systems for managing data.
- Describe and explain the elements that characterize the foundations of system development
- Explain the approaches to system integration

- Describe and analyse the mathematic models employed in operations research.
- Explain the process of protecting assets and information; consumers privacy and financial transactions in the internet.
- Working through this course

To complete this course, you are required to read the study units and read other materials provided by the NOU. You will also need to undertake practical exercise for which you need access to a personal computer running windows operating system and the Microsoft Access software. Each study unit contains self-assessment exercises, and at a point in the course you are required to submit assignments for assessment purposes. At the end of the course is a final examination.

COURSE MATERIALS

Main components of the course are:

- Course Guide
- Study Units
- Assignment File (will be available of the NOU website)
- Presentation Schedule (will be available at the NOU website)

STUDY UNITS

There are twenty one study units in this course organized into size modules as follows:

Module 1

Unit 1 The organizational environment

Unit 2 The technology environment

Unit 3 The mission of information systems

Module 2

Unit 4 Looking inward: E-business to employee

Unit 5 Looking across: e-business to business

Unit 6: Technical Considerations

Unit 7 Legal and ethical considerations

Module 3

Unit 8 Foundations of System development

Unit 9 System integration

Unit 10 Internet-based systems

Unit 11 Project management

Module 4

Unit 12 Managing Corporate data records

Unit 13 Managing data

Unit 14 Managing information

Module 5

Unit 15 What are operations?

Unit 16 Outstanding information systems functions

Unit 17 Security in the internet age

Unit 18 Disaster recovery for distributed systems

Module 6

Unit 19 Mathematical programming

Unit 20 Where s the information system department headed?

Unit 21 The CIO's responsibilities

SET TEXTBOOKS

There are no set textbooks for this introductory course. However, you may supplement the course units with related personal reading. You will also be able to increase your understanding of information system management contexts and strategies by paying attention to how people organize information in different media – in textbooks, computer screens, IT industries, etc and thinking through the principles and strategies of information technology that such people might be applying.

COMPUTER SOFTWARE

You will be expected to undertake some practical exercises on a micro computer running the windows operating system, and the Microsoft Access Software for creating, using and managing data. Besides, access to the internet and basic internet browsing skills are required.

ASSIGNMENT FILE

The assignment file will be available at the NOU website in due course. In this file, you will find all the details of the work you must submit to your tutor for marking. The marks you obtain for there assignments will count towards the final mark you obtain for this course.

PRESENTATION SCHEDULE

A presentation schedule for this course will be included in your course materials. The schedule gives you the important dates for this year for the completion of tutor-marked assignments (TMAs) and for the tutorials. Remember you are required to submit all your assignments by the due dates. You should guide against falling behind yin your work.

ASSESSMENT

Tutor-marked assignments (50%) comprising of the best 5 out of seven tutor-marked assignments that you will be required to submit. You must obtain at least 25 marks (out of 50 marks) in your best five TMAs.

Final examination (50%). You will be expected to answer five out of six questions in this three-hour examination. You must also obtain at least 25 marks (out of 50 marks) in the examination.

DAM 362: INFORMATION SYSTEM MANAGEMENT

MODULE 1: THE IMPORTANCE OF INFORMATION SYSTEM MANAGEMENT

UNIT 1: The Organizational Environment

UNIT 2: The Technology Environment

UNIT 3: The Mission of Information Systems

UNIT 1 THE ORGANIZATIONAL ENVIRONMENTAL SYSTEMS

1.0 Introduction

2.0 Objectives

3.0 Main Content

3.1The External Business Environment

3.2 The Internal Organizational Environment

3.3 Goals of the New Work Environment

4.0 Conclusion

5.0 Summary

6.0 Tutor Marked Assignment

7.0 References/ further reading

1.0 INTRODUCTION

The way information technology is used depends on the environment surrounding the organization that uses it. This environment includes the economic conditions, the characteristics of principal resources, management philosophies, the social mores of the society and other factors. This environment has been changing constantly. Simultaneously, technological advances affect the way technology can be used.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- ❖ Understand the external business environment.
- ❖ Explain the internal organizational environment.
- ❖ Mention goals of the new work environment.

3.1 THE EXTERNAL BUSINESS ENVIRONMENT

The changes taking place in the worldwide scene have been widely discussed in both the public and technical press. Today, our turbulent business world includes dotcom companies rising and falling faster than we can keep track of them. IT contributes to this turbulence because it allows information to move faster, thus increasing the speed increasing the speed at which individual and organizations can respond to events. Following are the main changes we see taking place in the market place

The New Digital Economy.

Far and away the largest external driver is the new economic world being formed around the Internet. This new economy began with business-to-consumer retailing, commonly called e-tailing, which means selling over the World Wide Web (Web). The leader was Amazon.com. The action then moved to business-to-business,

with buyers and sellers using marketplaces on the Internet to find consummate business deals. The new economy has new rules, which are in the process of being discovered, so success is not garnered in the same way as the as in the brick-and mortar "Old Economy." The main point is that the new economy will encompass both old and new, and IT is the underpinning of this e-economy.

Globalization.

The entire world has become the marketplace. To succeed, large companies believe they need to be global, meaning huge and everywhere. Merger Mania is occurring across industries as companies aim for this goal. The mergers even cross country borders. It is unusual for a British food company to own US., French and other food and beverage companies, or Swiss pharmaceutical company to buy out American and Japanese counterparts.

In addition, the Internet allows companies to work globally- with three main operating arenas, Asia/Pacific, the Americans, and Europe- and work around the clock by passing work from one to the next following the sun.

Globalization has become a two way street. Firmly entrenched companies suddenly find unexpected competitors from halfway around the world bidding on work via the Internet an unlikely occurrence just a few years ago. Parts and subassemblies are being manufactured in many countries, then shipped to other countries for final assembly, to cut overall labor costs.

The internet also allows small firms to have a global reach. Norwegians can order extra hot chili sauce from Texas. Europeans can order books over the internet from US companies before those books are available in the country. And so on. The business environment is now global, but tastes still matters.

Ecosystems.

A new term is creeping into the business lexicon: ecosystem. An ecosystem is a web of relationships surrounding one or few companies. For example, Microsoft

and Intel are the centre of the Wintel ecosystem that has dominated the PC world.Yet, although they dominate the PC ecosystem, they are far less dominant in other ecosystems, such as the Internet ecosystem and the wireless communication ecosystem. The point about ecosystem is that they appear to follow biological "rules" rather than industrial-age machine-like rules. They require flexibility because relationships change more frequently; they are more organic. Relationships and co-evolution and such thinking require a different corporate mindset from the command-and-control mindset of the past.

Idea economy

Whereas tangible item, such as capital, equipment, buildings, and such, were the tenets of power in the industrial age, in the New Economy, entangles items such as ideas, intellectual capital, and knowledge have become the scarce, desirable items. For this reason, managing talent has become more important to corporate success than managing finances. Without talent, ideas dwindle, the new-product pipeline shrivels up, and the company is less competitive. More and more talk focuses on managing intellectual capital (the knowledge in people's heads), and this talk will only increase.

Deregulation

The deregulation of major industries – banking, telecommunications, transportation, utilities, and others – has made it easier for new companies to enter these industries. In the United States, for example, regional airlines have literally driven major carriers out of some short haul, but lucrative, markets. The U.S. banking industry has been fighting hard to get the U.S congress to limit the ability of non-banking firms to enter the banking field. Although it is true that deregulation in the United States is more widespread than elsewhere in the world, this trend in underway in many countries. The fierce global competition in the

telecom industry worldwide, especially in the wireless area, has resulted from deregulation.

Deregulation has prompted companies to cross industry boundaries, such as major brokerage firms offering bank – like service with their cash management accounts (loans, credit card, etc.) insurance companies are essentially in the securities business, with their single payment life insurance policies in which owners can direct the investment of the policy cash values. Major brands are entering the entertainment business, not only sponsoring sporting and other major events but broadcasting them via their Web sites. GM, for example, webcast the Detroit Auto Show with commentary and other features on its Web site – creating a spike in hits on its site that lasted long after the webcast. Most of these boundary-crossing examples are led by IT-enable products or service.

Faster business cycles.

The tempo of business has accelerated appreciably, so companies do not have as much time to develop new products or service and move them into the marketplace. Once on the market, the useful lives of goods and services tend to be shorter as well, so speed has become of the essence. Efforts to accelerate "time to market" or reduce "cycle time" often depend on innovative uses of IT. Even "Internet time" seems to be getting shorter. It used to be that four Internet years equaled one calendar year. We recently heard it is now seven. No wonder twenty –something million aires: retired" in their thirties. They probably reached Internet retirement age.

3.2 THE INTERNAL ORGANIZATION ENVIRONMENT

The work environment is also changing, so the art of managing people is undergoing significant shifts. These changes are profound enough to change the structure of organizations. Here are some of the changes that impact how people work and how organizations operate.

Talent wars.

In the early 1990s, companies were laying off people right and left. In the late 1990s, all of sudden, companies could not find enough people to go around. The information Technology Association of America estimated 850, 000 IT jobs were left unfilled at the end of 2000 in the United State alone! What happened: An explosion of innovation in business was fuelled by the Internet and the e-economy. It led to severe labour shortage in certain areas and "talent wars" where companies compete for all manner of talent. At long last people have actually become "our most important asset," as companies touted for years, but did not truly practice. The shortage is causing companies to locate near talent, often in faraway places. It is causing cities, state, and countries to rethink their educational system, infrastructure, and mindsets, and it is leading to employee who expects much different treatment from their employer than in the past.

Demand – pull.

The 1990s saw an increase in system that let consumer's access corporate computer system. Bank automated teller machines (ATMs) were an early example. Customers could check account balances, determine whether certain checks had cleared, and establish automatic bill-paying processes. The Internet has accelerated such consumer computing beyond anyone's forecasts, determine whether certain checks had cleared, and establish automatic bill-processes. The internet has accelerated such consumer computing beyond anyone's forecast; wireless internet will blow even the widest forecast. We ca safely say that most companies have, or are planning, B2C systems that allow consumer to purchase products, inquire about the state of an order, and in general, do business with the firm online through the World Wide Web. FedEx was one of the first companies to leverage the Web by allowing customers top directly access its package

tracking system via its home page. Today, companies that ship products via FedEx have links to the same home page, providing that service to their customers.

This access is causing a shift in kind from supply-push to demand-pull. In the industrial age, companies did their best to figure out what customer wanted. They were organized to build a supply or product or services and then ‘’push’’ them out to the end customer, on store shelves in catalogs, and such. The Internet, which allows much closer to one-to-one contact between customer and seller, is moving the business model to demand-pull. Companies offer customers the component of a service or product and the consumers create their own personalized version, creating the demand that pulls the product or services through the supply chain, or rather now, the demand chain.

Companies thus need to essentially reverse their business processes to be customer-facing to move to this consumer-pull mass communication business model. In fact, this model can lead to suppliers and consumers creating products and services. For example, book buyers who put their critiques of books on Amazon.com Web site are in a sense co-creating part of Amazon’s service to other book buyers, Demand-pull is just one of the ways the economy operates differently from the past economy.

Team-base working

The trend now is toward people working together on projects. Rather than depend on chains of command and the authority of the boss, many organization are emphasizing teams to accomplish major tasks and projects. Peter Drucker’s classic article in the Harvard Business Review uses the analogy of a symphony, where each member of the team has a unique contribution to make to the over-all result. Task-oriented teams form and work together long enough to accomplish the task then disband, perhaps to form another team. This project-based working, where people are simultaneously working, where people are simultaneously working on several projects with different teams across different organization, is

generating major interest in information systems called groupware, which support meeting, promote collaborative work, and enrich communication among far-flung team members

Anytime, Anyplace Information work

Information workers are increasingly mobile so the need for computers is not just for accessing mobile so the need for computers is not just accessing information but for communicating with others. One of the hallmarks of the new economy is that communications capabilities of computers are more important than the computing abilities. Communication technology has developed to the point where information work can be done anywhere with a laptop computer, cellular telephone, and modem. Electronic mail, facsimile, and voice-mail systems across time zones to allow work anytime, anywhere. People are sporadically working daily; they are working in their preferred geographical location, even if it is remote from the main office. The advances in the wireless technology enable many people to work in their car, on the beach, while walking and so on.

Outsourcing and strategic alliances

To become more competitive, organizations are examining which work they should perform internally and which can be done by others. Outsourcing may be a simple contact for services or a long-term strategic alliance. Between these two extremes are a variety of relationships that are redefining the way organizations working together. Strategic alliances built around an organization's core competencies are becoming known as the "extended enterprises." IT is providing the information and communication flows to manage complex sets of relationships.

The demise of the hierarchy

The traditional hierarchical structure groups several people performing the same type of work, overseen by a supervisor. The supervisor allocates work, handles the problem, enforces, disciplines, issues rewards, provides training and so on. Management principles such as division of labour, unity of command, and chain of control define this traditional work environment.

But it is no longer the most appropriate in factories or offices. Self managed-groups whether working on an assembly line or in an insurance company, provide much of their own management, have lower absenteeism, yield higher productivity, produce higher productivity, produce higher quality work, and are more motivated than workers in the traditional settings.

A major reason for the demise of the hierarchy is that the more turbulent business environment – represented by the changes just noted – challenges the premises of a hierarchical structure, because it cannot cope with rapid change. Hierarchies require a vertical chain of command where lines of responsibility do not cross and approval to proceed on major initiatives is granted from above. This communication up and down the chain of command takes too much time for today's environment. IT enables team-based organizational structures by facilitating rapid and far-flung communication.

3.3 **Goals of the new work environment**.

As a result of theses changes in the internal and external organizational environment, companies around the world are in the throes of redefining their work environment--a tumultuous proposition, at best—without any true guidance.

Their goal is to either simply survive in the new business climate or to thrive in it. We see the following overarching goals for thriving in the new work environment:

- Leverage knowledge globally
- Organize for complexity
- Work electronically

- Handle continuous and discontinuous change

Leverage knowledge globally

The newly recognized asset, the new form of capital, in companies is knowledge. Not "knowledge" in an expert system or a Lotus Notes database, but knowledge in people's head. Knowledge they "know" but cannot really explain to others is called tacit knowledge, as opposed to explicit explainable knowledge. Companies that are able to leverage it globally will be successful— provided, of course, its use is directly by sound strategy.

Brook Manville and Nathaniel Foote of McKinsey &Company point out those knowledge-based strategies, not knowledge. Intellectual capital is meaningless unless companies have the corporate fundamentals in place, such as knowing what kind of value they want to provide and to whom.

They also point out that executing a knowledge-based strategy is not about managing knowledge but about nurturing people who have the knowledge, tapping into the knowledge that is locked in their experience. Although companies have numerous systems in place to share explicit knowledge, the key to unlocking tacit knowledge is a work environment in which people want to share.

A manufacturer that tried to foster greater "knowledge transfer" while downsizing discovered that the combination was impossible. Why would employees share what they know when the bosses were looking for ways to consolidate expertise?

The means to tap tacit knowledge is to foster sharing in the work environment and support the sharing with technology. E-mail and groupware can provide the interconnection, but the driving force is the culture. When people want to share, they from "work nets" – informal groups whose collective knowledge is used to accomplish a specific task. So sharing and leveraging knowledge happens through organizational "Pull"- people needing help from others to solve a problem – rather than organizational "Push", which overloads

people with information. Therefore, leveraging knowledge is all about raising the aspirations of each individual, say Manville and Foote.

Organize for complexity.

A second overarching goal of companies, whether they recognize it or not, is to be able to handle complexity. Why? One reason is because the world has become so interconnected that simple solutions no longer solve problem. Corporate decisions can have an environmental impact, human resources impact, economic impact, and even ethical impact. The issues are systematic. Furthermore, capturing market share today oftentimes requires allying with others who have complementary knowledge. Alliances increase complexity, so does specialization. Have you bought shampoo, crackers, or tires lately? Those used to be fairly straightforward decisions. Today, the choices are so numerous that consumers can spend an inordinate amount of time making a selection. To thrive in this new age, companies need to be organized to be able to handle complexity.

Work Electronically.

Just as a market place is moving to market space, the workplace is moving to the workspace. Taking advantage of the internet, and networks in general, is a third major goal of enterprises these days. But just as the move from horse and buggy to train automobile to jet plane each was not simply a change in speed but a change in kind, so too is the move to working in a “space” rather than a “place” a change in kind. It requires different organizing principles, compensation schemes, office structures, and more. It also changes how organizations interact with others, such as their customers.

George Gilder, columnist and author, noted that business eras are defined by the plummeting price of the key factor of production. During the industrial era, this key factor was horsepower, as defined in kilowatt hours, which dropped from many dollars to 7.5 cents. For the past 35 years, the driving force of economic

growth has been transistors, translated into million instruction per seconds (MIPS) and bits of semiconductor memory. The latter has fallen 68 percent a year, from $7 per bit into a millionth of a cent. We are now approaching yet another "historic cliff of cost" in a new factor of production: bandwidth. "if you thought the price of computing dropped rapidly in the last decade, just wait until you see what happens with communications bandwidth, " said Gilder, referencing a remark by Andy Grove, CEO of Intel.

Up to this point, we have used MIPS and bits to compensate for the limited availability of bandwidth. However, as we move into an era of bandwidth abundance, the vastly increase their ability to master bodies of specialized learning. Microchips both flattened corporations and launched new corporations. Bandwidth, on the other hand, moves power all the way to the consumer. That's the big revolution of the internet, Gilder said, and the reason behind the move to "relationship marketing" with consumers.

This revolution creates a different world. For example, TV is based on a top-down hierarchical model, with a few broadcast stations (transmitters) and millions of passive broadcast receivers (televisions). The result is "lowest common denominator" entertainment, like what we get from Hollywood. The internet, on the other hand is a "first -choice book. First –choice culture is vastly different from lowest common denominator culture, says Gilder. As the internet spreads, the culture will move from "what we have in common" to one in which our aspirations, hobbies, and interests are manifested.

Handle continuous and discontinuous change.

Finally, to keep up, companies will need to innovate continually- something most have generally not been organized to do. Continual innovation, however, does not mean continuously steady innovation. It goes in fits and starts. Change takes one of two forms: continuous change is needed to improve efficiency. However, when it is not fine, discontinuous change is needed to move entirely new way of

working. The two often form a cycle. Companies need to be able to handle both for their products and processes.

These four major goals, then, we are what we believe underlie the new work environment. With the organizational environment as a backdrop, we now explore the emerging technology environment.

4.0 CONCLUSION

In this unit, we explore two aspects of the organizational environment: the external forces that are causing executives to re-examine how their firms complete successfully and the internal structural forces that affect the way organizations operate or are managed.

5.0 SUMMARY

Lastly, we considered how these environmental trends led to a new set of goals for thriving in the new work environment.

6.0 TUTOR MARKED ASSIGNMENT

1. What changes are taking place in the external business environment?
2. What changes are occurring in the internal organizational environment?

7.0 REFERENCES \ FURTHER READING

Bridging the gap: Information Technology Skills for the new millennium, Information Technology Association of America, 1616N. FT Myer Dr, Suite 1300, Arlington, VA22209, www.taa.org ,April 2000.

UNIT 2: THE TECHNOLOGY ENVIRONMENT

1.0 INTRODUCTION

The technology environment enables advances in organizational performance. The two have a symbiotic relationship; IT organizational improvements evolve jointly. The IT evolutions now described in the four traditional areas of hardware, software, data and communication.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- Explain hardware and software trends
- Discuss data trends and communication trends

3.1 HARDWARE TRENDS

In the 1950s and ’60s, the main hardware concerns of data processing managers were machine technology and tracking new technological developments. Batch

processing was predominant, with online systems emerging later. At that time, hardware was centralized, often in large “showcase” data centers behind glass walls.

In the mid -1970s processing power began to move out the central site, but only slowly. Often, it was at the insistence of users who bought their own departmental mini computers and word processors. In the 1980s, mainly due to the advent of personal computers (PCSs) interacting with the web.

This major development in hardware toward mobile and handheld devices is led by two factions: telecom companies (and the cell phone manufactures that serve them) and handheld computer manufacturers, such as palm. The hardware is getting smaller and more powerful. Use of wireless hardware is becoming the norm for growing the segment of the anytime, anyplace workforce.

These hardware trends are further distributing processing beyond organizational boundaries, to suppliers and customers. The result is the movement of enterprise wide hardware and processing power out of the control – although perhaps still under the guidance – of the IS department

3.2 SOFTWARE TRENDS

The early dominant issue in software and programming was how to improve the productivity of in-house programmers, those who created mainly transaction processing systems. Occasionally, IS management discussed using outside services, such as time-sharing services, application packages, and contract programming from independent software houses. The software industry ward still underdeveloped, however, so application development remained the purview of IS managers.

Later, programming issues centred first on modular and structured programming techniques. Then the topic expanded to life cycle development methodologies and software engineering, with the goals of introducing more rigorous project management techniques and getting users more involved in the

earth stages of development. Eventually, prototyping (quick development of mock-up) become popular.

Then two other software trends appeared. One, purchased software trends became visible alternative to in-house development for many traditional, well-defined systems. Two, IS managers began to pay attention to applications other than transaction processing. Software to support decision support system (DSS), report generation, and database inquiry shifted some programming from professional programmers to end users develop their own system on their PCs using such languages as Visual Basic.

During the 1990s a push for open systems was driven primarily by software purchasers who were tired of being "locked in" to proprietary software (or hardware). The open systems movement continues to demand that different products work together, that is, "interoperate." Vendors initially accommodated this demand with hardware and software black boxes that performed the necessary interface conversions, but the cost of this approach is lower efficiency.

Another major trend in the 1990s was toward enterprise resource planning (ERP), spurred by management's desire for cross-enterprise financial figures, and manufacturing tracking, and by concerns that their existing systems were not Y2K complaint. Implementing ERP involves integrating components, which is called systems with a suite of tightly integrated ERP application. ERP has proven to expensive and troublesome, especially for those companies wanting to modify the software to fit their unique processes.

Like hardware, software is migrating to network cetric. Rather than replace legacy systems many companies are outfitting them Web front-ends to broaden access and "empower" employees, customers, and suppliers. Furthermore, companies are turning towards buying software off the Web on a per-use basis. One example is what is called a "corporate portal" where employees log into their company intranet (which is maintained by a third party) and utilize software

housed on that site. This approach moves the software from being decentralized (on PCs) to being centralized (on a server somewhere). It also reduces the capital outlay for software is rented (or more properly, leased) rather than bought.)

3.3 DATA TRENDS

The evolution of the third core information technology area—data –has been particularly interesting. At first, discussions centered on file management and organizations techniques for files that served individual applications. Then generalized file management systems emerged, for managing corporate data files. This more generalized approach led to the concept of corporate database to serve several application s, followed a few years later by the concept of establishing a data administration function to manage these databases.

In the 1970s the interest in data turned to technical solutions—database management system. As work progressed, it became evident that a key element of these products was their data dictionary\directory. The early function of these dictionaries was merely specification and format, but that function has expanded significantly. Dictionaries store more than data definitions, they store information about relationships between systems, sources and use of data, time recycle requirement, and so on.

So for the first 20 years of information processing, discussions on data were about techniques to manage data in a centralized environment. It was not until the advent of fourth generation languages and PCs that interest in letting employees directly access corporate data began to develop. Then users began to demand it.

In addition to disturbing data, the major trend in the early 1990s was expanding the focus from data resources to information resources, both internal and external to the firm. Data management organizes internal facts into data record format. Information management, on the other hand, focuses on concepts (such as ideas found in documents such as web pages), from both internal and

external sources. Thus "information resources contain a richer universe of digitized media, including voice, video graphics, animation, and photographs.

Managing this expanded array of information resources requires new technologies. Data warehousing has arisen to store huge amounts of historical data from such systems as retailer's point of sale systems. Data mining uses advanced statistical techniques to explore data warehouses looking for previously unknown relationship in the data, such as which clusters of customers are the most profitable. Similarly, the massive amount of document-based information is organized into the document repositories and analyzed with the document mining techniques. And as noted earlier, businesses now emphasize managing the intellectual capital of the organization. Some believe knowledge can reside in machines, others believe it only resides in people's heads. Either way, knowledge management is of major importance in the new economy because the intangible hold the competitive value.

3.4 COMMUNICATIONS TRENDS

The final core information technology is telecommunications. This area has experienced -enormous change, and has now taken centre stage. Early use of data communications dealt with online and time sharing systems. Then interest in both public and private (intra-company) data networks blossomed.

Telecom opened up new uses of information systems so it became an integral component of is management. Communications based information systems were used to link organizations to their suppliers and customers. In the early 1980s, a groundswell of interest surrounded inter-organizational systems, because some provided strategic advantage.

Communication technology is a crucial enabler for distributing computing. Local area networks connected to wide area networks (WANs) allow computer connectivity provided by the worldwide telephone system. The growth of these network infrastructures within companies further shifted mainframe – centered

computing to network – centric computing. The slogan " the network is the computer" has become the dominant view of information systems.

The internet, and it's dramatic growth in business, primarily through electronic mail and the world wide web, has completed this shift. Development of telecom infrastructure that interconnects organizations and individuals around the world has launched electronic commerce, communications, education, and entertainment on a global scale.

Networking of computer-based equipment is also blurring the boundaries between industries, and between private and working life. Cable TV provides internet access, consumer electronic firms make hybrid PC/TVs, and telephone companies make smart phones, combining the functionality of PCs, cellular telephones, pagers, and a fax in small, portable products. He development of these and other " information appliances" is leading to the vision of an ever-present, ubiquitous " information window" through which people network.

Add to these options the explosion of wireless communication, and we can see that people use wireless networks to do their jobs anytime, anyplace. The interweaving of the business and IT revolutions make now an exciting time to live, perhaps too exciting for some.

4.0 CONCLUSION

Like hardware, software is migrating to be network centric. Besides, the interest in data turned to technical solutions - data base management systems.

5.0 SUMMARY

Lastly, communication technology is a crucial enabler for distributing computing. Besides, the explosion of wireless communication to do jobs anytime, any place.

6.0 TUTOR MARKED ASSIGNMENT

Give two or three characteristics of the technology trends in hardware, software, data and communications.

7.0 REFERENCES / FURTHER READING

Manville, Brook and Nathaniel Foote, “trategy as if knowledge mattered”, fast company, www. Fastcompany.com, 1996.

UNIT 3: THE MISSION OF INFORMATION SYSTEM

1.0 INTRODUCTION

With the organisational and IT environments as back drops, we now turn to the mission of information system. In the only days of transaction processing, systems acted as ”paperwork” to get employees paid, customers billed, products shipped, and so on. During that era, the objectives of information systems were defined by productivity measures, such as percentage of up time for the computer, through put number of transactions processed per ay) and lives of program code written per week.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Explain a simple model of information system
- Discuss the system development
- Understand information systems management

3.1 A SIMPLE MODEL

We propose a simple model to help define a structure for the is function in organization. Figure 1-2 represent the process of applying it to accomplish useful work. On the life is the technology and on the right are the users who put it to work. The arrow represents the process of translating user's needs into implemented system that apply the technology in the early days of information system; this Translation was performed almost entirely by system analysts.

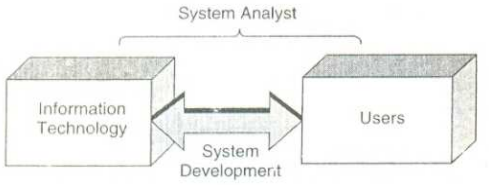


FIGURE 1-2 A Simple Model of Technology Use

Figure 1-3 is a simple representation of what has happened during the past 40 years technology has become increasing complex and powerful: used have become increasingly sophisticated. Information system are now viewed as system "products" and users have become "customer" the increased distance between the two boxes represents the increasingly complex process of specifying, developing, and delivering these system products. It is no longer feasible for one system analyst to understand the fine point of the technologies needed in an application as well as the nuances of the application. More specialization is required of system professionals to bridge this wider gap.

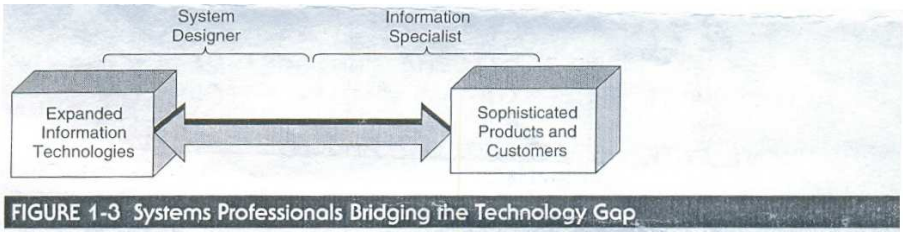


FIGURE 1-3 Systems Professionals Bridging the Technology Gap

System professionals are not the only ones who can help bridge this gap between the technology and its users. Technology has become sophisticated enough to be used by many employees and consumers. At the same time, they are becoming increasingly computer-literate; many employees even develop their

own applications. Figure 1-4 depicts this trend. Today, some of the technology is truly user-friendly, and some application, such as Web page development, database mining, and spreadsheet manipulation, are handled by employees. Transaction systems, however, are still developed by professional developers, either inside or outside the firm.

The main point of this discussion is that the technology is getting more complex, the applications are becoming more sophisticated, and users are participating more heavily in the development of applications. The net result is that management of the process is getting more complex and difficult as it is becoming more important to do well.

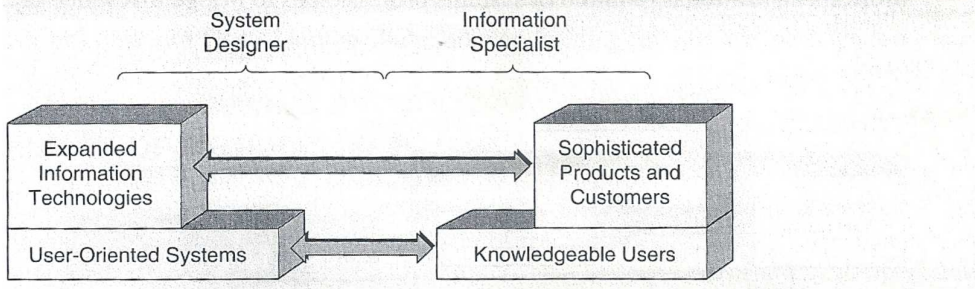
3.2 A BETTER MODEL

Expanding the simple model gives us more guidance into managerial principle and tasks. We suggest a model with four principal element:

1. A set of technologies that represent the technology infrastructure installed and managed by the IS department.
2. A set of users who need to use the technology to improve job performance
3. A delivery mechanism for developing, delivering, and installing applications and functions that serves the users.
4. Executive leadership to manage the entire process of applying the technology to achieve organizational objectives and goals.

Let us look more carefully at each of these elements

FIGURE 1-4 Users Bridging the Technology Gap



The Technologies

Several forces contribute to the increased importance and complexity of IT. One of course, is the inexorable growth in computing and communications capacity accompanied by significant reductions in cost and size of computer and telecom components. Another is the merging of the previously separate technologies of computers, telephones/telecom/cable TV, office equipment, and consumer electronics. Still a third is the ability to store and handle voice, image, and graphical data and to integrate them. Here is a brief list of some rapidly growing technology area:

- Handheld wireless devices
- The internet
- Wireless and fiber-based networks
- Multimedia integrating voice, image, text, graphics, and more
- Integration of consumer electronics and IT

These technologies form system products that are employees, customers, supplier, and consumers. No longer relegated primarily to automating transactions, information system now fills major roles in management reporting, problem solving and analysis distributed office support, customers service, and communication in fact, most activities of information workers are supported in some way by IT; the same is becoming true of suppliers customer and consumers.

The users

As IT becomes pervasive the old categories of user are no loner appropriate the users of electronic data processing and management information system were relatively easy to identify and the function of a system was defined to meet a set of their needs. Now, however, employees need system to do their daily work, making new taxonomies necessary.

One helpful dichotomy to describe actives of information worker defines procedure-based activities and knowledge-based (or goal–based) activities. The

value of this model is that focuses on the important characteristic of information worker their job procedures and knowledge, rather than on the type of data (for example number versus text) or the business function (production versus sales), or even job title (managerial versus professional).

Procedure-based activities are large-volume transactions, where each transaction has a relatively low cost or value. The activities are well define so the principal performance measure is efficiency (units processed per unit of resource spent). For a procedure-based task the information worker is told what to accomplish and the steps to follow. Procedure-based activities mainly handle data **.**

PROCEDURE BASED	**KNOWLEDGE BASED**
• High volume of transaction	• Low volume of transactions
• Low cost (value) per transaction	• High value (cost) per transaction
• Well-structured procedures	• Ill-structured procedures
• Output measures defined	• Output measures less defined
• Focus on process	• Focus on problems and goals
• Focus on efficiency	• Focus on effectiveness
• Handling of "data"	• Handling of concepts
• Predominantly clerical workers	• Managers and professionals
• Example "Back office" Mortgage serving Payroll processing Check processing	• Example Loan department Asset/liability management Planning department Corporate banking

FIGURE 1-5 A Dichotomy of Information Work

Knowledge based activities on the other handle fewer transactions, and each one has higher value. These activities, which can be accomplished in various ways, must therefore measured by results, i.e, attainment of the objectives or goals. Therefore, the information worker must understand the goals because part

of the job is figuring out how to attain them. Knowledge based activities are based on handling concepts, not data. Figure 1-5 summarizes these two kinds of information-based work, giving several examples from banking.

Some authors use the words “clerical” and “managerial” to refer to these two types of activities. Looking at the attributes, however, it is clear that manager often do procedure-based work, and many former procedure-based jobs now have knowledge-based components. Furthermore, the distinction between manager and worker is blurring.

The most important benefit of this dichotomy is that it reveals how much of a firm’s information processing efforts have been devoted to procedure-based activities which is understandable because computer are process engines that naturally support process-driven activities. As important as they are however, it is clear that procedure-based activities are the “wave of the past” The wave of the future is applying information technology to knowledge-based activities, where the objective is more important than the process. For the task “pay employees” or “bill customers,” the system analyst can identify the best sequence of steps. On the other hand, the task “improve sales of the Asian market” has no best process. Decision makers need a variety of support systems to leverage their judgment.

3.3 SYSTEM DEVELOPMENT

In our model system development and delivery bridges the gap between technology and users, but system for procedure-based activities differ from system for knowledge-based information work.

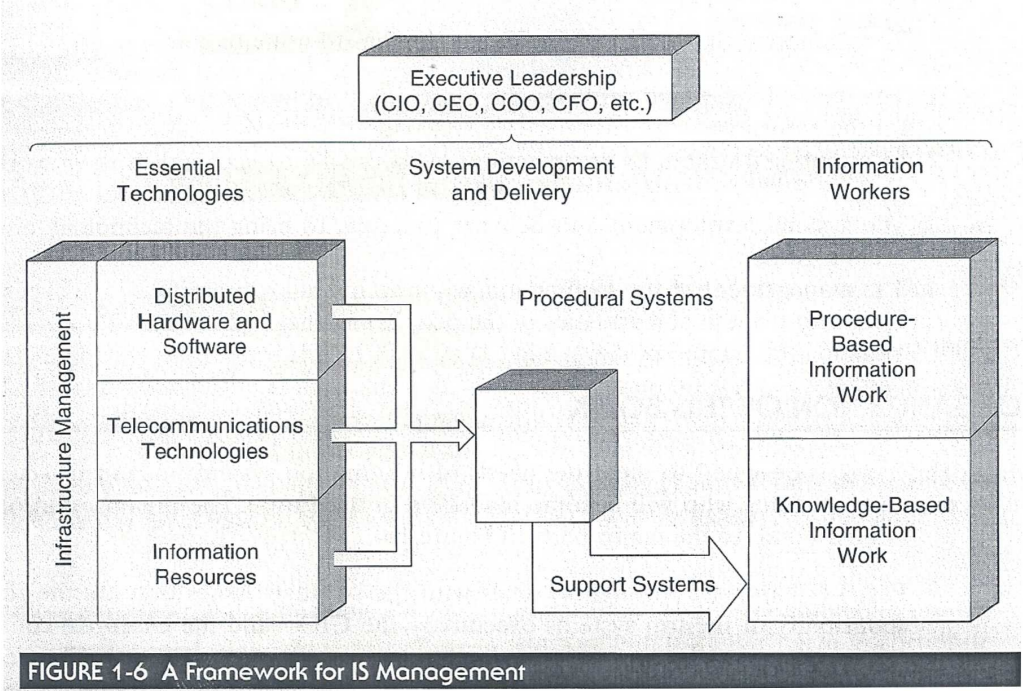


FIGURE 1-6 A Framework for IS Management

Figure 1-6 shows, on the left side the set of technologies that form the IT infrastructure. Organization builds system on these technology resources to support both procedure-based and knowledge-based activities. The three main categories, called "essential technologies," are computer hardware and software, communication networks, and information resource. We call management of them "infrastructure management"

On the right are the two major kind of information work, procedure-based and knowledge- based work. These two categories are not distinct or separate of course, but it is helpful to keep their major differences in mind become they lead to difference approaches, and frequently different teams, in the bridging function of system development and delivery figure 1-6 separates the delivery of services to procedure-based users and knowledge-based users.

3.4 INFORMATION AND SYSTEM MANAGEMENT

The fourth component of this book's model may be the most important of all – executive leadership of the process of applying IT to accomplish organizational goals. Change required to support emerging organizational structure require a significant amount of well-coordinated business and IT executive leadership. The IT leadership comes from a "chief information officer" (CIO) who must be high enough in an organization to influence organizational goals, and have enough credibility to lead the harnessing of the technology to pursue those goals. The business executive lead ship includes all the Cs-CEO, COO, CFO – plus the lead executives of the functional areas. The technology is becoming so fundamental and enabling, that this executive team must work together closely to manage and utilize it fully

4.0 CONCLUSION

The mission for information systems organisation is to improve the performance of people in organisation through the use of information technology. The ultimate objective is performance improvement – a goal based on outcomes and results rather than a go through – the – step process goal. The focus is the people who make up the organisation. Improving organisational performance is accomplished by the people and groups that comprise the organisation.

5.0 SUMMARY

Finally, the resource for this improvement is IT. Many intertwining factors contribute to performance improvement, but this module focus on resource available from the development and use of IT: computer, information, and communication technologies.

6.0 TUTOR MARKED ASSIGNMENT

1. What is the mission for information systems recommended in this module?

2. How does it differ from earlier perceptions of the purpose and objectives of information systems?

7.0 REFERENCE/FURTHER READING

Manville, Brook and Nathaniel Foote, “strategy as if knowledge mattered” fast company, www.fastcompany.com 1996

MODULE 2: TODAY’S STRATEGIC IMPERATIVE AND E-BUSINESS

Unit 1: Looking Inward: E-Business to Employee

Unit 2: Looking Across: E-business to Business

Unit 3: Technical Consideration

Unit 4: Legal and ethical Consideration

UNIT 1: LOOKING INWARD: E-BUSINESS TO EMPLOYEE

1.0 INTRODUCTION

In the 1990's the commercialization of the internet set off a revolution of the use of information technology for conducting business. Old assumptions about the lost structure and geographic limits of networked systems became irrelevant, it became possible to build systems with worldwide reach quickly and inexpensively. Business people responded by creating entirely new types of businesses and fundamentally altering existing businesses. The once limited "strategic use" of IT become widespread New terms were created to label this resolution: electronic commerce (more commonly called e-commerce) and electronic business (e-business).

2.0 OBJECTIVES

3.0 BUSINESS TO EMPLOYEE

The primary e-business way to reach employees is via "Intranets." Intranets are private company networks that use internet technologies and protocol, and possibly the Internet it self. Applications use the web Interface and are accessed through browsers; communication use several protocol, Including hypertext transfer protocol (HTTP) for addressing Web sites, hypertext markup language (HTML) for web content structuring, and transmission control protocol/Internet protocol (TCP/IP) for network routing. The result is open system using nonproprietary technologies.

The benefits from Intranets have been significant: wider access to company Information, more efficient and less expensive system development, and decreased training. By using an Intranet's open-system architecture, companies can significantly decrease the cost of providing companywide Information and connectivity. One of the most important attributes of intranet is that they support any make or brand of user device-from high-end workstation to PC, to laptop, to handheld device-as existing databases and software applications. Such interconnectivity has been the promise of open system for many years. The

internet provides the connecting standard protocols to make the open-system promise a reality.

Furthermore, investments in a companywide electronic infrastructure are significantly less than building a proprietary network. Companies only need the servers, Brower's, a TCP/IP network to build an intranet. If. In addition, the company wishes to use the infrastructure of the internet to geographically extend its intranet, the only additional components needed are firewalls to keep the public from accessing the intranet and local access to the internet. Figure 3-3 shows the basic architecture of an Intranet. The link to the Internet allows the company to expand its intranet worldwide easily and inexpensively-a significant benefit that was unthinkable before the Internet.

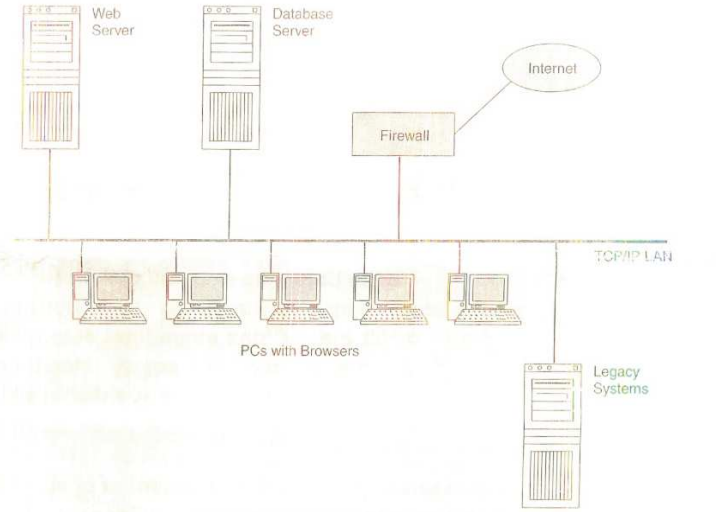


FIGURE 3-3 Intranet Architecture

Finally, becomes an Intranet uses the browser Interface, user do not need extensive training on different products. And, due to the HTML standard and the availability of easy-to-use Web page authoring tools, employees can easily create their own Web pages for whatever purpose they need. As a result. All employees are potential site creators, reducing the IS department's program bottleneck, while adhering to companywide standards. And companies only need to record Information in one place, where it can be kept up-to-date for access by all

employees no matter where in the world they are located. In the following case, Microsoft shows how it effectively implemented an Intranet for human resource management

Managing intranets

Although Intranets offer many advantage to companies they create a

number of managerial concerns as well. Two key issues are figuring out how to integrate legacy systems into the intranet and deciding how much control of the system should be decentralized. A lager amount of the information a company wants to make available to its employees resides in legacy system, but the proprietary interface on those legacy system make it difficult to integrate them into an intranet. Enterprises have two basic options; either leaves the legacy system untouched and replicates the data for the intranet, as Microsoft did in its HR Web system, or modifies the legacy system to allow direct access to their data through a browser. With a history of failures in IT projects, many companies resist modifying working legacy system for fear that the system may stop functioning properly.

Due to the ease with which Web sites can be created, many employees have built their own, leading to a proliferation of sites company information. As employees build more and more Web sites, employees' desktop become cluttered with confusing icon and links, many of which are obsolete or incorrect. In addition, potentially valuable company information is stored on independent sites-sites most likely not under central control. The result is problems of data redundancy, integrity, and security. Mangers face the old trade-off between central control, which provides greater data management, and decentralized control, which provides more timely and relevant data.

One proposed solution this control conundrum is to create a corporate portal to act ad the firm's internal resource, information, and internet services. This solution brings access to company data and application together in a single

site. Employees simply need a Brower. At the same time, the portal provides IS management with a way to monitor and control the growth of internal Web sites, and the portal provides a link to internet resources external to the company, such as for industry news, customer, and business partners.

Although the concept of corporate portals seems straightforward, many firms are reluctant to implement them because portals require changing existing system and processes. These same reasons are why firms have had so many problems implementing enter praise wide ERP application. One approach to manage the inherent problems and risk involves developing separate departmental or divisional portals, such as sales, HR, operations, and finance portals can them be linked to form a corporate portal

3.1 BUSINESS TO CONSUMER

Business-to-consumer e-business is the most widely reported form of e-business. It entails linking a company to its customers over the internet. Providing a means of selling products or Services, and Managing customer relations. Nearly every type of product can now be purchased online, from books, CDs, and flowers, to automobiles, legal services, and wine. But, success is not easily achieved. Arguably the most Visible e-retailer Amazon. Com continues to have its business viability questioned. Levi Strauss, a leader in the use of IT for strategic purposes, was ahead of its target for online sales, yet, in January 2000, it quit selling jeans over the internet. Senior managers state that selling over the Internet was a complex proposition and management had better uses for company funds.

The advantages of selling online are numerous and seem obvious Figure 3-4 lists some of the many advantages indeed, it is not difficult to find success stories, such as Dell computer, e Trade, and cheap Tickets. However, the potential problems are also numerous but not so obvious. Figure 3-5 lists some of the potential problems face in creating a successful business-to consumer system.

FIGURE 3-4 ADVANTAGE OF B2CE-BUSINESS

Global accessibility: the internet eliminates geographic boundaries.

Reduced order processing: Automated order processing improves efficiency.

Greater availability: The Company is available online 24 hours a day, 7 day a week.

Closer customer relationship: with a direct link to customers, the company can quickly address concerns and customize responses.

Increased customer loyalty: with improved customer service and personalized attention Comes greater customer loyalty.

New products and services: with direct links to customers, the company can provide information-based products and services.

Direct making: manufacturers can bypass retailers and distributors, selling directly to customers.

FIGURE3-5 Potential B2C problems

Technical: The information systems are not always reliable or may be poorly designed.

Logistics: getting products to Customers around the world in a timely manner bring "physical" barriers to the virtual business.

Personal: few people have expertise in dealing with the new environment, both in technical and business arenas

Competitive response: The case of creating Web presence brings low barriers to entry for competitors.

Transparent prices: Customers can easily compare prices across Web sites, reducing profit margins

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Greater competition: The elimination of geographic boundaries means a firm must compete with competitors from around the world.

The E-business model

Successful selling over the Internet entails much more than setting up a Web site and taking orders. It involves organizing the entire value chain around the Internet. As shown in Figure 3-6, the retail value chain crosses several organisations. Success in e-business requires retailers to rethinks their value chain from end to end, determining where they can exploit technology add value. E-business affords new opportunities to redefine value to customers and add values by redesigning relationships with business partners.

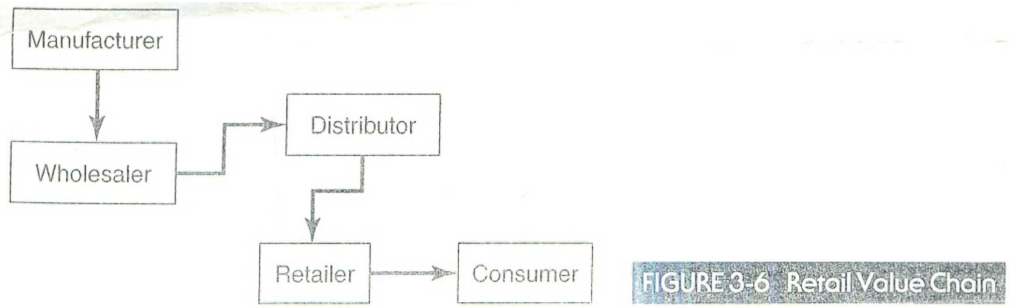


FIGURE 3-6 Retail Value Chain

Redefining customer value.

Information technology has changed what consumers value. They now expect service to be fast; the key term is "demanding on-demand." E-business allows firms to respond by drastically reducing the time it take to respond to customer request for company, product, and price information, to process an order, and to get products to customers.

Consumers also expect convenience. They want more than one-stop shopping; they want a single point of contact in the company. E-business allows gathering and managing customer information so that whoever interacts with the customer has all the relevant customer information at hand.

Consumers further expect personalization of service E-business allows direct on going communication with customers, so that preferences and buying patterns can be tracked and analyzed to provide individual service. By reducing the time to process orders, e-business allows firms to customize products to individual customers. Thus, products from music CDs to rethink their pricing of products and services. Consumers now have access to a wide range of competitive prices and sellers for products, driving down profit margins and the price of products. Some observers have speculated that e-business will drive profit margins and the price of products. Some observers have speculated that e-business will drive profit margins to miniscule levels. Although some initial studies have confirmed the lower price for goods purchased online, the highest volume sellers do not always have the lowers price. Prices are offset by branding, awareness, and customer trust. Indeed, most successful online, retailers spend a significant amount of money on money on marketing and customer acquisition through traditional media, such as TV and magazine advertisements, to build brand awareness and customer trust.

Redesigning Relationships With Business Partners. Many retail value chains include intermediary firms between the manufacturer and customers. The intermediaries can be distributors or sellers of the products, such as travel agents, automobile dealership department stores, and real estate brokers. E-business allows for "disintermediation which means bypassing intermediaries by directly linking customers to the manufacture. For example, airlines now sell tickets to consumers over the internet, saving commissions to travel agents.

E-business also allows the development of "virtual organizations." In a virtual organization, a firm does not own part of the value chain but rather controls the coordination of other firm to appear as a single firm. The following case illustrates how one company, garden.com, created a virtual organization.

4.0 CONCLUSION

We define e-businesses as the use of telecommunication networks, particularly the Internet, to conduct business transactions.

E-business can be divided into three categories, which map directly into the three strategic roles of IT – inward, outward and across.

- Business to Employee: Internet-based applications Internet to a firm.
- Business to Consumer: Internet-based applications for a firm's consumers.
- Business to Business: Extranet-based applications for a firms business partners.

5.0 SUMMARY

E-commerce was coined originally to refer to all three categories. However, as the consumer-oriented e-commerce, - the buying and selling of goods over the Internet – began to receive considerable attention both in the IT industry and in the popular press, e-commerce began to refer only to the business to consumer applications.

6.0 TUTOR MARKED ASSIGNMENT

1. What are the three basic types of e-businesses and how do their strategic roles differ?
2. Why has e-business grown so quickly?

7.0 REFERENCE/ FURTHER READING

The e-business value chain: winning strategies in seven global industries, Economics Intelligence Unit, http://www.eiu.com, October 2000

UNIT 2: LOOKING ACROSS: E-BUSINESS TO BUSINESS

1.0 Introduction

2.0 Objectives

1.0 INTRODUCTION

Business have long used information technology to reduce the cost and time of inter-organisational transactions, inter-organisational system (IOS) have become standard business tools for airlines, hotel, and rental car companies. A computer reservation system that links major business partners is essential.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Explain Electronic Data Interchange
- Discuss Integration

3.1 ELECTRONIC DATA EXCHANGE

Simply stated, EDI is the transmission, ion standard syntax, of dta for business transactions between computers of independent organisations. As soon as businesses began using computers, the amount of paper they generated began to expand. Soon most of the paper generated by one computer was used as input into another – not an efficient way to run a business. For example, purchasing orders, invoices, shipping notices, and payment verification notices.

Traditional EDI

The initial goal of EDI was to replace the paper document involved in business transactions this goal only required automating existing business processes; it did not involve redesigning processes. Although it sound like a modest undertaking today, two barriers to successful EDI system proved extremely challenging: technology and standards. The first barrier was the available technology. To link two computers, firms needed a telecommunications interface between them, which meant leasing a data line between the companies, sending data over standard phone lines using modems, or contracting with a third party to handle the

transmission. Each of these three options had various advantages and disadvantages, but they all entailed costly, in flexible system.

The second barriers to EDI, standards, or more precisely, the lack of standards, includes both technical and business standards. To exchange data, the two computers, needed compatible communication protocols, and the messages or documents needed to be in a standard format. In an EDI transaction, a company-specific form needs to be translated into a generic form and transmitted to the business partner, who then translated the generic form into its own company-specific form. For EDI to be successful, firms needed to agree on these generic-form standards.

Completing "universal" standards were developed, such as X12 from the American National Standards |Institute (ANSI) and EDIFACT from the United Nations Economic Commission for Europe. In addition, Industry-specific standards were developed for document formats. The development of standards became, and still is a major task in facilitating EDI.

An entire industry has emerged to facilitate the user of EDI: value-added network providers, or VANs. A VAN is a third party company that provides communication links and EDI services to other companies. The services include translations between communication protocols and business standards, and message store-and-forward services. In eliminating the need for companies to work out all the details of implementing EDI systems, VANs provided valuable services and proved to be successful businesses.

Therefore because EDI provides an efficient and safe method of sending purchase orders, invoices, product information, shipping data, and other business documents, many large companies have adopted and continue to use EDI. However, the barriers to EDI have proven too expensive and difficult for most small and medium sized companies. E-business is changing that.

Internet based EDI

The internet adds several important dimensions to IOS (see figure 3-7),. First it overcomes many of the technical barriers to EDI. Being an inexpensive public network that is widely available, it eliminates the need for expensive telecommunication networks. This wide access also provides for more flexible systems; trading partners can join the EDI system without high start-up costs, allowing small volume partners to participate. Next, the Internet provides a standard communication protocol. Finally, it provides the means to send multimedia documents, rather than simple integrate with other e-business systems.

3.2 SUPPLY CHAIN INTEGRATION

The supply chain covers all the processes involved in creating products and delivering them to customers. These activities include logistic, procurement, production, and distribution. Management and redesign of the supply chain has become a major strategic issue. Over the last dozen years firms such as Dell Computer and Procter & Gamble (P&G) have gained significant competitive advantage by streamlining their supply chains, reducing operational cost but, more importantly, allowing them to offer new and faster services to their customers. The use of e-business to integrate the supply chain has proven to be the e-business application with the highest payoff.

TRADITIONAL	INTERNET
• Private networks	• Public networks
• High setup cost	• Low setup cost
• Specific groups	• Large group
• Secure networks	• Less secure networks
• Value added services	• Limited services

Figure 3-7 Traditional versus Internet-based EDI

Integrating the supply chain require coordinating many activities across organisations and maintaining close communication with customers. As orders for

products are placed, the company needs to know immediately whether the products are available for shipment, and if not, how long it will take to manufacture and deliver the products. The manufacturing plant needs to know what raw materials are on hand, which suppliers can supply the materials, and how long it will take to get the materials. The delivery department needs to track the status of all deliveries.

Support for the activities of the supply chain has long been in individual information systems, for example, scheduling, inventory, procurement, production planning, and demand forecasting systems. Business-to-business e-business aims to facilitate the integration of all these systems within a company and across business partners. Once integrated, the firms reap the cost reduction benefits of more efficient operations. They can then consider more strategic options.

The strategic options include shifting from mass production and selling from inventory to a build-to-order mode of operation. In the automotive industry, we expect to see consumers being able to custom-design their car over the Internet and have it manufactured and delivered in a matter of days.

Another strategic option is to eliminate intermediaries in the supply chain. For example, in the computer industry, manufacturers like Dell Computer, have been successful selling directly to customers.

A third strategic option is designing the procurement process by using electronic markets or auctions. General Electric (GE) uses an Internet-based system Trading Process Network, to do more than $1 billion in business per year with about 1, 500 suppliers. Using the system, GE purchasers specify their requirements and suppliers submit bids. The bids might contain a variety of information, including product drawings. The software also helps manage the proceeding of bids.

Movement in a number if industries is fuelling the creation of common e-business procurement systems. One of the most notable is in the automotive industry.

3.3 INTEGRATION WITH BACK-END SYSTEMS

Most, if not all, business-to-business systems must integrate with existing back-end systems, which proven to be particularly challenging. Back-end systems cover a wide range of applications, including accounting, finance, sales, marketing, manufacturing, planning, and logistic. Most of these systems have been around for years, operate on a variety of platforms, and were not designed to integrate with other systems. Modifying these systems entails many risks, particularly when the integration must cross organisations. Luckily, most organisations have a head start on inter-organisational integration because they have been working for a number of years on internally integrating their systems.

Understanding the need for internal integration, many companies replaced, or are currently repaying, their old back-end systems with newer ones using database management systems (DBMS) and ERP systems. The benefits of DBMS and ERP systems have always stemmed from their ability to provide integration. Recognising the importance of e-business, DBMS and ERP vendors have modified their products to integrate with Internet-based applications. In doing so, the vendors provide platforms for building business-to-business systems.

Another approach to establishing B2B integration is to create an extranet. An extranet is a private network that uses Internet protocols and the public telecommunication system to securely share part of a business's information or operations with supplier, vendors, partners, customers, or other businesses. An extranet is created by extending the company's intranet to users outside the company. The same benefits that Internet technologies have brought to corporate intranets have accelerated business between businesses.

Whatever the approach, the goal is to extend the company's back-end systems to reengineer business processes external to the company. Example activities include sharing product catalogs, exchanging news with trading partners, collaborating with other companies on joint development efforts, jointly developing and using training programs, and sharing software applications

between companies. Initially, the benefits come in the form of greater cost and time efficiencies. Ultimately, the systems will change the structure of industries.

4.0 CONCLUSION

In banking and financial services, electronic funds transfer systems have been in use for decades. In manufacturing, electronic data inter-change systems (EOL) were developed in the 1960s and are now almost universally used.

Business to business e-business represents the next stage in the evolution of inter-organisational system.

5.0 SUMMARY

It is not clear what the future holds for e-business, but it is clear that e-business has made a permanent change in the nature of business.

6.0 TUTOR MARKED ASSIGNMENT

1. What are the major barriers to e-business?

7.0 REFERENCE/FURTHER READING

Microsoft Corporation, http://www.microsoft.com/technet/showcase, October 2000

UNIT 3: TECHNICAL CONSIDERATION

1.0 INTRODUCTION

As with any new technologies development especially one as profound as the Internet, a new economy is created. That new economy brings challenges with it. In the world of the Internet, two of the technical challenges are concerns about the further of the Internet and what to do about security.

2.0 OBJECTIVES

At the end of the unit, you should be able to explain the evolution of the internet

- Explain the evolution of the Internet
- State the security measures against Hacking, Sniffing, and Spoofing.

3.1 EVOLUTION OF THE INTERNET

As use of the Internet continues to grow, concerns have raised about its ability to handle the traffic generated by e-business. Chief among these concerns are quality of service, availability, and security. In network engineering, “quality of service” refers to the ability of a network to provide a range of assured levels of performance.

Performance is characterized by many metrics including bandwidth, latency (the percentage). And packet loss rata (the percentage of data packets that do not reach their destination).

They current version of the Internet was not designed provide guaranteed quality of service levels. The TCP/IP protocols were designed using a philosophy of best effort in the delivery of packets. Delivery is not guaranteed nor is the sender notified in the event of non-delivery. Even in the face of rapid expansion

of fiber links, bandwidth on the Internet has had trouble keeping up with the growing demand, and that produces bottlenecks, causing problems with latency and availability. As a relatively inexpensive public data network, the Internet remains the network of choice for e-business. Companies continue to upgrade components on the Internet, but how long can it continue to provide a minimum level of quality of service?

Two major cooperative efforts are underway to develop a replacement network that will provide higher levels of quality of service, availability, and security. The first is the U.S government's Next Generation Internet (NGI) project; the second consists of two projects sponsored by private sector organisation, the University Consortium for Advanced Internet Development (UCAID).

The NGI initiative began in October 1997 and involves a number of federal agencies, including the Defence Advanced Research Projects Agency (DARPA), the National Science Foundation (NSF), and National Aeronautics and Space Agency (NASA). NGI has three components: research and development on advanced network technologies, the deployment of high speed tested networks, and the development and demonstration of revolutionary applications that demand high speed networks nor currently possible on today's Internet.

UCAID, incorporated in 1998, sponsors two related projects: the Internet 2 and Abilene projects. The internet 2 project will link more than 100 member universities with an advanced academic network. It will also support research which requires applications that cannot be run over the current Internet, Abilene is seen as a second Internet 2 backbone. Spearheading this project are Qwest, Cisco System, Nortel, and Indiana University. Abilene will build a network to support the demands of advanced research application of UCAID members and a testbed for new networking technologies.

3.2 SECURITY

Security ranks as one of the top management and consumer concerns about e-business. Managers are concerned about protecting company assets and information, and ensuring the integrity of e-business transactions. Consumers are concerned about protecting their privacy and financial transactions. We divide the security concerns into three categories:

1. Sniffing
2. Spoofing
3. Hacking

Sniffing is the interception and reading of electronic message as they travel over the communication networks. Spoofing is the assumption of a false identity and the execution of fraudulent transactions. Hacking in the unauthorised access to a host computer. This access may be a direct intrusion or via a computer virus or Trojan horse.

To protect against hacking, a firm must install a firewall. A firewall is a device placed between the company's network and the internet that monitors and controls all data traffic entering and leaving the company's network. Firewalls can take many forms, from routers, which packets, to hardened host computers, to software applications. Hardened firewall host are stripped down computers especially designed for security; they provide the highest level of security. Routers and software provide less security, bout have a much lower price.

To protect against sniffing messages must be encrypted before being sent over the Internet. The two classes of encryption methods in use today are the secret key encryption and the public key encryption. The most common secret key method is the Data Encryption Standard (DES) developed by IBM, the National Security Agency, and the National Bureau of Standards. Using this method, the sender and receiver of the message use the same key to code and decode a message. The level of security is a function of the size of the key. DES is widely used and available in many software applications.

The common public key encryption method is RSA, named for the three developers: Rivest, Shamir, and Adleman. To send an encrypted message using RSA, two keys are necessary: a public and a private key. As its name implies, the public key is known to many people and is not kept secret. However, the private key must be kept secret. The two keys are used to code and decode message; coded with one can only be decoded with the other.

Figure 3-8 shows how an encrypted message is sent. First the message is encrypted using the receiver's public key. The message is now secure – it can be decoded using the receiver's private key, which is only known to the receiver. Note that the sender uses the receiver's public key, not a key belonging to the sender. If a secure message is to be sent back to the original sender, then the public key of the original sender would be used. Thus, for two-way secure communications, both parties must have a set of keys.

The RSA method is secure and widely used. It is incorporated into all major web browsers and serves as the basis for the secure Socket Layer (SSL) in Internet communications however; full two-way secure communications requires all parties to have a public and private key. Because most individuals do not have such keys, most business-to-consumer applications requiring encryption, such as the transmission of credit card numbers, are only secure transmission from the consumer to the merchant, not from the merchant to the consumer.

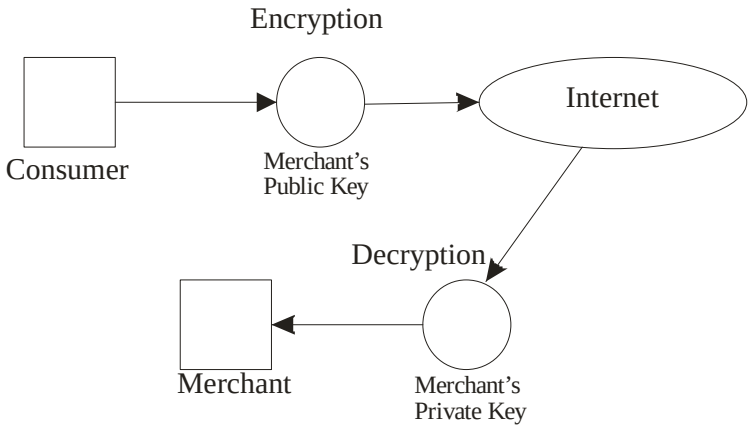


FIGURE 3-8 Sending an Encrypted Message

Finally, to protect against spoofing, firms need a way to authenticate the identity of an individual. This verification requires a form of digital ID. The most common form of digital signature uses the RSA encryption method. Because the private key is known only to one person and a message encrypted with that key can only be decode with the matching public key, the private key provides a way of verifying that the message came from a certain individual. Figure 3-9 shows the basic process.

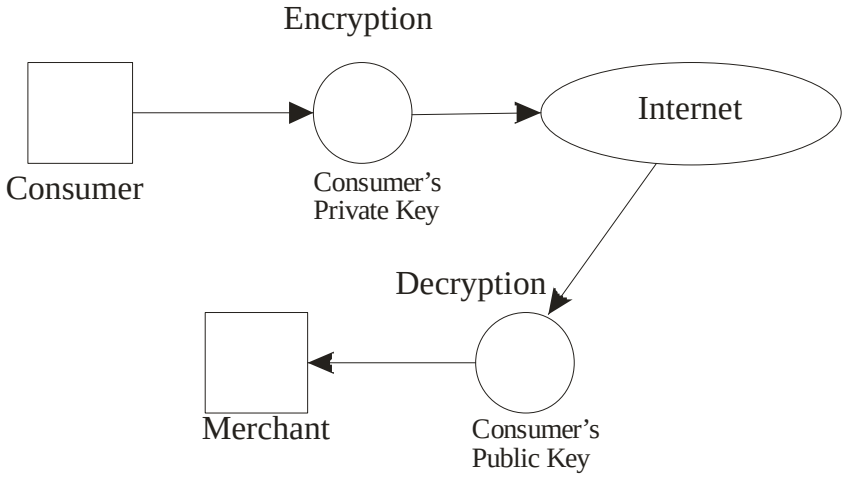


FIGURE 3-9 Sending a Digital Signature

For digital signature to work, a trusted third party must issue the keys to individuals and firms. These parties are called "certification agencies" and can be government agencies or trusted private companies. The agency issues a digital

certificate containing the user's name, the user's public key, and the digital signature of the certification agency. See Figure 3 -10. The digital certificate can then be attached to a message to verify the identity of the sender of the message.

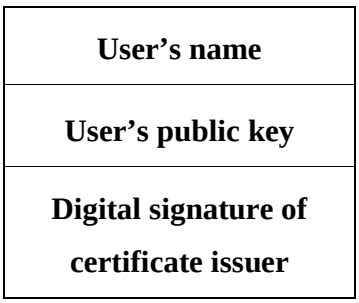


FIGURE 3-10: A Digital Certificate

4.0 CONCLUSION

As a relatively inexpensive public data network, the Internet remains the network of choice for e-business. Besides, companies are concerned about protecting their assets and information, and ensuring the integrity of e-business transactions.

5.0 SUMMARY

As attack on the online system could either be passing (is one, which the hacker enters the system without physically interfering with any program or data) or aggressive (is one in which the data or program is altered in some ways). This may involve the transfer of funds, alterations of records, or indeed the introduction of a virus. The Internet with all its obvious benefits has major sore point, which is "security".

6.0 TUTOR MARKED ASSIGNMENT

1. What are the three categories of e-business security concerns and how do they differ?
2. Describe the public key encryption method
3. How has the Internet change consumer's expectation?

7.0 **REFERENCE/FURTHER READING**

Electronic commerce in developing countries, Catherine Man.

UNIT 4: LEGAL AND ETHICAL CONSIDERATIONS

1.0 **INTRODUCTION**

As with any other business activity, e-business must adhere to legal and eithical codes. However, e-business entails some new legal and ethical issues of which managers must be aware, including the following:

- Privacy
- Intellectual Property Right
- Legal Jurisdiction
- Content Regulation

2.0 **OBJECTIVE**

At the end of this unit, you should be able to

- Explain privacy and intellectual property rights

- Discuss legal jurisdiction to control certain types of information.

3.1 PRIVACY

As with any other business activity, e-business must adhere to legal and ethical codes. However, e-business entails some new legal and ethical issues of which managers must be aware, including the following:

- Privacy
- Intellectual property right
- Legal Jurisdiction
- Content regulation

Privacy includes freedom from intrusion, the right to be left alone, the right to control information about oneself, and freedom from surveillance. It is a major issue in e-business because of the widespread availability of personal data and the ease of tracking a person's activities on the Internet.

The United States and many other countries have enacted laws to control certain types of personal information, such as medical, credit, and other financial information. These laws carry over to the e-business environment. However, in the United State no laws protect the privacy of consumer purchasing data. As companies build large database on their e-business customers, the values of this data makes the selling of the data an attractive business option.

Internet technologies, cookies in particular, make tracking the browser activities of individuals possible. Consumer concerns about this perceived invasion of privacy is requiring companies to post and adhere to privacy statements on their Websites. The following hypothetical scenario found on zeroknowledge.com dramatise these concerns:

Bob's father has just been diagnosed with cancer. In an effort to learn more about it, Bob visit cancer Websites and posts several inquiries to a

discussion group. A month later, Bob insurance company informs him that he is no longer eligible for a certain rate given his "condition."

Some companies use third party cookies (that is, cookies by a firm other than the owner of the site being visited) to do "online profiling." It is also known as profile-base advertising, and it is a technique that marketers use to collect information about online behaviour of Internet users and to facilitate targeted advertising. Profile-based advertising could easily be considered a form of online surveillance. What's worse, some third party cookies are often placed on Web browser' computers without their knowledge when banner advertisement appear. It is not necessary to click to the banner advert to generate a cookie.

3.2 INTELLECTUAL PROPERTY RIGHT

The protection of Intellectual property is critical to e-business because many products and services contain Intellectual property, copi8es are easy to make, and the copy is as good as the original. Example of e-business activities in which Intellectual property right are critical include electronic publishing, software distribution, virtual art galleries, music distribution over the Internet, and inline education.

We look at four types of legal protection of Intellectual property: copyrights, patents, trademarks, and trade secrets.

Copyright.

Copyright law aims to protect an author's or Artist's expression once it is in tangible form. The work must be expressive rather than functional; a copyright protect the expression, not the idea. For example, a cartoon duck is an idea and cannot be copyrighted, but Donald Duck and Daffy Duck are expressions of that idea and are copyrighted. Registering a copyright is not a requirement; putting the expression into tangible form is sufficient. A copyright is valid for the life of the author plus 50 years.

Just about all original content on a website can be copyrighted by the creator of the site, from buttons to video, from text to site layouts. If a company hires someone to develop a site, by default, the copyright belongs to the developer, not the company. The developer can then demand royalties from the company if it uses the Website; therefore it behoves companies to clearly define the owenership of the copyright in the contract.

The Internet raises many interesting issues for copyright law, which was developed for physical media. Placing copyrighted material, such as a photograph, on a Website without permission of the copyright holder is clear violation of law. Less obvious is whether inserting a link to someone else's copyrighted material is a violation of the law. If, for example, the site contains a direct link to the content of another site, say a photograph, is it a violation of copyright law? In case, the answer is probably yes. However, if one includes a link to the homepage of the site rather than a direct link to the content, then probably no violation has occurred. Internet copyright issues are now being worked out in the court and legislatures.

Patents.

Patent law aims to protect inventions – things or processes for producing things – that is, "anything under the sun made by man" but not "abstract idea" or natural laws, according to U.S. copyright law. Valid for 20years, the protection is quite strong. In the United States, patents are granted by the U.S. Patent and Trademark Office after stringent thresholds on inventiveness have been met.

The United States recognizes patents for business processes. Although software, in general, cannot be patented – it must be copyrighted – certain business practices implemented in software can be patented. In the e-business area, Amazon.com has received a patent for "one click purchasing." The company has enforced its patent rights against its main competitor, Barnes and Noble cannot use one click purchasing on its Website. British Telecom has claimed to have invented the hyperlink. To obtain the patent, the company will have show that no

prior use of hyperlinks occurred before its use. Any prior use would invalidate the patent.

Trademark.

Trademarks protect names, symbols, and other icons used to identify a company or product. Trademarks can be registered with the U.S. Patent and Trademark Office. A trademark is a valid indefinitely, as long as it is used and does not become a generic name for the goods or services. The aim of trademark law is to prevent confusion among consumers in a market with similar identifying names or symbols. The standard for trademark infringement is whether the marks are "confusingly similar."

The biggest area of trademark conflicts in e-business has to do with domain name registration. For a while, "cyber squatters" were registration domain names that clearly referred to known companies, realizing those companies would eventually want the domain name and would be willing to pay for it. Although this tactic worked for a while, anti-cyber squatting laws were passed and the practice is now illegal. To avoid potential problems, firms should obtain and register a trademark for its domain name. Note that most online services that register domain names do not check for trademark infringements. Firms are advised to do a search for possible trademark infringements before using a domain name to avoid future litigation.

Trade secret.

Trade secret, as the name implies, protect company secrets, which can cover a wide range of processes, formulas, and techniques. A trade secret is not registered and is valid indefinitely, as long as it remains a secret. Although laws protect against the theft of trade secrets, it is not illegal to discover a trade secret through reverse engineering. Trade secrets are the area of Intellectual property rights least application to e-business.

3.3 LEGAL JURISDICTION

Laws are written for particular jurisdictions with clear geographic boundaries, so how do those laws apply in cyberspace, which has no geographic boundaries? Take foe example the case of trademark rights, which are limited to geographic area. In the physical world, a sign over “Lee’s Computers Services” in Singapore would not have a significant impact on “Lee’s Computer Services” in Honolulu – nether in customers nor competition. However, in cyberspace the web pages of the two companies would clearly overlap and, if the companies were to take advantage of the global reach of the Internet, significant completive overlap could be an issue. The companies have little legal recourse for resolving the identity trademarks.

Gambling provides another interesting example. Do Hawaiian laws against gambling apply to a Nevada company with a gambling site on its Web server located in Las Vegas? The attorney General of Minnesota has asserted the right to regulate gambling that occurs on a foreign Web page that is accessed and “brought into” his state by local resident.

Similar cases have involved site dealing with pornography and securities trading. Alabama successfully prosecuted a California couple for bringing pornography into Alabama; their server was in California. Note that U.S. pornography laws are based on “community standard”; Los Angeles standards are clearly different from those of Mobile. The state of New Jersey is attempting to regulate securities trading over the Internet, if anyone in the state has access to it, and many states are revising their tax codes to gain revenues from e-commerce.

We see a trend that, at best, is disturbing and, at worst, could greatly disrupt e-business: Faced with the inability to control the flow of electrons across physical boundaries, some authorities strive to impose their boundaries on cyberspace. When technological mechanisms, such as filters, fail, the authorities assert the right to regulate online trade if their local citizens may be affected. In essence, under this approach, all Internet-based commerce would be subject simultaneously to the laws of all territorial governments. Imagine a Hawaiian,

company setting up a Web site for retailing over the Internet needing to consider the laws of Hawaii, California, New York, and the other forty-seven states, plus Singapore, Peru, Syria, and any other place you might name. This situation would clearly cripple e-business.

The concepts of "distinct physical location" or place where an activity occurred" fall apart in cyberspace; no clear answer is available to the question: where did this event take place? Of relevance are the locations of the business's offices, warehouses, and servers containing the Website. Some of the uncertainty can be resolved by placing online contracts on the site specifying the legal jurisdiction that will be used for disputes. Users who agree to the contract designate so by clicking a button that says "I agree." In most case, the contract will hold.

In the United States, states have adopted the Uniform Commercial Code (UCC), a wide-ranging codification of significant area of U.S. commercial laws. The National Conference of Commissioners of Uniform State Law and the American Law Institute, who sponsor the UCC, are working to adapt the UCC to cyberspace.

Internationally, the United Nation Commission on International Trade Law has developed a model law that supports the commercial use of international contracts in electronic commerce. This model law establishes rules and norms that validate and recognize contracts formed through electronic means, sets standards governing electronic contract performance, defines what constitutes a valid electronic writing and original document, provides for the acceptability of electronic signatures for legal and commercial purposes, and supports the admission of computer evidence in courts and arbitration proceedings.

3.4 ONLINE CONTRACTING

A contract is a voluntary exchange between two parties. Contract law looks for evidence that the parties have *mutually assented* to the terms of a particular set of

obligations before it will impose those obligations on them. Before the law will recognise the existence of binding contract, there must be

1. A definite *offer* by one party, called the "offeror"
2. A timely *acceptance* by the "offeree"
3. Some *consideration* must pass between the offeree and the offeror

A widespread misconception hold that contracts must be writing and signed before they are enforceable in court. The general rule is that offerees can show their acceptance of a contract offer by any means that are "reasonable under the circumstance." Reasonable acceptance includes oral agreements. Some exceptions do apply, however. For example, sales of real property require signed writings and, in the United States under the Uniform Commercial Code, any contract for the sale of goods for a price greater the $500 requires writing.

In e-business, evidence of acceptance of a contract can be a simple click on a button saying "I Accept" or "I Agree." The case becomes more complex when the transaction involves payment greater than $500. the relevant question are: Is our purely electronic communication "in writing" and have we "signed" the agreement? The answers are as yet unresolved. No cases have been presented regarding whether a file that exists in a computer's memory is "written" for purposes of contract law. Most commentators think the answer is properly "yes" but the final answer will have to wait until courts have reviewed the issue more closely.

In June 2000 President Clinton Signed the Electronic Signatures in Global and National Commerce Act (E-Sign). Basically, E-Sign grants electronic signatures and documents equivalent legal status with traditional handwritten signatures. It is technology-neutral so that the parties entering into electronic contracts can choose the system they want to use to validate an online agreement. Many browsers contain minimal authentication features and companies are developing pen-based and other types of technologies to facilitate online

contracting. In addition, a number of companies already provide digital signature products using public key encryption methods.

The full impact of E-sign may not be as revolutionary as some would hope. The act specific that no one is obliged to use or accept electronic records or signatures – all parties must consent to using the method. The act does not apply to a wide range of situations, such as the creation and execution of wills, adoptions, divorces, any notice of cancellation or termination of utility services, or foreclosure or eviction under a credit agreement. In addition, the marketplace has to sort out some serious problems with varying electronic signature standards. For example, a number of companies issue digital certificates, but none of them can operate with the others. It would require parties interested in adopting electronic signatures for their business to provide several technologies, or risk losing access to some customers.

4.0 CONCLUSION

Security includes authenticating business transaction, controlling access to resources such as web pages for registered or selected users, encrypting communications and effectiveness of transactions.

5.0 SUMMARY

Intellectually, the model law developed by the United Nation Commission International Trade Law, establishes rules and norms that validate and recognise contracts formed through electronic means, set standards governing electronic contract performance and provides for the acceptability of electronic signatures for legal and commercial purposes.

6.0 TUTOR MARKED ASSIGNMENT

What are the four methods of legal protection of intellectual property?

7.0 REFERENCE/FURTHER READING

The e-business values chain: winning strategies in seven Global Industries, Economist Intelligence Unit, http://www.eiu.com, October 2000.

MODULE 3: TECHNOLOGIES FOR DEVELOPMENT SYSTEM

Unit 1: Foundations of System Development

Unit 2: System Integration

Unit 3: Internet – Based Systems

Unit 4: Project Management

UNIT 1: FOUNDATIONS OF SYSTEM DEVELOPMENT

1.0 INTRODUCTION

One of the toughest jobs in information systems management is developing new systems. In spite of the complexity of system development, the information systems field has made significant progress in improving the process of building systems.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- List all the element that characterise System development
- Explain structured development methodology
- Understanding fourth – generation languages

3.1 STRUCTURED DEVELOPMENT

Structured development methodologies accompanied this system development life cycle and were meant to handle the complexities of system design and development by fostering more discipline, higher reliability and fewer errors, and more efficient use of the resources.

More Discipline.

By establishing standards for processes and documentation, the structured methodologies attempted to eliminate personal variations. At first they seemed to threaten programmer's creativity, but their discipline did increase productivity and permit developers to deal with greater complexity. The complexity was handled through successive decomposition of system components, coupled with preferred practices for conducting analysis, design, and construction. The result was a more disciplined system development process.

Higher Reliability and Fewer Errors.

The structured methodologies recognised that mistakes of both omission and commission were likely at all stages of system building. One of the main tools for coping with this tendency was (and still is) inspections, performed at every development stage and at every level of system decomposition. The goal has been to catch errors as early as possible. The methodologies also recognised that iteration would be required to redo parts of a system as mistakes were uncovered.

More Efficient Use of Resources.

The project management approaches usually included in the structured methodologies contributed to cost savings, increased productivity, and better allocation of human resources. By imposing a time and cost control system, the classic approach decreased (but did not eliminate) the tendency for system development efforts to incur cost and time overruns.

3.2 FOUTH – GENERATION LANGUAGES

In the early 1980s, two major developments occurred. One was the availability of fourth-generation languages (4GLs). Previously, developers only had third-generation languages, such as COBOL and PL/1. The advent of 4GLs allowed end users to develop some programs, or allowed programmers to use a different development method: prototyping. Formerly, system requirements were fully defined before design and construction began. With prototyping, development was iterative: specify as much as possible, prototyping it, try using the prototype, refine the prototype based on this experience and so on until the specifications were fully defined via the prototype.

Both 4GLs and prototyping have proven to be important underpinnings for today's application development world.

Fourth-generation languages are really more than computer languages, they are programming environments. The major components or characteristics of 4GLs are listed in Figure 9-3.

The heart of a 4GLs is its database management system (DBMS) for storing formatted data records as well as unformatted text, graphic, voice, and perhaps even video. Almost as important is the data dictionary, which stores the *definitions* of the various kinds of data. The language programmers and users use is nonprocedural, which means that the commands can occur in any order, rather than the sequence required by the computer. The commands can be used interactively to retrieve data from files or a database in an ad-hoc manner or to print a report (using a report generator). The screen painter allows a user or

programmer to design a screen by simply typing in the various data input field names and the locations where they are to appear, or by choosing graphic off a menu. Some 4GLs include statistical packages for calculating time series, averages, standard deviations, correlation coefficients and so on.

FIGURE 9-3 Features and Functions of Fourth-Generation Languages

- Database management system
- Data dictionary
- Nonprocedural language
- Interactive query facilities
- Report generator
- Selection and sorting
- Screen formation
- Word processor and text editor
- Graphics
- Data analysis and modelling tools
- Library of macros
- Programming interface
- Reusable code
- Software development library
- Back up and recovery
- Security and privacy safeguards
- Links to other DBMS

3.3 SOFTWARE PROTOTYPING

According to *Webster's 20th Century Dictionary*, the term *prototype* has three possible meaning: (1) It is an original or model after which anything is formed, (2)

It is the first thing or being of its kind, and (3) It is a pattern, an exemplar, or an archetype.

J. David Naumann and A. Milton Jenkins believe the second definition best fits the prototypes used in software development because such prototypes are a first attempt at a design that generally is later extended and enhanced. Franz Edelman, a pioneer in the use of software prototyping, described the process of software prototyping as "a quick and inexpensive process of developing and testing a trial balloon."

A software prototype is a *live, working system:* it is not just an idea on paper. Therefore it can be evaluated by the designer and eventual users through its use in an operational mode. It performs actual work; it does not just simulate that work. *It may become the actual production system,* or it may be replaced by a conventionally coded production system. Its purpose is to *test out assumptions,* about user's requirements, about the design of the application, or perhaps even about the logic of a program.

A prototype is a software system that *is created quickly* – often within hours or days, or weeks – rather than months or years. With only conventionally programming languages, such as COBOL, it was much too expensive to create both a prototype and a production version, so only production systems were developed. With end user tools, people can get prototypes up and running quickly. The prototype *is relatively inexpensive to build* because the language creates much of the code.

Prototyping *is a process.* It begins with a simple prototype that performs only a few of the basic functions. Through use of the prototype, system designers or end users discover new requirement and refinements to incorporate in each succeeding version. Each version performs more of the desired functions and in an increasingly efficient manner.

To demonstrate a dramatic use of both a 4GL and prototyping, we describe work at Santa Fe Railroad in the early 1980s. Their use of a 4Gl was

unique because it took the opposite approach of just about everyone else. Most companies used 4GLs for management reports and end user applications, that is, as a sidelight for their operational system. Santa Fe, on the other hand, used the 4GL for their operational system, and left the management reporting in COBOL. Their approach, using today's tools, would be just as unique. The reasons for unusual decision are made clear in the case example.

3.4 COMPUTER-AIDED SOFTWARE ENGINEERING

Even though the structured programming and analysis techniques of the 1970s brought more discipline to the process of developing large and complex software applications, they required *tedious* attention to detail and lots of paperwork. Computer-aided software engineering (CASE) aimed to automate structured techniques and reduce this tediousness.

Definitions.

At a CASE Symposium, sponsored by Digital Consulting, Inc. Carma McClure, a CASE pioneer, defined CASE as any automated tool that assist in the creation, maintenance, or management of software systems. In general, a CASE environment includes:

- An information repository
- Front-end tools for planning through design
- Black-end tools for generating code
- A development workstation.

Often not included, *but implied and necessary*, are a software development methodology and a project management methodology.

An information repository: A repository forms the heart of a CASE system and is its most important element, said McClure. It stores and organised all information needed to create, modify and develop a software system. This information includes, for example, data structures, processing logic, business rules, source code and project management data. Ideally, this information

repository should also link to the active data dictionary used during execution so that changes in one are reflected in the other.

Front-end tools: these tools are used in the phases leading up to coding. One of the key requirements for these tools is good graphics for drawing diagrams of program structures, data entities and their relationships to each other, data flows, screen layouts, and so on. Rather than store pictorial representations, front-end tools generally store the meaning of items depicted in the diagrams. This type of storage allows a change made in one diagram to be reflected automatically in related diagrams. Another important aspect of front-end design tools is automatic design analysis, for checking the consistency and competence of a design, often in accordance with a specific design technique.

Back-end tools: These tools mean code generators for automatically generating source code. A few CASE tools use a 4GL. Successful front-end CASE tools provide interfaces to not just one, but several, code generators.

Development workstation: The final component of a CASE system is a development workstation, and the more powerful the better to handle all the graphical manipulations needed in CASE developed systems.

Time boxing.

One of the most intriguing CASE products and approaches in this timeframe is the "Timebox," which is a technique that uses CASE to guarantee delivery of a system within 120 days. Although CASE proponents would have argued that such an approach would not work with large, complex systems, which is where CASE proved to be the only alternative, IS departments now honour speed over complexity, which is why many are turning illustrates a RAD techniques. Which is applicable today

4.0 CONCLUSION

Structured system development was characterised by the following element:

- Hand coding in a third – generation language (such as COBOL)

- A “structured programming” development methodology
- An automated project management system
- A database management system
- A mix of online and batch applications in the same system
- Development of mostly mainframe applications
- Programming by professional programmers only
- Various automated, but not well – integrated, software tools.
- A well – defined sign – off process for system delivery
- User participation mainly in requirements, definition and installation phases.

5.0 SUMMARY

This development supposedly followed the famous “waterfall” approach, shown below

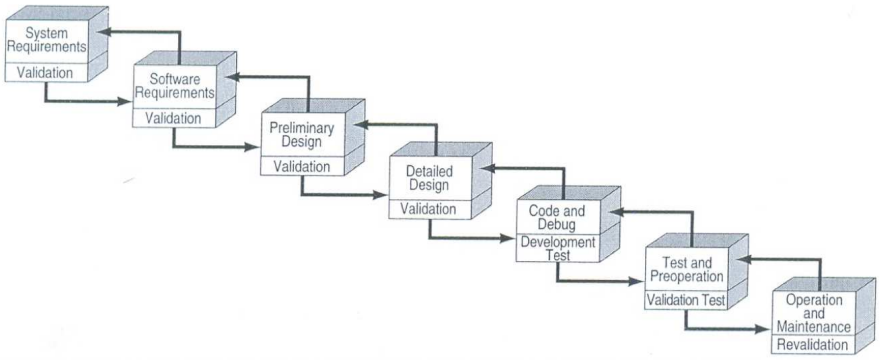


FIGURE 9-1 The "Waterfall" Development Life Cycle

Source: Barry Boehm, *Software Engineering Economics* (Upper Saddle River, NJ: Prentice Hall, 1981).

This unidirectional waterfall was much touted but rarely used. Development did not proceed in a straight line from requirements through operation, a lot of back-tracking and iteration secured.

6.0 TUTOR MARKED ASSIGNMENT

What are the goals of the traditional system development life cycle approach?

7.0 REFERENCE/FURTHER READING

Canning, R.G, Electronic Data Processing for Business and Industry, 1956.

UNIT 2: SYSTEM INTEGRATION

1.0 INTRODUCTION

Integration is complex, expensive and risky recently, competitive pressures have raised the importance of integrating business processes and therefore, the underlying information systems. The trend away from in – house software development toward the use of off-shef software has furthered the used of integration. And the growth of e-business has provided the means of integrating systems across organisation. Infact, technology vendors have responded with a number of products to facilitate the integration of systems.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- Explain an enterprise resource planning system
- Explain database management system
- Highlight the application of middle ware

3.1 DATABASE MANAGEMENT SYSTEM

The database management system approach takes a data-oriented view of integration. DBMSs allow application to share data stored in a single or distributed database. The application can come from a number of sources, but they employ a common DBMS.

The EPR approach, discussed in the next section, takes an application view of integration. All application come from a single vendor and are specifically designed to communicate with each other through third party translation software.

Each of the three approaches has advantages and disadvantages, depending on the conditions of the enterprise. Typically, organisations use a combination of the three. Indeed, a quick look at the strategies of the vendors also reveals a mixture of the approaches. Oracle, firmly in the database management systems market, has moved towards offering enterprise applications, SAP, a major ERP vendor and long a competitor of oracle, has modified its products to use standard DBMS, including that of Oracle. So the three approaches are not mutually exclusive.

3.2 ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS

An enterprise resource planning (ERP) system attempts to integrate corporate systems by providing a single set of applications, from a single vendor, operating with a single database. The goal is to provide the means to integrate business department and functions across an organization. ERP vendors offer a complete set of business applications, including order processing, human resource management. By automating many of the tasks involved in the business processes and standardizing the processes themselves, the ERP system can provide substantial payback to a company, if a system is installed properly.

Although the history of ERP implementation projects contains both successes and failures have been notable. Scott Buckhout and his colleagues reported on a study of ERP implementations in companies with more than $500 million in revenues. The average cost overrun was 179 percent, and the average schedule overrun was 230 percent. Despite these overruns, the desired functionally was 59 percent

below expectations, on average. Only 10 percent of the implementation projects actually finished on time and within budget 35 percent of the projects were cancelled. Even It companies have had problems. Dell Computer cancelled its ERP project after two years and expenditures of more than $200 million.

Some failures can be attributed to other factors common to other IS projects, such projects, such as the system's large size and complexity. But, ERP systems differ in a significant way, which is not always recognised. Because they are designed to integrate and streamline numerous business functions, ERP systems have significant implications for the way a firm organizes and operates. Many failures result from too much attention being given to the organizational impacts.

An ERP system contains a model of business that reflects assumptions about the way the business operates. The vendor makes these assumptions and designs the ERP to reflect the vendor understands of business processes in general. As a result, the business model imbedded in the ERP system may be different from the way the customer actually operates. Even though the ERP system can be customized to some degree, configuring the system entails compromises. The company must balance the way it wants to operate with the way the system wants the company to operate.

In order to realize the benefits of an ERP system–integrated systems and integrated business processes –a company must therefore change their organizational structure and culture. From his extensive studies of ERP implementation, Thomas Davenport stresses that companies that have derived the greatest benefits have been those that viewed ERP system (he preferred the term *enterprise system, ES)* primarily in strategic and organizational terms not technical terms; they "stressed the enterprise not the system". He recommends therefore that before implementation decisions are made, managers need to ask the following questions: "How might an ES strengthen our competitive advantages? How might it erode them what will be the system's effect on our organization and culture? Do we need to extend the system across all our

functions, or should we implement only certain modules? What other alternatives, if any, for information management might suit us better than an ES?"

An example of a successful implementation of ERP, consider Colgate-Palmolive.

3.3 MIDDLE WARE

Most organizations have a wide range of applications, new and old, from a wide variety of vendors, running on platforms. Replacing or rewiring these applications is not feasible. So one option is to employ a class of development products known as *middleware.* As its name implies, middleware is software that works between and connects application, allowing them to share data. Without middleware, applications would have to be to be modified to communicate with each other, usually by adding code to each application—a risky endeavour. Middleware acts as translator between the applications so they do not need to be changed.

As Woolfe points out, middleware simplifies development by acting as the glue that binds the component together, allowing them to work together. A plethora of middleware is available, as figure9-4 illustrates. Some are for communicating among applications, others are for managing transactions across platforms, and still others provide general services, such as security, synchronizing timing, or software distribution.

A new type of middleware is gaining popularity among larger companies; Enterprises Application Integration (EAI) products. EAI tools typically use a message broker to transfer data between applications and add a new level of functionality that distinguishes it from other types of middleware. EAI tools allow users to define business processes and make data integration subject to rules that govern those processes. As an example, a rule might state that data moves automatically from the purchasing application to the accounts receivable application only after the appropriate person has signed off on the purchase.

FIGURE 9-4 Types of Middleware Used in Client-Server Application

Inter-application communication facilities: link components.

- Application programming interfaces (APIs): provide a standard way of interfacing
- Remote procedure call (RCPs): enable a dialogue between two geographically dispersed applications
- Objects request brokers (ORBs): allows application or utilities to network nit h standard ways
- Message-oriented middleware (MOM):uses asynchronous message passing for interapplication communication

Transaction managers: Handle transaction across multiple platforms

- Standard query languages (SQLs): standardize the way in which database are accessed
- TP monitors (CICS, for example): monitor online transaction processing with a database
- Two-phase commit: a protective mechanism for transactions that fail to complete successfully

Utilities: Provide general services

- Directory services: resource allocation
- Time services: timing
- Security services: encryption, and so on
- Software distribution: including configuration control

Companies purchase a central module plus the interfaces needed to connect the applications. To handle unique integration needs, EAI vendors provide customs programming to modify the EAI modules to fit the company's requirements.

4.0 CONCLUSION

To improve the process and retain customers, enterprise application, integration technologies was used. No new ordering process was required,; the existing process was simply automated

5.0 SUMMARY

Finally, the IT industry has responded with new tools and approaches. Application servers support integrated across a wide range of new and legacy systems, as do component based development tools.

6.0 TUTOR MARKED ASSIGNMENT

- What are the basic characteristics of an ERP system?
- Describe the three main approaches to integrating the information systems within an organisation.

7.0 REFERENCE/FURTHER READING

Bluckhout, Scott, Edward Frey and Joseph Nemec Jnr. Making ERP Succeed

UNIT 3: INTERNET – BASED SYSTEMS

1.0 INTRODUCTION

The Internet and e-businesses are changing the nature of information systems in organisations. Now that the Internet has gained wide acceptance as a medium for conducting business, companies must expand their Internet-based systems beyond simple Web pages. These Internet-based systems must be sealable, reliable and integrated both internally and externally with the systems of customers and business partners.

2.0 OBJECTIVE

At the end of this unit, you should be able to

- Explain Application Servers
- Describe Java Development Platform
- Discuss Application Service Provide

3.1 APPLICATION SERVER

Originally conceived as a piece of middleware to link a Web sever to applications on other company systems, the application server has grown into a framework for developing Internet-based applications. Figures 9-5 illustrates the basic application server architecture. A set of application servers is connected to create a single virtual application server. This virtual server takes requests from clients and Web servers, runs the necessary business logic, and provides connectivity to the entire range of back-end systems.

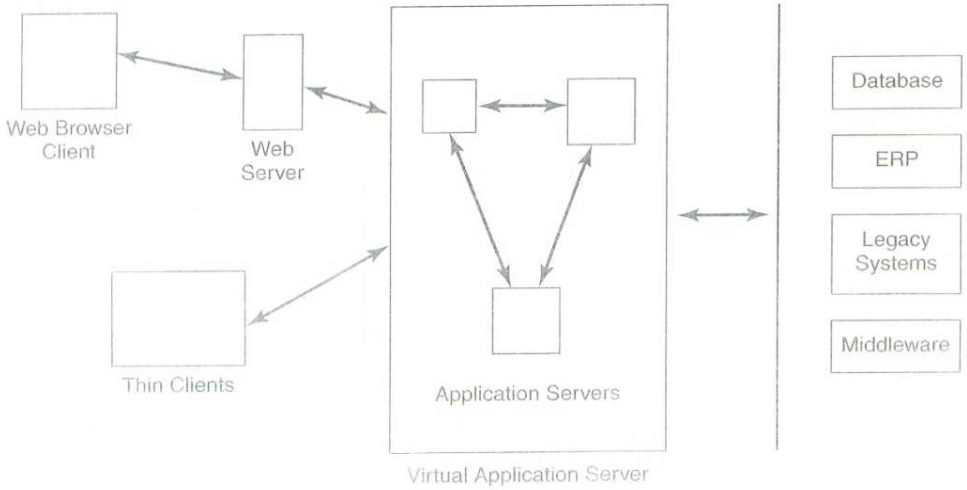
In addition to the middleware and integration functions, application servers have become application development platforms, with wide range of development and automatic code generation tools. Their functions can be divided into five categories, says Radding: business logic processing, automation of low level core processes, middleware, application development, and prebuilt components.

- ***Business Logic Processing.*** The application server stores and runs business logic components for applications. These components are basic,

reusable building blocks for applications and might, for example take the form of applets or Java-Beans. More recently, vendors are standardizing on Java 2 Enterprise Edition (see the following Standards section) to provide components.

- ***Automation of Low-level Processes.*** The application server can generate networking and communication code, and code for a wide range of low-level functions. These functions can include security, session pooling, and database connectivity. This capability can drastically reduce the time needed to code an application, increasing programmer by as much as 75 percent.
- ***Middleware.*** As already mentioned, the application server becomes the backend link to legacy systems. In addition, it becomes the link to systems of customers and business partners. Thus, the application is the central point of integration for all Internet-based systems.
- ***Application Development.*** The application server is delivering many of the capabilities provided by integrated development environments (IDE).

FIGURE 9-5 An Application Server Architecture



With the IDE an integral part of the application server, companies can build many of their client-server application server.

- ***Prebuilt Components.*** Recently, vendors of application servers have begun including prebuilt components, such as tag libraries, servlets, JavaBeans, or, in the Microsoft world, components based on the component object model. Again, the goal is to increase programmer productivity.

In addition to providing application development tools, the application server framework provides scalability. As demands on applications grow, a company can increase the power of its virtual application server by either installing more servers or replacing smaller servers with larger ones. In either case, the application server framework provides easy migration. The application server also provides automatic load balancing among the multiple servers and coordinates session information across multiple instances of an application.

In summary, the goal of the application server is to automate and manage many of the technical tasks in the development and running of Internet-based applications. In doing so, developers can focus more on the business issues, rather than the technical details.

3.2 JAVA DEVELOPMENT PLATFORM

If companies are to develop Internet-based systems quickly, as the e-business environment demands, they need component-based development tools. If, in addition, the systems being developed are to be portable and scalable, the companies need to employ open system architecture. For both component-based tools and open systems, industry standards are necessary. Currently, some of the most widely used standards for Internet-based systems development have evolved from Java.

Java was originally developed to provide applets that run on We clients: however, it quickly evolved into a full-programming language with the goal of

providing a platform-independent language that could run on any system through a “Java virtual machine.” This promised application portability was dubbed “write-once, run-anywhere” that promise has not been met, however. As a language for client applications, Java performed poorly relative to other languages, such as C++. So companies have not converted their client-based applications to Java. However, Java has evolved into a standard platform for developing server-side applications.

The two major components in the Java server-side platform are Enterprise Java Beans (EJB) and the Java 2 Enterprise Edition (J2EE) software specification. EJBs emerged on the developer scene in 1998 when Sun Microsystems unveiled a specification for creating server-based applications using software components using software components. These components, the EJBs, act as preconfigured pieces of code that IT staff no longer have to build from scratch. A component can be as simple as an order-entry form or as complicated as a virtual shopping cart that keeps track of where users have been and maintain their privacy. The use of these reusable components can greatly enhance programmer productivity.

In the Windows environment, and in direct competition with EJBs, Microsoft wants developers to build application using the Components Object Model (COM) and Distributed Component Object Model (DCOM). Although COM components of the same benefits of EJBs, they have some significant differences. COM server components can realistically be deployed only on windows servers, and COM-based services components can realistically be deployed only on Windows servers and COM-based services are generally unavailable to non-Windows machine. On the other hand, EJBs supply data to Java-enabled Web browsers running on a wide variety of platforms. As a result, EJBs have emerged as the early preferences for companies building Internet-related services.

The J2EE software specification defines a standard for developing Internet-based enterprise applications. It simplifies enterprise applications by

basing them on standardized, modular component, by providing a set of services to those components, and server-side delivery of data and for thin-client software that interacts with users throughout the enterprise. Components of J2EE include an API for database access, security modules that protect data in the Internet environment, and modules supporting CORBA for interactions with existing enterprise applications. J2EE also provides full support of EJB components and Java servlets, as well as support for XML technology.

J2EE provide a standard, which vendors of application server products are quickly adopting. From the user perspective, J2EE and EJB provide an alternative to building e-business systems from scratch or buying packaged e-business systems. Having a multivendor platform with prebuilt, reusable components allows companies to reduce the development cost and the time-to –market for new enterprise applications or upgrades to existing enterprise applications.

3.3 APPLICATION SERVICE PROVIDERS

A new alternative to system development exists that essentially outsources the entire process. As noted, application service provider (ASPs) are companies that rent software applications over the Internet. Costumers subscribing to an ASP use applications residing on the ASPs servers. Subscribing to an ASP allows companies to avoid purchasing, installing, supporting and upgrading expensive software applications.

ASPs offer a wide range of applications and services, from Web hosting to ERP use, from database management systems to industry B2B e-commerce portals. If fully responsible for all application maintenance and upgrades, the ASP also manages the relationships with the vendors. The target markets for ASPs have been small companies that want minimally customized applications, large organisations in need of complex “niche” applications they cannot afford to develop themselves, and vertical industries that need B2B electronic commerce

services or industry-specific software. Figure 9-6 shows one categorisation of ASPs.

The key benefit of using an ASP is that a company can get an application up and running in a short time with little initial investment. The company can use the resources it saved on its core business activities. The downside, however, is that companies have reported problems with negotiating service level agreements and support during downtime. In addition, a company needs to consider the strategic implications of having applications running outside the direct control of the company.

The preceding sections have discussed the foundations of system development and the newer kinds of system development options. But, in the end, system development is about projects. So a main tenet of good system development is good project management.

FIGURE 9-6 Types of ASPs

Type	**Capabilities**
Enterprise	Delivers a variety of high-end applications and offers some degree of customization and availability guarantees.
General Business	Provides a variety of non- or minimally customizable applications to small and medium-sized business.
Specialist	Delivers only a particular types of application (i.e ERP, customer resource management (CRM), human resources (HR), personal productivity, etc).
Vertical	Provides packaged and/or specialized applications targeted at a particular vertical market segment.

4.0 CONCLUSION

In developing Internet-based systems, companies have learned they must negotiate language differences. For example, a system may have to port old COBOL application to java, reconcile interface discrepancies, and interface with back-end legacy applications, often without documentation or past experience with these systems.

5.0 SUMMARY

Many languages tools frame works are available for developing internet-based systems. Currently, the application server frame work appears to be the preferred method of users and vendors, also following the spirit of the Internet, customers are demanding open system, they do not want to be tied to a single vendors priefang technology. One open system language standard, java has evolved from a proposed client-side programming standard to a server-side application development standard.

6.0 TUTOR MARKED ASSIGNMENT

Development five categories of functions for an application server

7.0 REFERENCE/FURTHER READING

Naumann, T.D and A.M. Jenkins Prototyping: The New Paradigm for Systems Development

UNIT 4: PROJECT MANAGEMENT

1.0 INTRODUCTION

Project management is simply the management of a project. This definition may sound simple and self evident but that does not make it easy. Many people get confused or concerned about IT project management because it involves the "T" word technology. In reality IT project management is not much different form other forms of project management, such as those used to construct an office tower or a bridge.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Explain Internet Project Management
- Mention and Discuss tips for good Project Management.

3.1 KEYS TO PROJECT MANAGEMENT

Numerous keys influence project management success. Here are some, writes Matthew:

Establish The Ground Rules.

Define the technical and architectural specifications for the systems following four guidelines:

- Adhere to industry standards.
- Use an open architecture.
- Web-enable the system.
- Power with subsystems.

These principal should help ensure no "nasty surprise" along the way, as well as provide the ready ability to update/switchover systems in the future. The basic tenet is that the systems should be as simple as possible while fulfilling all the (reasonable) user requirements.

Discipline, Planning, Documentation, And Management

In many respects, these elements are what project management is really all about. It does not matter how well the requirements have been specified or weather the "project" solution has been selected; if the process is not controlled properly, anything can happen or, more realistically, potentially "nothing" will happen.

A firm timeline for system rollout needs to be formally established and signed off. Once this task has been done, the project team needs to work backward from the critical dates and map out the timing for the intermediate steps, and include any "interdependencies." Teams actually should take the critical date and subtract some time, say one month, for unforeseen contingencies. The project must progress with the target critical date in mind, which requires strong discipline.

The project also needs to follow a sound methodology, and have key points planned and documented (and reported on) using a product such as Microsoft Project. All members of the teams need to be aware of their responsibilities and timeline. Nothing should be lift assumed. In addition, regular meetings and updates of this project plan are needed, along with proper documentation of the system development effort. Senior management needs to able to see this documentation whenever they want. Management, key users and even vendor personnel should be included on project steering groups, which should meet regularly to make sure the project continues on track and that all members are aware of their responsibilities. Such meetings also provide a venue for airing problems and raising issues that might affect others.

In addition it is desirable to have an overall IT project steering committee. Regular project manager meetings from the various projects are key to keeping each other informed of their progress and for raising issues that might affect other project.

Obtain And Document (The "Final") User Requirement

Documenting user requirements is critical because it is the only way the team can evaluate its outcome. Scope creep (users asking for more and more functions)

causes many system failures. Documenting requirements helps lock in the scope of the work, and helps reduce the possibility of casting problems and time overruns due to additional requests. Documenting user requirements can be done via variety of methods, including facilitation sessions and one-on-one interviews.

A common mistake is to get too technical in writing user specs. Some IT consultants make this mistake in the interest of "maintaining the mystique." But the tendency can do harm. Similarly, IT project teams should not accept overly technical sign-off requests from software houses. They need to prove they can fulfil the users' requirements.

Obtain Tenders From All Appropriate Potential Vendors

Today, much software is bought rather than built in-house. And with the proliferation of e-commerce, a number of specialist software houses have appeared. This option needs to be considered when beginning a project, notes Mathew. In fact, companies that do not have expertise in the area under consideration might want to call in consultants to make a recommendation. Their extensive contacts in the IT community can significantly improve selection of the package or packages. Or they may simply help the IT project team create the selection criteria for evaluating the bids and selecting the winner.

Working With Suppliers

If the development is to be handled by an outside firm, then a joint project teams needs to be created. The supplier, or suppliers, will undoubtedly appoint their own project managers for their respective assignments. They need to be part of the governing team.

Convert Existing Data

Data conversion need to be properly planned to make sure the output data is complete and accurate. Although this task might appear quite simple, it is often the area that creates the biggest headaches. Here, perhaps the oldest maxim in the IT industry applies: garbage in, garbage out.

Moving Forward After Implementation

Upon successful implementation of the various systems project managers need to cross their ‘t’s and dot their ’I’s in terms of documentation, future maintenance processes, and so on.

The bottom line is that IT project management is no different from any other form of project management. To be successful, good planned is needed, along with good communication, and getting the active participation of all interested parties, say Matthew. These elements, along with some hard work, will better ensure a successful system.

3.2 INTERNET PROJECT MANAGEMENT

The rules of project management do not change in the New Economy, says Matthew. The principles and practices of project management, such as the need to define the scope, set timelines, and monitor progress, still hold true. However, Internet projects do tend to be more collaborative and iterative than traditional projects. In reality user ownership and effective implementation are the goals of all IT development and project management. They have become a reality in Internet projects.

Web-Based Project Management Tools

Even though the use of the term Web-based will hopefully shortly become largely meaningless – when all project management tools have a significant Web-based component – a number of excellent tools have emerged. These systems have been a boon to business but a “disaster” for airlines and the hotel industry, particularly in the United States where any of the “meetings” and much of the collaborations take place using these Web-based tools as opposed to people travelling to traditional face-to-face meetings. The features of such tools are shown in Figure 9-7.

TIP FOR GOOD PROJECT MANAGEMENT

Most people would agree that a successful project has the following characteristics:

- It is “delivered” on time
- It comes in on or under budget.
- It meets the original objectives.

And although all these elements are true, some people do not realize that a successful project is also one that meets the users’ and organisation’s needs, which may have changed since the original objectives.

FIGURE 9-7 Features of Web-Based Collaboration Tools

- Discussion groups
- Links to e-mail
- Chat sessions
- Group setups
- Online conferencing and presentation capabilities
- Document sharing and organisation
- Linking items (e-mails, documents, tasks, graphics) to each other and to people and groups
- Document searching and filtering facilities
- Events-driven notifications to individuals, groups and project teams
- Decision support features such as voting and polling
- Workflow management.

Identifying the full user requirements as early as possible and meeting them is as critical to project success as the key components of planning, managing, monitoring and controlling the project. Projects that do not give the users what they want cannot be deemed a success. Assuming a project has been correctly defined and specified up front, the following items are necessary to ensure that a project is successful, notes Matthew.

Proper Planning

Planning is most powerful contributor to the success of a project for one simple reason: If done properly, it keeps the focus on the desired outcomes. Planning needs to address a number of questions to determine the project outcomes:

- What actions are required?
- When should those actions commence and finish?
- How long will they take?
- Who will do them?
- What equipment, tools and materials will be needed?
- What interdependencies exist between the preceding issues?

These issues need to be controlled and monitored. To do so use of an appropriate software tools is recommended, if not mandatory. The best planning also includes anticipation of problems and potential courses of action if things go wrong, as they invariably do. Finally, whether it is called project planning or project organisation, the essential steps in this area include generating the following

- Project specifications
- Roles and responsibilities definitions
- Budget and accounting procedures
- Change control procedures

Above all, creating accurate estimates and budgets is vital to a project's success.

Appropriate User Involvement And Storge Visible Management Support.

This need might seem self-evident but its important cannot be overstressed. Without these involvements, the project might as well halted at the outset.

Project Manager(S) With Authority And Time

Although this point again may seem obvious, it is not always followed. Without the appropriate and supported authority, project managers, like other managers, will struggle to do their job.

More common and equally devastating is the part-time project manager, who is expected to hold down a day job and at the same time run a project. No matter how good a person is, he or she cannot be the CFO and implement a new finance system nationwide at the same time.

The project manager is a key. Preferably, they need to have appropriate experience and be able to demonstrate a range of skills including leadership, communication, organisation, motivation, and decision making.

Good Change Management

Project managers also need to have access to good change management skills. All projects have a target of creating change. The manner in which that change is managed makes a considerable difference to the project's success. Successful management of project changes relies on:

- Commitment through involvement and explanation
- Allowing people to take responsibility for their own actions in the change process
- Giving people enough information and training to enable them to manage change effectively.

Working As A Team

Surprisingly, the creation of a team and the mechanics of how it operates are often overlooked or mishandled. The role of the the team is vital to the success of a project. Members of project teams.

- Have a shared purposed
- Undertake cooperative action.
- Generate collective outcomes.
- Create defined, measurable team products or outcomes.

Team member should be chosen for their functional skills, their decision-making and problem-solving skills, and their skills in working with other team members. Put simply, projects rely on the creativity and skills of people to ensure

their completion and success. To assist in this area, the project should have appropriate induction, team building and counselling.

Proper Project Monitoring And Control

In addition to the normal management control and supervision needed, good project management also relies on formal project monitoring and provision of relevant information to management. Project monitoring is essential for providing key information of the project, such as performance, cost, time, and quality.

These items and other relevant information need to be reported and discussed at regular project meetings. In addition, such information should be available to management for all aspect of the project. The goal is to provide answers to such key management questions as:

- Will we finish on time?
- Will we achieve what we set out to do?
- Will we overspend the budget?

Proper Project Closure

Project closure is as important as the planning in contributing to project success. Effective and efficient closure is achieved by careful management of the project's people, its communications, its information, and its power structure.

Project post implementation review, audits, and other appraisals should be conducted to evaluate the success of the project. These reviews should not only examine whether the actual benefits exceeded the plan but also record what lesions learned during the project, could be useful for future projects. The best advice to project participant, notes Matthew is, "In all circumstances: Keep your focus on the end result."

4.0 CONCLUSION

A project is a collection of related tasks and activities undertaken to achieve a specific goal. Thus, all projects (IT or otherwise) should

- Have a clearly stated goal.

- Be “finite”, that is, have a clearly defined beginning and end.

It has been said that IT project management is 10 percent technical and 90 percent common sense of good business practice: Indeed many of the best IT managers do not have a background in IT at all, but they possess the important skills of communication, organisation and motivation.

5.0 SUMMARY

Finally, no discussion of system development is complete without noting project management. It is one of the main skills in high demand these days in IS departments. It is becoming an increasingly crucial asset as IT becomes more crucial to company success.

6.0 TUTOR MARKED ASSIGNMENT

7.0 REFERENCE/FURTHER READING

MODULE 4: MANAGING INFORMATION RESOURCES

Unit 1: Managing Corporate Data Records

Unit 2: Managing Data

Unit 3: Managing Information

UNIT 1: MANAGING CORPORATE DATA RECORDS

1.0 INTRODUCTION

Managing information resources used to mean managing databases. The amount of internal and external data and information available to organisation is increasingly by leaps and bounds. Internally, the intranet has caused a revolution, because it allows companies to bring internal data and information together from far-flung files and database and make them available company wide. It gives employees access to far more corporate data and information than they ever had before.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Understand the scope of information
- Explain the importance of data dictionaries.

- Discuss the role of data administration

3.1 THE PROBLEM: INCONSISTENT DATA DEFINITIONS

In a nutshell, the problem has been incompatible data definitions from application to application, department to department, site to site, and division to division. How has this inconsistency happened? Blame expediency. To get application systems up and running quickly, system designers have sought the necessary data either from the cheapest source or a politically expedient source. Generally, it has meant using data from existing files and adding other new data. In effect, data has been "dribbled" from application to application. The result has been data showing up in different files, with different names for the same data in different files with different update cycles.

The use of such data may be acceptable for routine information processing, but it is far from acceptable for management uses. Management cannot get consistent views across the enter prise under such conditions. Also, changes in data and programs are hard to make, because a change can affect files anywhere in the organization. Furthermore, such inconsistency makes it difficult to change the tracking and reporting of the organization's products, markets, control structure, and other elements needed, to meet changing business conditions.

If a major role of the IS department were *managing data*, rather than getting applications running as quickly as possible, then quite a different scenario would occur. All the types of data interest would first be identified. Then the single source of each data type would be identified. Then the single source of each data type would be identified, along with the business function that creates the data. Finally, a transaction system would be built to collect and store that data, after which all authorized users and applications would have access to it. This data driven approach does not involve in one huge database to serve the whole organization, but it does require administrative control over the data, as well designing the databases to support users from the outset. It starts out by describing

the data, the enterprise needs. Then the approach is selected that provides the data that gives a good balance between short-term, application-oriented goals and long-term, data-oriented goals.

3.2 THE ROLE OF DATA ADMINSTRATION

The use of DBMS reduced, to some extent, the problems of inconsistent and redundant data in organizations. It is clear, however, that merely installing a DBMS is not sufficient to manage data as a cooperate resource. Therefore, two additional thrusts have moved organizations in this direction: broader definition of the data administration role and effective use of data dictionaries.

Database administrations concentrate on administrating databases and the software that manages them. Data administration is broader. One of the main is purposes is determining what data is being used outside the organizational unit that creates it. Whenever data crosses organizational boundaries, its definition and format need to be standardized, under the data administration function.

The *data dictionary* is the main tool by which data administrators control standard data definitions. All definitions are entered into the dictionary, and data administrators monitor all new definitions and all requests for changes in definitions, to make sure that corporate policy is being followed.

To bring order to the data mess *that* still exists, data administration has four main functions:

- Clean up data definitions.
- Control shared data.
- Manage data distribution.
- Maintain data quality.

Clean up data definition.

Data administration needs to have the responsibility and authority to ensure data compatibility throughout an organization by getting rid of redundancies and inconsistencies among definitions. For instance, two or more names should not

exist for the same data item, nor should the same name be used for two or more different data items. In most companies, sorting out existing data synonyms and then reconciling them is a monumental job. More and more companies are finally tackling this job seriously, to support a data warehouse effort, to install a company wide ERP package such as SAP, or in some instances, to consolidate company-based corporate databases into an intranet where everyone in the company, worldwide, draws from the same data pool.

In this role of cleaning up data definitions, data administrations design standard data definitions, the data dictionary, and the databases to reconcile conflicting user needs. They also design the data integrity process to flag suspected data and guard against inaccurate, invalid, or missing data polluting the pool of correct data. Finally they train users on the meanings and proper use of data. Unless users understand the data definitions, the clean data will not stay that way for long.

Control Shared Data.

Even though data used solely by one organizational unit might be considered "local" and under the control of that unit, used by two or more units should be considered shared data. The data administration function must control the definitions, and some of the processing, of all shared data.

Ina controversy in this area, one side says that essentially *all* the data in the organization should be under the control of data administration. Just because some data is currently not been used across organizational boundaries is no reason to suppose that it will not be in the future. The other view is that each organizational unit can do whatever it wishes with *its* data; only data must flow to other units needs to be standardized. It is impractical to try to standardize everything, and it will impose unreasonable rigidities, say those people. Data administrators have to confront this issue and decide how broadly or narrowly to define "shared" data.

The data administration function must also analyse the impact of proposed changes to programs that use shared data. All programs that would require changes need to be identified before approving the change. A data dictionary is a tremendous help here, because it provides one place to look for all uses of the data. Finally, approval to proceed with the change might be held up until all affected programs have been changed in order to keep those applications from aborting. Changes also require informing users of changes in meanings of data, if it occurs. Otherwise, users may base decisions on incorrect assumptions about the data they are using.

Manage data distribution.

Shared data, as defined here, crosses organizational boundaries. Distributed data, on the other hand, is geographically dispersed data. Managing data in a distributed dimension, with probably several levels of detail, presents significant challenges to data administrators, challenges that have, to date, caused companies to stick with the single master file concept and only distribute copies that do not need to be kept in sync.

Maintain Data Quality.

Cleaning up data definitions, and the other important functions of data administration, can become useless unless policies and procedures are developed to maintain data quality. A dominant guideline has been to decentralize or distribute this function by putting the owners of the data in charge of editing and verifying the data accuracy and quality, but this practise requires resolving the question of who owns the data.

Maintaining data quality data also requires putting processes in place that correct is being input into databases. People do not enter incorrect data on purpose, but many times, the inputting process permits errors, rather than catching them at he source where they can be easily corrected. The two elements of maintaining quality are to clean up the current data in databases (the data pool) and then ensure that the data stream is not polluting the pool with bad data.

3.3 THE IMPORTANCE OF DATA DICTIONARIES

In the previous section, we referred to a data dictionary as the primary tool to manage data definitions, Data dictionaries are systems and procedures, either manual or automated, for storing and handling an organization's data definitions, Data definitions are often called *metadata* these days. A data dictionary does not, in itself, generally produce data for an organization. Instead, its purpose is to eliminate errors of understanding, ambiguities and difficulties in interpreting data.

Ideally, a data dictionary should be considered at least as soon as a database management system is considered. An ideal sequence is to (1) set up the data administration function, (2) develop data standards, (3) purchase and install a DBMS, and (4) install a data dictionary as the first database application. Unfortunately, the most prevalent situation has been to bring in data dictionary after the DBMS has been used as an access method rather than as a true DBMS. In this case, many database applications have been run with little integration among them and little or no documentation of data definitions, so that they redundant and inconsistent, This huge cleanup task faces many organizations head-on today.

To illustrate one company's success in getting its corporate data in shape, consider the work of Monsanto.

4.0 CONCLUSION

- Data consist of facts devoid of meaning or intent
- Information is data in context, which means that the data has an explicit meaning within a specific context
- Knowledge is information with direction, or intent, where intent is derived from strategies.

Data records contain primarily facts about entities, such as individual employees, customers, parts or transactions. Well-structured data records are used to hold a

set of attributes that describes each entity. In contrast, document-based information pertains primarily to concepts ideas, thoughts and opinions. Less well-structured documents or messages, with a wide variety of information forms, are used to describe this kind of information.

5.0 SUMMARY

The item of interest in a data record is the entity, which is a part in an inventory system or an employee in a human resource system. Each attribute of interest is represented by a data item or field. The data record is the collection of the attributes necessary to describe the entity. Related records form a file a group of file form a database, and a collection of databases can comprise an information system. Finally, a "data mode describes the relationships among the entities and attributes. Beside, information resources need to be managed well, which now include data information and knowledge. Further more, in managing corporate data records, we need four types of information, namely: the source of the information – external or internal to the organisation. The second dimension is based on the structure of the information – data record – based and document – based.

6.0 TUTOR MARKED ASSIGNMENT

- What is the difference between data, information and knowledge?
- What are the four kinds of information that define the scope of information "information management"? Describe each briefly

7.0 REFERENCES/FURTHER READING

Atre, Shaku, Database: Structured Techniques for Design, Performance and Management, John Wiley & Sons, New York, 1980.

UNIT 2: MANAGING DATA

1.0 INTRODUCTION

Database management systems are the main tool for managing computerised corporate data. They are based on two major principles: a three – level conceptual model and several alternatives “data models” for organizing the data.

2.0 OBJECTIVES

At the end of this unit, you should be able to

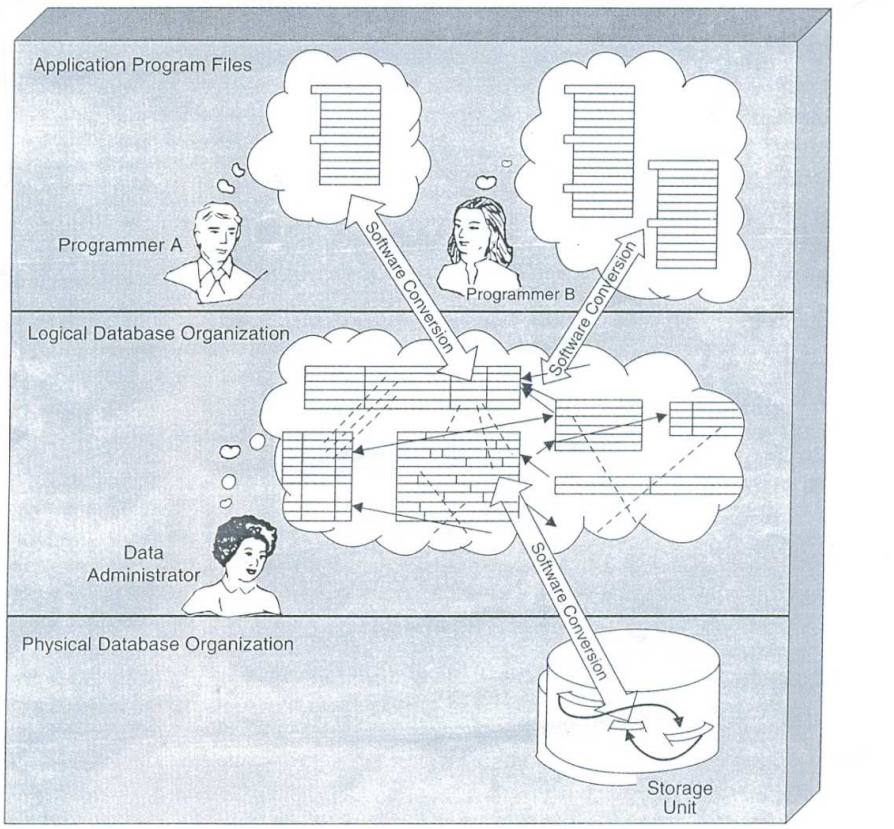
- Understand how data is distributed
- Explain data warehousing
- Discuss the four data models

3.1 THE THREE LEVEL DATABASE MODEL

One of the easiest-to-understand discussions of database technology is by James Bradley[2] in his description of the three-level database model, which was the result of work done by the Standards, Planning and Requirements Committee of the American National Standards Institute (ANSI/SPARC) in the mid-1970s. The concept is still an underpinning of the DBMS field. The following discussion is based on Bradley, Martin,[3] and Atre.[4] It begins with the level that the application developer sees.

- *Level 1* is called the external, conceptual, or local level. As Figure 7-4 illustrates, this level contains the various “user views” of the corporate data used by application programs−each has its own view. This level is not concerned with how the data will be physically stored or what data is used by other applications.

FIGURE 7-4 The Three-Level Database



Source: James Martin, *Principles of Database Management* (Upper Saddle River, NJ: Prentice Hall, 1976).

- *Level 2* is called the logical or "enterprise data" level. It encompasses all an organization's relevant data under the control of the data administrators. Data and relationships are represented at this level by one or more DBMS. This level contains the same data as level 3, but with the implementation of data removed.
- *Level 3* is called the physical or storage level. It specifies the way the data is physically stored. A data record consists of its data fields plus some implementation data, generally pointers and flag fields; The end user, of course, need not be concerned with these pointers and flags; they are for use by the DBMS only.

The advantage of three-level model is that the logical data (the data administrators' view) can be separated from the physical storage method, so that

different physical devices can be used without changing the application programs. The logical data relationships can also vary for different programs that use the data, without requiring data redundancy. In addition, application can use a subset of the database and organize it, again without redundancy, in the best manner for the application.

3.2 FOUR DATA MODELS

The second major concept in database management is alternate ways to define relationships among data. These so-called “data models” are methods by which data is structured to represent the real world and the way that data is accessed. Four main data models are in use today: hierarchical, network, relational, and object.

Hierarchical Model.

This model structures data so that each element is subordinate to another in a strict hierarchical manner, like the boxes in an organization chart. This model uses the terminology *parent* and *child* to represent these relationships. This approach, where a data item can have only one parent, is represented by IBM’s IMS database management system.

Network Mode.

With this model, each data item is allowed to have more than one parent. Assembly parts lists illustrate this structure, where the same part can be used in more than one assembly. This approach is represented by the Codasyl-type database management systems, such as Computer Associates’ IDMS. In hierarchical and network models, the data relationships are stated explicitly, generally by pointers stored with the data. These pointers provide the means by which programs access the desired data records.

Relational mode.

Edgar F.Codd of IBM[5] proposed this model in 1970. In the relational model, the relationships among the data items are not expressly stated by pointers. Instead, it is up to the DBMS to find the related items, based on the values of specified data fields. Thus, all employees of a certain department are found by searching for the department number in each employee record.

Relational databases store data in tables. Each row of the table, called a *tuple*, represents an individual entity (person,part,account). Each column represents an attribute of the entities. Eight relational operations can be performed on this data, as shown in Figure 7-5.

Relational systems are not as efficient as hierarchical or networked database systems, where the navigational maps through the data are predefined. But because relational systems allow people to create relationships among data on the fly, they are

FIGURE 7-5 Relational Operations

- **Select** chooses particular columns.
- **Project** chooses particular rows.
- **Join** concatenates rows from two or more tables, matching column values.
- **Product** concatenates rows from two or more tables, but does not match column values.
- **Intersection** selects rows whose value(s) exist in both tables.
- **Difference** select rows whose value(s) exist in one table, but not in the other.
- **Union** merges two tables that have similar data, eliminating duplicates.
- **Division** also merges two tables, but with more complicated selection capabilities. For a simple example, suppose a table contains all the products you buy and a table contains all your suppliers and the products they sell. Relational division can be used to find all suppliers that can supply all the products you buy.

much more flexible. Hence, they have become the database technology of choice in today's systems.

The relational model caught the attention of the industry because computer scientists see it as a good "theory" of data structure, while users find its tabular representation comfortable and familiar. Database management systems based on the relational model were first used primarily to handle end user queries; they are now widely used in high-volume transaction systems with huge files.

Much of this current interest in relational systems comes from their capability to enable on-the-spot concatenation of data from several sources. This capability is precisely what end users want, because they do not know the format of many of their adhoc queries ahead of time. This capability also increases the flexibility of large mainland systems.

Object Model.

As the newest data model, the object-oriented approach expands the view by storing and managing "objects" each of which consists of the following:

1. A piece of data
2. "Methods" or procedures that can perform work on data
3. Attributes describing the data
4. Relationships between this object and others

Objects are important because they can be any type of data, whether a traditional name or address, an entire spreadsheet, a clip of video, a voice annotation, a photograph, or a segment of music. A collection of objects is called an *object base*, although such terms as *object database* or *object-oriented database* are also used.

Object data management techniques draw from the past. They retain traditional DBMS features, including end user tools, high-level query languages, concurrency control, recovery and the ability to efficiently handle huge amounts of data. But they include two other major concepts as well. One is object

management, which is the management of complex kinds of data, such as multimedia and procedures. The other concept is Knowledge management, or the management of large numbers of complex rules for reasoning and maintaining integrity constraints between data.

Stonebraker and Kemnitz provide an example of an application that requires object management, as well as data management and knowledge management. It is a newspaper application that needs to store texts and graphics, and can be integrated with subscription and classified ad data. In this application, the customer billing requires traditional data management, storage of text, pictures, and the newspaper's banner require object management. Finally, it needs the rules that controls the newspaper's layout. One rule might be, "Ads for completing department stores cannot be on facing pages."

Stonebraker and Kemnitz believe that *most* data management problems in the future will require all three dimensions: data, object, and rule (or knowledge) management.

A look to the future

Silberschatz, Stonebreaker, and Ullman give seven samples of database applications that cannot be handled well, or at all, with today's database products or technologies.

1. NASA estimates that it needs to store 10 bytes of satellite images from just a few years' worth of space exploration in the 1990s. How can it store and search such a massive database, which is enough to fill 10,000 optical disk jukeboxes?
2. **CAD** data for a skyscraper must maintain and integrate information from the viewpoints of hundreds of subcontractors. For example, when an electrician drills a hole in a beam to run an electrical wire, the system should ideally, re-calculate the stresses on the beam to ensure that its load-bearing capabilities have not been compromised.

3. The U.S National Institute of Health and the U.S Department of Energy have a joint project for constructing the DNA sequence of the human genome, which is a several billion elements long. Matching patients' medical problems to differences in genetic makeup is a staggering problem requiring new data representation and search technologies.
4. Large retail chains record every product code scanning action of every cashier in every store. Corporate buyer explore this data using ad hoc queries to uncover buying patterns. This procedure, called *data mining,* is growing, not only in retailing but in medicine, science and many other fields.
5. Databases of insurance polices are going multimedia by storing photographs of damaged property, handwritten claim forms, audio transcripts of appraisals, images of insured objects, and even video walk-through of houses. Such image data is so large that these databases will be ernomous. This application also pushes the limits of available technology.
6. A design database should notify designers when one of their systems designs is affected by a modification made by another designer. These systems could encompass elaborate sets of triggers to track important actions. Separate rule-based systems, common today, probably are not efficient enough to handle these complex situations.
7. We need new data models to handle spatial data, and uncertainty. Finding the closest neighbour to a data element in 3D space requires new multidimensional access methods. Exploring the state of a database at a point in time, or retrieving the time listing of a data value, are functions requested by engineers, retailers, and physicists. Unfortunately, time often is not supported in today's commercial databases.

Just as there is essentially one worldwide telephone system and one worldwide computer network, some believe we will eventually have a single worldwide file system.

To achieve this global ness requires collaboration among nations, which is actually happening in some areas. The human genome project is one example.

Defence contractors want a single project. An auto company wants to give its suppliers access to new car designs, under certain circumstances. Both of these needs require inter-company databases. The challenge is making these databases behave as though they are part of a single database. This interoperability is the main challenge of distributed systems.

Yet another challenge is providing easy-to-use uniform browsing tools that work across heterogenous databases. These query systems must be able to explain to a user where an inconsistency occurred, or where a database was missing; otherwise, these systems cannot be trusted to perform complete searches.

Finally, security is of major importance in today's DBMS, and distributed, heterogenous Internet-linked databases exacerbate the problem. Companies may want to permit access to some portions of their databases while restricting other parts. This selective accessibility requires reliability authenticating inquirers. Unless security and integrity are strictly enforced, users will not be able to trust the systems.

To date, the database industry has shown remarkable success in transforming scientific ideas into products, say Silberschatz, Stonebraker and Ullman.

3.3 DISTRIBUTING DATA

A major challenge in managing internal data records is distributed data. At the moment, difficulty with distributed data may sound a bit unusual, because everyone is placing so much emphasis on creating intranets that consolidate data. But, in truth, intranets and even e-commerce will foster more coordination among distributed data.

True distributed databases.

Chris Date, of Codd and Date Consulting Group, formulated 12 rules for a distributed database. These rules, listed in Figure 7-6, have become *the* fairly technical definition of a "true" distributed database. Although it is not stated, these operating principles depend on the underlying databases being relational.

A standard query language.

A myriad of technical challenges faces designers of distributed systems. Fortunately a standard language for accessing relational databases is currently available: SQL. It is not a full application development language or an end user query tool. Rather, it is an English-like language for manipulating data and performing queries against relational tables. It has three components.

1. A *data definition language* for creating relational tables, creating indexes to data, and defining fields of data
2. A *data manipulation language* for entering information into a database and accessing and formatting the data
3. A *data control language* for handling security functions

The use of SQL provides a number of benefits. It can be embedded in procedural languages, such as C or COBOL, and can be incorporated in packages, such as spreadsheets, that run on PCs and workstations. It can act as an intermediary between production applications and databases, between client requests and server responses, and between browser-based applications and databases. It thus insulates applications from changes in physical and logical database structures. Furthermore, it provides the foundation for standard communications among heterogeneous databases, via application programming interfaces (APIs) for databases.

FIGURE 7-6 Twelve Rules for Distributed Databases

1. ***Local autonomy***. Local data are owned and managed locally, with local accountability and security. No site depends on another for successful functioning.

2. ***No reliance on a central site***. All sites are equal, and none rely on a master site for processing or communications.
3. ***Continuous operation***. Installations at one site do not affect operations at another. There should never be a need for a planned shutdown. Adding or deleting installations should not affect existing programs or activities. Likewise, portions of databases should be able to be created and destroyed without stopping any component.
4. ***Location independence (transparency)***. Users do not have to know where data are physically stored. They act as if all data are stored locally.
5. ***Fragmentation independence (transparency).*** Relations between data elements can be fragmented for physical storage, but users are able to act as if data were not fragmented.
6. ***Replication independence.*** Relations and fragments can be represented at the physical level by multiple, distinct, stored copies or replicas at distinct sites, transparent to the user.
7. ***Distributed query processing***. Local computer and input-output activity occurs at multiple sites, with data communications between the sites. Both local and global optimization of query processing are supported. That is, the system finds the cheapest way to answer a query that involves accessing several databases.
8. ***Distributed transaction management***. Single transactions are able to execute code at multiple sites, causing updates at multiple sites.
9. ***Hardware independence.*** Distributed database systems are able to run on different kinds of hardware with all machines participating as equal partners when appropriate.
10. ***Operating system independence***. Distributed database systems are able to run under different operating systems.
11. ***Network independence***. Distributed database systems are able to work with different communications networks.

12. ***Database independence.*** Distributed database systems are able to be built with different kinds of databases, provided they have the same interfaces.

3.4 ALTERNATIVES TO "TRUE" DISTRIBUTED DATABASES

Many databases do not have to be true distributed databases, as defined by Date. Many alternatives have suffered quite well, including the following:

- Downloaded data files
- Copies of data stored at nodes
- Not fully synchronized databases
- Server-based database
- Federated databases

Downloaded data files:

Sending data from servers to PCs is common. In fact, it it the most popular method for distributing data. But most companies do not allow files to be updated directly to a production file for fear that the integrity of the data will be compromised. An intermediary verification process is involved. Many do not even allow direct downloading of data from production files to PCs. Instead data is extracted from the production files and put into a data warehouse or internet file.

Copies of data stored at node:

A second approach to distributing data is to locate working copies of data at nodes such as a data warehouse or Internet file. These data files are accessible to remote users for query and sometimes to post updates and changes. This so-called "memo posting" provides fast answers to queries and helps process customer activity during the workday. The master files reside at one or more data centres, and the "official" updating of the files is done at these centres, usually at night. Then during early morning hours, the new and changed records are downloaded to the nodes for use during that workday.

Not fully synchronized databases:

It may not always be necessary to have distributed databases that are synchronized at every point in time, as long as the errors can always be caught quickly and fixed easily. The distributed name service (DNS) on networks works in the manner. The service stores the names and addresses of files on the network. Each service node has one authoritative copy and one secondary copy of these names and addresses.

The secondary copy is kept in cache (fast memory), and is responsible for refreshing itself from the primary copy. But it does not worry about synchronization, because it gives out a wrong address, the requesting message quickly discovers the error and returns and asks for primary copy of the correct address. Where the alternative is possible, it is a simple and robust solution.

Server-based databases:

Significant differences separate true distributed databases from server-based databases. The difference is in the concept of "location transparency." In a true distributed database, each node has a copy of the DBMS, and the dictionary; therefore the application need to know the location of the data because the node can determine the access strategy. In server-based systems, on the other hand, only a limited number of nodes run the DBMS, so the applications must know where the data is located. Therefore, they do not support location transparency. Nevertheless, they are appropriate for higher-performance transaction processing, he believes

Federated databases:

Another alternative to fully distributed databases are "federated databases" rather than distributed databases. Therefore, the existing databases will retain the their autonomy, their will continue to be defined independently, each local DBMS will essentially take care of itself, retaining rules for others to access its data.

We have seen this approach work when incompatible databases, such as those that contain text, alphanumeric, and image, are needed in a single application. These databases are left intact on their own machine, and their data is

pulled together at the workstation. The application software on the client machine calls on the various databases, and displays data from each one in a different window, in whatever format it has been programmed to use. For handling multidimensional data, companies typically take this approach. A good example is the Northwest Airline System. This approach is also being used in intranet-based applications and data warehouse-based applications.

3.5 DATA WAREHOUSING

An important development in the use of internal record-based information is data warehousing. Briefly, a warehouse is a database that contains data from many sources, including operational sources. It is updated periodically, and it comes with repository of "metadata" that describes precisely what each type of data means in terms that marketing folks, the salesforce, management and others can understand. A major driving force behind most data warehouses has been to more finely target marketing: the desire to gather customer data in one place, segment it into customer groups such as profitable and unprofitable customers, see the buying patterns in each customer group, and then develop new products and services targeted for each.

Typically, data is first extracted from mainframe and other databases. Prior to being placed in data warehouse, the data is processed (i.e., "cleaned") to make it more usable for decision support. Many vendors provide software specifically for this purpose. The data is then maintained on a file server, and special-purpose software is used to support analysis activities.

Online analytical processing (OLAP) refers to managers and professionals doing decision support analyses without help from intermediaries or information systems professionals. The term contrasts with online transaction processing (OLTP). OLAP is driven by (1) the need for information; (2) the emergence of software that supports the building, maintenance, and use of data warehouses; and

(3) more computer proficient users who are able and willing to do their own decision support.

Even though decision makers are better equipped to analyse the vast qualities of data stored by organizations, manual searching is inadequate because important developments may go undetected if no one is looking for them. In response to this problem, vendors now offer software agents, also known as intelligence agents, that continually send queries to databases to find exception conditions. When one is found, it is automatically sent to the appropriate person, often through e-mail. Software agents provide a "detect and alert" capability. They reflect an exciting integration of artificial intelligence and decision support. Because data warehousing and data mining are most relevant for decision support, and because they evolved primarily from work on the data component of decision support systems.

4.0 CONCLUSION

A design database should notify designers when one of their system designs is affected by a modification made by another designer. These systems could encompass elaborate set of triggers to track important actions.

5.0 SUMMARY

Finally, security is of major importance in today's database management system (DBMS), and distributed, heterogeneous Internet –linked databases exacerbate the problem. Unless security and integrity are strictly enforced, users will not be able to trust the systems.

6.0 TUTOR MARKED ASSIGNMENT

1. What is the main problem in "managing data"?
2. What are the four roles of data administration?

7.0 **REFERENCE/FURTHER READING**

Stonebraker, M and G. Kemnits, "The Postgres Multi-Generation Database Management System.

UNIT 3: MANAGING INFORMATION

1.0 **INTRODUCTION**

Information is power. We are in the information age. These and similar statement would lead you to believe that managing information is a key corporate activity. Infact, some believe that information management, rather than technology management, is the main job of the information system.

2.0 **OBJECTIVES**

At the end of this unit, you should be able to

- Discuss information management issues
- Explain four types of information
- Explain the difference between information management and knowledge management

3.1 IMFORMATION MANAGEMENT

If information is to be viewed as an asset, as many companies now doe, it must be treated differently from the traditional assets of labor and capital, because it is different from, says Thomas Davenport at Boston University. For one thing, it is not divisible. Nor is it scarce. In addition. Ownership cannot be clearly defined. Devenport discusses three categories of issues in managing information.

1. Value issues
2. Usage issues
3. Sharing issues

Value issues:

Information's value depends in the recipient and the context; it is contextual. In fact, most people cannot put a value on a piece of information until they have seen it. Despite these drawbacks, people do, indeed, place values on information. Look at all the information services that people buy. Information marketplaces do exist, inside and outside companies. The only practical way to establish the value of information is to establish a price for it and see whether anyone buys. Pricing possibilities include charge for the information itself rather than for the technology or the provider. Charging by the document rather than smaller unit, charging by length or time or number of users, and charging by value rather than cost

A number of tools are being used at companies to increase the value of information.

- **Information Maps:** These maps can be textual charts or perhaps even diagrammatic maps that point to the location of information whether in written martial, experts' minds, and so forth. IBM, for example, created a guide to market information, so the managers can find out where to get quick answers to their ad hoc questions. The result has been less money spent on

duplicate information and increased understanding of the kinds of questions people typically ask.

- **Information Guides:** Guides are people who know where desired information can be found. Librarians have traditionally played this role. Hallmark Cards, for instance, created a guide job in its business units to help employees find computer-based information on available jobs. These guides have substantially reduced the time needed to find information.
- **Business Documents:** Business documents are yet another tool for sharing information. They provide organization and context. One fruitful way to embark needs. This process can be easier, and more useful, than defining common terms. Dean Witter, for instance, discovered that its brokers all used the same document, over and over. Some 90 percent of these documents could be put on one CD-ROM, kept on local server, and updated, monthly, greatly facilitating information use.
- **Groupware:** Groupware is a tool for getting greater value out of less structured information. It allows people to share information across distances in a more structured manner than electronic mail. Lotus Notes is such a product. Groupware can ease discussions and aid distribution of information, but its success depends upon the culture. For one thing, better access to information increases (not decreases) people's appetite for more information. However, employees using sophisticated groupware products need education to learn how the technology can be used to improve work habits and profits, neither of which flows naturally from the technology.

  To have value, the databases need to be managed, even pruned and restructured. Knowledgeable people are needed to manage the information resource and its use. This need is true for intranet and web sites as well.
- **Usage Issues:** Information management is a management problem because it deals with how people use information, not how they use machines, says

Davenport. Three points illustrate the importance and difficulty of managing information use.

One, information's complexity needs to be preserved. Information should not be simplified to be made to fit into a computer, because doing so truncates sharing and conversation. Information does not conform to common definitions. It is messy. It naturally has different perspectives, which are important and need to be preserved. A certain amount of tension between the desire for one common global meaning and numerous familiar local meanings is inevitable; therefore, companies that want to settle on common corporate terms must do so with line people, not technical people, because line people will use the end results. The IS organization can facilitate these discussions, but the business people should determine the meanings.

Two, people do not easily share information, even though is value grows as it is shared. Culture often blocks sharing, especially in highly competitive organizational cultures.

Three, technology does not change culture. Just building an information system does not mean that people will use it. It is a false assumption that too many IS people make. To change the information culture of a company requires changing basic behavior, values, attitudes, and management expectations.

- **Sharing Issues:** If information sharing is the goal, a number of contentious problems must first be resolved. Davenport explains that a sharing culture must be in place or the existing disincentives will thwart using a sharing system.

  Technical solutions do not address the sharing issue. For example, much talk has touted "information architectures," where the definitions of stable types of corporate data, such as customers, products, and business transactions, can be specified ahead of time and used consistently across the firm. This approach has yet to fulfil its promise. The enterprise models are

difficult to understand, they take years to populate, and they are probably outdated before they are usable. But even more importantly, information architectures have failed because they do not take into account how people use the information. Managers get two-third of their information from conversations, one-third from documents, and almost none directly from computer systems. So a common information architecture is not likely to solve the information management problem.

An issue in sharing is: Who determines who has legitimate need of the information? The "owning" department? Top management? And who identifies the owner? The development of the principles for managing information- how it is defined and distributed- is more important than the final principles, because the touchy subject of information sharing is brought out into the open. In short, working out information issues requires addressing entrenched attitudes about organizational control.

Is sharing good? Not in all cases. Forcing employees to share information with others above them can lead to intrusive management. Some executive support systems limit "drill down" for just this reason. Managers think about these types of issues in information management.

Unlimited information sharing does not work. Limits are necessary. On the one hand, the sharing of corporate performance figures is beneficial, even when corporate performance is poor, because it usually increases morale; uninformed employees usually guess the worst. On the other hand, the sharing of rumours (non-information) generally demoralizes people. Separating information from non-information is an information management issue. Allowing employees to send messages to large distribution lists exacerbates the information management problem. Managements have awoken to the fact that they need to address this issue. Vendors are developing filters and "agents" to be used with electronic mail systems. These responses will only

help resolve corporate information management issues if the correct underlying policies are put in place.

Even hiring practices play a role in information management. If promotions are based on circulation and publication of new ideas, a sharing environment exists. If these activities are not rewarded, sharing may be an anathema to the culture.

In all, getting value out of information requires more than technology. It is inherently hard to control. It is ever expanding and unpredictable. Only when executives view it in this light will they manage information for most effective use.

3.2 FOUR TYPES OF INFORMATION

Internal record-based information has been the focuses of attention of information systems because it is the type of information computer-based application systems generate and manage easily. External record-based information can now be accessed over the Internet, or through other electronic means, via public databases. End users themselves have generally handled the procurement of this kind of data by subscribing to database services. Generally, IS executives have paid little attention to document based information, either internal or external. Intranets have changed that. Documents are now an integral part of the kinds of information these sites house. Even in competences to be their realm, after a short time, they gladly turn responsibility for the technical issues over to IS. We now look at ways companies are managing and utilizing these four types of information.

INTERNAL RECORD-BASED INFORMATION:

Thus far, this chapter has dealt with the internal record-based cell of the matrix in Figure 7-2. As we have seen, the three –level database is the conceptual model for organizing internal record-based data. Database management systems manage data using data models that define the relationships among entities and attributes

of the data. The four dominant data models are the hierarchical, network, relational, and object models.

Monsanto represents the recent resurgence of effort in getting record-based information into shape. They and others have discovered that it requires a two-pronged approach. One is to get the pool of data cleaned up. The second is to ensure that the data streams that feed that pool contribute clean data. Dealing with data inputting processes requires tracking those processes through the company to uncover any sources of errors, perhaps using a quality management approach. As Cornalia Varney noted, one company routed orders that contained errors int an "error bucket". The data quality group then followed these data errors "upstream" to find the root cause. From there, they and the users who input the data decided how to change the process to eliminate the errors. Oftentimes, all that was required was to explain the use of the data, something those users had never been told.

Internal document-based information:

The management of internal document based information traditionally rested with the vice president of administration, who oversees records management (document records, not data records). However, document management is a crucial issue facing CIOs. For our purposes, a document is a semi-formal "package" of information, structured for human comprehension. It has organizational relevance, so it is stored, transmitted, and consequently maintained in the context.

Electronic document management includes a variety of technologies, such as document and image processing, text retrieval, hypertext and hypermedia, EDI, and desktop publishing. In addition, electronic document management includes the technologies that have been used for years in traditional records management areas: micrographics (film and fiche), computer output microfilm (COM), and automated records centre applications. The document handled by this enlarged set of technologies might be letters, blueprints, sales notes, voice mail messages,

images, or multimedia documents. Increasingly, they include documents from external sources, such as news items, the internet, government or industry reports, and even incoming correspondence.

We have identified data, information, and knowledge as the total information resource of the firm. Much of this resource exists in the form of documents. Despite more than 40 years of progress in computerizing information processes, many organizations still have a hug, crucial amount of "paperwork" required to do business. The amount of paper is not likely to decrease either, despite the use of the technologies already mentioned. Xplor International estimates that the total number of electronic and paper documents will continue to soar from just over 2 trillion in 1998 to 20 trillion by 2005. See Figure 7-7.

The percentage of documents that will be printed will decline substantially from 90 percent today to 40 percent in 2005. However, the overall number of pages will offset the decline in percent printed, yielding an overall increase in the number of pages printed (from 1.8 trillion to 8 trillion). The remaining 60 percent of pages will be in the form of electronic documents existing in various repositories: the World Wide Web, corporate internal networks, government repositories, and so forth. *Conservatively ,that's 60 percent of 20 trillion documents, or 12 trillion documents in electronic format.* A portion of the 40 percent printed will also reside in electronic format. These electronic documents will only be useful if they can be accessed, read, categorized, summarized, and shared.

Despite 15 to 20 years of developing management systems, decision support systems, and executive information systems with data, we have just begun to include the valuable information contained in documents. So information management needs to include managing the internal document-based information on which most organizations continue to depend.

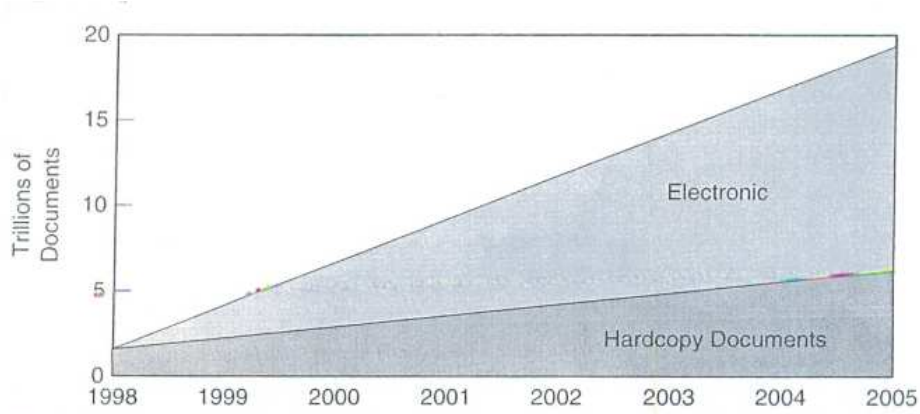


FIGURE 7-7 Growth in Documents 1998–2005

External record- based information:

It has generally been users, not the IS department, who have managed the acquisition of information from external databases. Strategic planning departments, financial planners, and other user departments have sought out services that provide this type of information. Yet, with the increasingly turbulent business environment, companies will want to coordinate their use of such external services, as well as combine internal and external information to better understand consumers. As an example of an external source of record-based information, consider Isuzu's use of geographic information system data.

External document-based information:

Many IS executives consider external document-based information to be the least manageable form of information. It has been the responsibility of corporate librarians in most companies. Yet, as the amount of such external information grows, and as more and more of it becomes computerized, it will become increasingly important for inclusion in IS executives' jurisdiction. Just witness what is happening with the Web and its plethora of external documents.

One area is environmental scanning-searching the world of external information in areas relevant to an organization. Environmental scanning services

have been available for many years. They review publications, clip out pertinent articles or create abstracts of these articles, and then pass them along to the client. A newer development is the delivery of this information to a company's internal computer, perhaps even a PC, where it can be searched, browsed, and interpreted by managers. Yet a newer development is the Web, with its plethora of information, search engines, and custom interest profiles.

The extremely rapid growth of computer-based document and reference services is not surprising. Jane Fadorowicz[10] describes this growth and the technology advances that have enabled it. She cites a study by Information Market Indicators, Inc., that shows U.S. businesses increased their online database expenditures by 117 percent in three years. Companies are retrieving more and more information from text databases, such as Dow Jones News Retrieval. The increased reliance on external market indicators and improved sources of information has dramatically booster the demand for online text database services.

Typically, users of these systems are trained librarians who provide a service within their company, or PC users who access general-purpose databases. Most of the time, the results of the search are hard copy reports of bibliographic, financial, or other stored information; although, increasingly, they can be files downloaded from the internet. Some decision support and executive information system products provide links to external databases and display the results of prespecified searches on the screen. The use of an online search service at California State University at Los Angeles illustrates the extent of external document based information.

3.3 MANAGING KNOWLEDGE

The IS world seems to be moving from data management to information management to "knowledge management." This third arena, often referred to as managing intellectual assets, is just beginning to be explored

FIGURE 7-8 The Scope of Information Management

	Typical Corporate Authority	*Information Sources*	*Technologies Used*
Internal record-based information	Information systems department	Transaction processing Organizational units	DBMS Data dictionaries Enterprise data analysis techniques
Internal document-based information	Administrative vice president Word processing center Records management	Corporate memos, letters reports, forms, email	Word processing Micrographics Reprographics Text retrieval products
External record-based information	End users Corporate planning Financial analysis Marketing	Public databases	Internet-based services Public networks Analysis packages
External document-based information	Corporate library	Public literature News services Catalogs and indexes Subscriptions Purchased reports	Bibliographic services Environmental scanning Public networks

Those who distinguish between information and knowledge appear to believe that knowledge is what is in someone's head, while information is in databases. Many feel that the term *knowledge management* creates the wrong impression. The term *management* often brings forth the "we can control it" mindset. Knowledge cannot be controlled or engineered, so the mechanical metaphor is wrong. It con only be leveraged through processes and culture. The biological or ecological metaphor is much better. The more people are connected, and e the more they exchange ideas, the more their knowledge spreads and can thus be leveraged.

As an example of the people and process emphasis in managing knowledge, consider the definition used by the CEO of Xerox, a company that has promoted this topic for several years.

"Managing knowledge means creating a thriving work and learning environment that fosters the continuous creation, aggregation, use, and re-use of both organizational and personal knowledge in the pursuit of new business value". __Paul Allaire, chairman and CEO, Xerox Corporation

The process is the key. An important concept is the difference between tacit knowledge (knowledge in someone's head that cannot easily be explained), explicit knowledge and the process of transferring "tacit" knowledge to others. To emphasize this idea, several companies have stopped talking about knowledge management and use only the term *knowledge sharing*. In this regard, IT is seen as one enabler, but not the main enabler. The key seems to be getting people together face-to-face, to explain about how they do things. Once people sit down and talk about what they do and why, barrier fall, knowledge flows, and sharing increases. Unfortunately, people are not given the time mor the space these days for this kind of interaction; "free time" to share is not seen as important. Figure 7-9 further emphasizes these concepts by distinguishing between information management and knowledge management.

So, unlike information management, knowledge management is more akin to knowledge "gardening." It needs to be nurtured, the correct environment and sharing norms need to be in place, and only than will the sharing take place. To better understand the tack that can be taken to change processes and increase sharing, consider what one large pharmaceutical company is doing.

FIGURE 7-9 Information Management is Different from Knowledge Management

Information Management	Knowledge Management
Emphasizes delivery and accessibility of content	Emphasizes adding value to content by filtering, synthesizing, interpreting and adding context
Has heavy technology focus	Balances focus between technology and culture or work practice
Assumes information capture can be standardized and	Requirement ongoing human inputs and links to communities

automated	

4.0 CONCLUSION

The job managing information resources is wildering significant. Not only must information system got corporate data in shape but they also need to create and build an information types.

5.0 SUMMARY

In summary, we have considered information management issues, the four types of information and the contract between information management and knowledge management. Besides, information system executive need to take a broader view of information management of they plan to manage it as a corporate resource.

6.0 TUTOR MARKED ASSIGNMENT

1. How does knowledge management differ from information management?
2. What is the purpose of data warehouses?

7.0 REFERENCES/FURTHER READING

Davenport, Tom, “Saving IT’s soul: Human centered Information Management” Harvard Business Review, March/ April 1994.

MODULE 5: MANAGING OPERATIOINS

Unit 1: What are operations?

Unit 2: Outsourcing information systems functions

Unit 3: Security in the internet age

Unit 4: Disaster Recovery for Distributed systems

UNIT 1: WHAT ARE OPERATIONS?

1.0 INTRODUCTION

A discussion of managing the essential information technologies is not complete without describing operational issues facing information system executives. Due to mergers, corporate restructurings, the Internet, and e-commerce, the subject of computer operations receiving a lot of attention, systems operations are important because, if they are not professionally run, a company could suffer a computer or network crash that could shut down their business for some period of time. It is not a trivial area, especially as companies become increasingly rehart on network and computers to run their business. Further more, poorly run information system

shops cause information system executives to end up fighting fires instead of setting policy or they find themselves looking for a new job or their operations are out sourced. Actually, this last options often seen as a welcome relief by many IS executives

2.0 OBJECTIVE

At the end of this unit, you should be able to

- Explain the driving force behind outsourcing
- Understanding the importance of operations
- Discuss the importance of good management

3.1 WHY TALK ABOUT OPERATIONS

Keeping the shop running is getting increasingly difficult, he said. The reasons become apparent at budget time. His total annual IS department budget had the following split:

- 33 Percent for systems and programming, of which 70 percent was for maintenance and 30 percent was for new development
- 1o Percent for department administration and training
- 57 percent for operations.

So, one reason operation are important is because they involve more money than any other part of the department.

At his company, operations included computer hardware at 64 locations, including 12 seaports, 12 sales offices. Hardware included computers, disk drives, tape drives, printers, and PCs. Operations also included communication lines and equipment, and software, such as operating systems, compilers, and networking sulting for developers, and operators who scheduled and ran production jobs, mounted tapes, delivered reports, and monitored the machines and network. And operations included disaster recovery planning and security.

“Putting all these things together sometimes gave me more excitement than I could stand,” quipped congleton, “Plus they were more expensive than I

wanted. Therefore, achieving a 10 percent reduction in operations has a far greater effect that a 10 percent reduction in any other area. That is why operations are important."

3.2 SOLVING OPERATIONAL PROBLEMS

System operations problems are obvious to the entire company: Response times are slow, networks are down, data is not available, or data is wrong. What can be done to improve operations? Congleton describes three strategies. One is to buy more equipment. As equipment costs drop, this solution might appear the most cost-effective, unless you run out of room for the equipment. The second approach is to continuously fight fires and rearrange priorities, getting people to solve the problem at hand. This solution really only moves the problem of poor management from one hot spot to another. The third solution is to continually document and measure what you are doing, to find out the real problems, not just the apparent ones. Then set standards. It is the solution congleton preferred. It is needed no matter whether the systems are long-time transaction systems or for internet e-commerce.

3.3 OPERATIONAL ISSUES

Operational measures are both external and internal. External measures are what customers see: system and network uptime (or downtime), response time, turnaround time, and program failures. These aspects directly relate to customer satisfaction. Internal measures are of interest to IS people: computer usage as a percentage of capacity, availability of mainline systems, disk storage utilized, job queue length, number of jobs run, number of jobs rerun due to problems, age of applications, and number of unresolved problems.

Problems reported by the external measures can generally be explained by deviations in the internal measures. To help uncover the problems related to equipment capacity, quality of applications, or improper use of systems by users,

numerous venders the various kinds of computer and telecom equipment, said Congleton. Storage management systems manage space more efficiently. Schedulers schedule jobs. And library management systems keep track of versions and backups of files and programs. So plenty of tools are available to help IS departments measure how efficiently their equipment is being used.

3.4 THE IMPORTANCE OF GOOD MANAGEMENT

Tools are useless, however, unless IS management has created a corporate culture that recognizes and values good operations, said Congleton. It is hard to find good computer operations managers because the absence of prestige (and sometimes pay) does not attract individual with the proper combination of skills and training. This reality is unfortunate, he said, because ion a good environment, an operations job can be particularly rewarding, both financially and professionally.

The skills required of an operations manager are similar to those needed in a factory or oil refinery. The factory manager must schedule work to meet promised delivery dates, monitor performance as work flows through the key pieces of equipment and respond quickly to production breakdowns. In a well-run factory, the manager can usually recover from one or two individual problems. In a badly run factory, a manager faces little problems and often does not know where to start to fix the problems. The same is true in computer and telecom centres where the “factory equipment” is the disk drives, database machines, host computers, servers, network gateways, routers, bridges, and the like.

In conclusion, CIOs need to be concerned about operation, said Congleton, by putting the proper operations environment in place. The keys to managing operations is the same as in any management job: set standards and then manage to those standards by finding an outstanding operations manager.

3.5 WHAT’S NEW IN OPERATION

Since the last edition of this book, several changes have been taken place in operations.

Companies Have “Cleaned Their Operational House.” Y2K and the Internet have forced companies to “clean house” in their data and network centre operations, says Rosemary LaChance, accompany that provides consulting on automating data center operations.

In the late 1990s, companies were fearful their old computer could not handle processing in the year 2000 because many of the programs left out the digit “19” in, say, “1993.” Once the millennium hit, these programs would think the year 2000 was the year 1990, yielding erroneous results.

Y2K forced companies to not only look at their existing software but also their computer operations, says LaChance, in particular, their standards and policies. Formerly, operations were managed reactively. They upgraded hardwares but thy rarely updated processes. Companies would not spend the money to improve procedures, thinking, “If it ain’t broke, don’t fix it.”

Y2K, and then the Internet, required management to think about the processes that computer operations supported and ask, “How are we going to do what we will do? How will we be able to add services or outsource operations? Will we be able to support e-commerce?” The resulting chances have led to far better operational structure because management took the time to define the rules for operations and put better policies and procedures in place.

“Had they not gone through Y2K, most companies would not be operationally prepared for the internet,” says LaChance. Although automation provides disciplines discipline, the rules must be in place to automate. Y2K forced companies to definite these rules, such as rules for gaining access to systems. They also got rid of such outdated procedures as transferring data via tapes (moving to more efficient and less costly online data transfers), and distributing reports on paper (moving to making them available via the company intranet).

In short, Y2K gave computer operation the attention it needed, but had not gotten. So companies are now in much better shape operationally. They have been forced to move from a survival mode ("Let's just get this job run") to a planning mode ("What do we need to support e-commerce?"). But challenges remain. Computer operators still cannot link identified problems with changes, so they do not have integration problem and changes management. That pieces of the operations structure is still missing.

Operations Managers are Beginning to Managing Outward. The picture congleton paints is based on the traditional "managing inward" view where enterprises manage their own data centers. By and large, that view has been true and remains true. But as the next section on outsourcing points out, a growling number of companies are turning to a third party to run their data centers. These changes do not mean CIOs can relinquish responsibility for operations. It just means they need to ensure that their people are properly managing the service providers.

Even for companies keeping their own data centers, an increasing number are taking advantage of operational services provided by third parties, especially for e-business operations. For example, some host their web site at a company that specializes in Web hosting, such as Exodus Communications. Offloading Web operations allows enterprises to forego large equipment and brick-and-mortar investments, expensing operational costs instead. Finding qualified employees is an acute problem in the IT field. It is easier to attract and retain IT talent when a company's core business is IT because staff can see a career path, the company is more likely to buy the latest tools and equipment, and the culture is more likely to be IT-friendly.

Operations are Being Simplified. Another trend is to simplify operations by centralizing applications in one place, rather than distribute them on PCs. Programs are then downloads when requested. This practice is called "server-based computing," and was discussed in Chapter 5.

Certain Operations are Being Offloaded. Yet another trend in operations is to offload certain kinds of operations or certain aspects of computer and network operations. Often, these relate to the Internet. For example, a large growth area in Internet operations is "event management," which means hosting a real-time event over the Internet. When successful, such events, called web casts, leads to a huge spike in web site hits. To avoid being swamped and having the Web site crash, companies are offloading the operational aspects of these events to third parties that specialize in hosting such activities. Here is an example of such a web cast.

4.0 CONCLUSION

In conclusion, the attention of CIOs in operation used to be focused on ensuring they had the in-house expertise to keep systems and networks up and running. Their attention now is toward determining where best to perform the various kinds of operations, in-house or with a third party. In an increasing number of cases, especially with respect to e-business, the choice is to use an outside specialist, which leads naturally to the next subject, outsourcing.

5.0 SUMMARY

Traditionally, managing operations has meant managing inward, that's, managing one's own operations staff, including those who work in the data centre, data administration, network administration and systems programming. Today, it is just as likely to mean managing outward, that is, managing the company's relationship with external IT service providers who have taken over the day to day operational work.

6.0 TUTOR MARKED ASSIGNMENT

1. What is the main shift in the operations view point?
2. What are three solutions to operational problem, according to congletion?

7.0 **REFERENCES/FURTHER READING**

Power, Richard, 2000 CSI/FBI Computer Crime and Security Surrey, Computer Security Institute, 600 Harrison St. Francisco, CA 94107, www.gosci.com, spring 2000

UNIT 2: OUTSOURCING INFORMATION SYSTEM FUNCTION

1.0 **INTRODUCTION**

Outsourcing means turning over a firm's computer operations, network operations or other it functions to a vendor for a specified time-generally, at least a few years, although that time frame is changing. Some years back, outsourcing became a legitimate management strategy by is departments. Until that time the only companies that outsourced their is department were those that were poorly run

2.0 **OBJECTIVES**

At the end of this unit, you should be able to

- Discuss the driving forces behind outsourcing.
- Discuss the history of outsourcing.

- Explain customer-vendor relationship

3.1 THE DRIVING FORCES BEHIND OUTSOURCING

At a meeting of the Chicago chapter of the society for Information Management, Mel Bergstein of Diamond Cluster Int'l. gave an overview of outsourcing. His main message was that outsourcing is another step in the evolution of the information system field.

Outsourcing descended on IS department as a follow –on to the merger and acquisition activities in the 1980s, said Bergstein. In the 1960s, only 10 percent of the U.S. economy had global competition. In the 1980s, which led to the huge amount of merger and acquisition activity. This activity was also driven by a new market for corporate control. High –yield bonds allowed a few people to buy a company and leverage it with debt were "prided" based on their shareholder value, that is, their discounted cash flow.

These two drivers-focus and value-are still leading companies to restructure and focus on core businesses by asking themselves, "where do we really add value" As examples, some apparel companies no longer cut, sew, manufacture, or distribute goods because as design and marketing. Likewise, some publishers no longer manufacture books. They manage and finance projects, and outsource everything else.

So outsourcing is part of the drive for focus and it is not solely an information system issue, said Bergstein; it is a business issue. Because top management must stress value, they must consider outsourcing in all their nonstrategic functions. In the age of e- business, they may even need to consider out sourcing their strategic functions to get a jump on the competition.

3.2 CHANGING CUSTOMER-VENDOR RELATIONSHIP

Outsourcers perform the same activities for a company that IS department perform in-house. But, overtime, the amount of work done by outsiders has

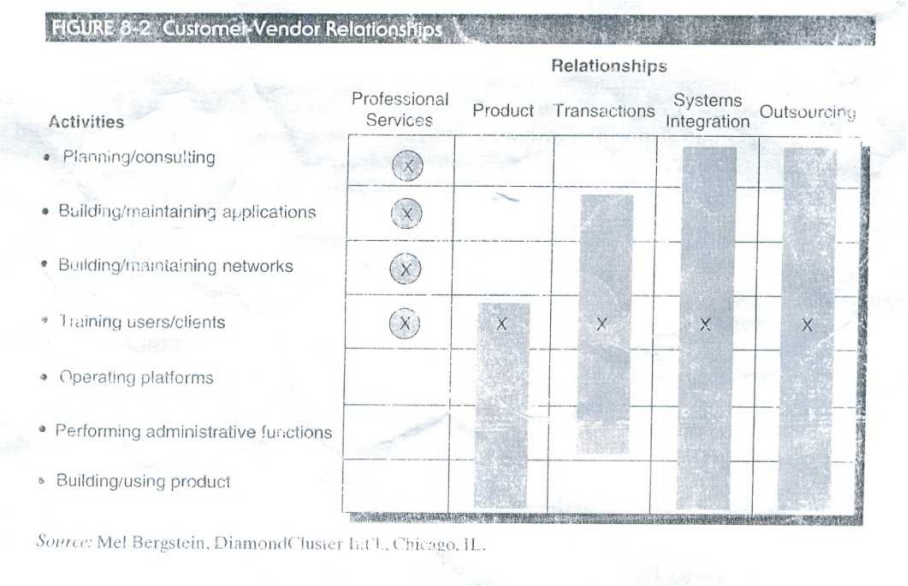
increased, said Bergstein, as the following expansion in customer-vendor relationship illustrates.

Traditionally, IS department have bought professional services, such as planning (or consulting), building or maintaining applications, building or maintaining networks, and training. They have also bought products, which may or may not include training. And they have bought transactions, such as payroll checks from a service. This third type of relationship is good for buyers because their costs become variable, and hence more controllable. It is also goods for the sellers because in taking on the risks, they can have higher margins

With the increasing use of packages and the need to integrate component to create integrated systems, companies have contracted with a systems integrator. They generally handle the entire life cycle-planning, development, maintenance, and training-for major system projects. Finally, the most bundled approach to contracting for IS services is outsourcing, where the outsourcer contracts to handles all or most of certain information system activities. The main difference between the latter two options is that system integration is project-based while outsourcing is time-based.

This five-options continuum, shown in Figures 8-2, demonstrates how the IT field has moved, said Bergstein. As you move from the more traditionally professional services category (on the left) to outsourcing (on the right), four changes occur in the vendor-customer relationship:

1. Information system management loses an increasing amount of control because more of the activities are turned over to outsiders.
2. Vendors take more risk as they options on the right.
3. Vendors' margins improve as they offer services on the right.
4. The importance of choosing the right vendor becomes more important to the right, because more is at risk in using an outside so



3.3 OUTSOURCING'S HISTORY

In 1989, essentially only one kind of outsourcing was available: IT outsourcing. Since then, field has expanded significantly, so here's a bit of history.

IT Outsourcing:

IT outsourcing essentially began "big bang" deals or mega deals, which consisted of outsourcing all a company's data center operating for up to 10 years. These deals required selling existing equipment to the outsourcer, transferring all software licenses, moving significant number of IS personnel from the company payroll to the outsourcer's payroll, negotiating how the outsourcers would help in the transition and which party would carry which costs, establishing desired services levels and ways to measures performance, and specifying every single service to be provided-because if it wasn't in the contract, it would be an added cost.

In those early days, the goal data center contracts was purely financial. Companies wanted to remove the huge hardware from their books. They wanted to shift fixed costs to variables costs, and they wanted to save money, generally about 15 percent. The deals were front-loaded, with the outsourcers losing money or breaking even the first year to two, but then becoming profitable after that, as

the costs of technology dropped, as they leveraged licenses across clients, as they shared expertise across clients, and as they inverted in productivity tools that made them more efficient.

Several problems occurred, however. An “us versus them” mindset often set in because neither the client nor the outsourcers handled the transition well. A lot of finger pointing took place as outsourcers tried to change for service client thought were included in the contract. And service levels did not always live up to expectations, or interpretations of the contract language differed

Furthermore, cultures clashed. Former employees might have kept their desk, but once they became an employee of the outsourcer, they became a supplier and were treated differently. Users had higher expectation of outsourcers than of there IS departments. In short, companies learned that managing the relationship was really the tough job. Formerly, they had negotiating the deal was the difficult part, so they had not carefully defined governance structures, that is, how the relationship would be managed.

Today, the industry has matured. Outsourcers have learned that heavy-handed treatment of clients can backfire. They are much more careful in transition planning. Clients’ attorneys have learned what’s important in a contract and where the pitfalls lie. Today, those initial contracts are being renegotiated, and although the client may not change outsourcers, they generally become more adept at renegotiating because they now know what they really need.

Of course, not all outsourcing deals were mega-deals. But even the small deals felt like a big bang to the employees who moved to the outsourcer.

Traditional outsourcing:

In the early 1990s, a new type of computing arose: client-server computing, as noted in chapter 5. IT outsourcing had been around for a few years, so CIOs with their hands full supporting legacy system looked into using outsourcing to transition to client-server computing. They chose one of two routes. Either they outsourced maintenance of their staff could concentrate on building new client-

server systems, or they outsourced client server development to specialists and kept maintenance in-house. In either case, once the new systems were brought in, the legacy systems they replaced were shut down.

Then, in the late 1990s, when the immense size of Y2K compliance surface-to retrofit old applications so they would work after the years 2000-most companies outsourced as much of their Y2K work as they could. Because of the enormous volume of work, offshore outsourcing to India, Ireland and other countries grew significantly. Unlike traditional IT outsourcing, however, contracts were generally shorter and did not include operations.

Best-of-breed outsourcing:

All through the 1990s, IT department outsourced different pieces of their wok; mainly infrastructure support, as noted in chapter 2 and IS Lite. However, CIOs learned that although selecting one outsourcer with broad capabilities might be easiest to manage, often no single company was "best in class" in all areas. Thus, selective outsourcing began, where one company handled desktop operations, another data centre operations, and a third network management. Even though the concept was good for getting the best-of –breed providers, coordination among multiple providers became a nightmare.

A more recent trend has been what we call "collaborative outsourcing," where one company becomes the prime contractor for numerous facets of IS operations, but some of the work is provided by other external service provider (ESPs). Often an operations partner, a development partner, and a telecom partner collaborate to bid on the work, but one is the "prime." So teams of large ESPs now bid against other teams for contracts. In some cases, these contracts take on quite a bit more than simply operations; the work includes development of new system as well. Best-of-breed outsourcing has perpetuated the tradition of long and complex contracts.

Shared services:

When IT outsourcing began to gain credibility, executives wondered, “Can we get the same economies of scale by pulling disparate noncore functions to sourced” to themselves, creating an organizational unit for functions such as IT, legal facilities management, real estate, mail room, finance, and on and on. The goal was to improve efficiencies and save money. Generally, companies created a centre of expertise in each area, with all the centre reporting to one shared service vice president.

IT was not always included, but, as in case of Mead Corporation, it was. Some executives believe having IT in shared service gives them the ability to leverage the IT underpinning of believe of the other services. Shared service also centralizes the management of outsourced functions because, in many cases, the functions are centralized and then outsourced. So shared service groups are becoming more adept at negotiating and managing contracts and supplier relationships because these tasks are a main part of their job.

Business process outsourcing:

As the IT outsourcing field matured, data center outsourcing desktop outsourcing, and other standard IT outsourcing areas became so well understood that they became like commodity services, hence profit margins dropped as the number of competitor rose. To move into higher-margins services, ESPs began specializing in specific functional areas, offering to handle specific business process as well as their IT underpinnings. This business process outsourcing (BPO) is defined as outsourcing all or most of a reengineered process that has a large IT component.

Gaining the expertise of a provider, rather than cost cutting, has been the main goal in BPO. Improving a process by handing it over to experts has also been a goal. Generally, companies have been most willing to outsource their noncore functions. Thus, one oil company now outsource now outsources its accounting function to PricewaterhouseCoopers, moving 1,500 employees to PwC. Companies have long outsourced payroll processing. Now companies are

outsourcing logistics, customer service, and many essential, yet peripheral, functions to the experts.

Balboa Travel, a travel agency in San Diego, California, handed over its ticket accounting to Unisys. Each week, travel agencies must report the tickets they sold to the Airline Reporting Corporation. The process is important, yet burdensome, and the president of Balboa Travel did not want to hire a programmer to maintain such a reporting system, which is what he would have had to do if he had not outsourced the work. It lets him offer his client---corporate travel departments reports about their ticket sales to uncover trends that will help them offer new and better services.

AS is obvious, BPO moves IT- based outsourced out beyond the IT department; it involves business units as well. BPO outsourcing is often quite a bit more complex than IT outsourced because it requires client to change their business process to fit with the processes of the service provider. Furthermore, some client want to retain parts of a process, so complex coordination may be necessary between the two firms as well.

BPO brought a mindset change to the field. Whereas IT outsourcing moved suppliers and customers closer to one another in terms of working together, a distance between the two came from not common goals. Client wants to save more money; outsourcers want to make more money.

In BPO, a number of the deals have tended to be more risks| reward, in that the parties enter a somewhat risky business venture together and if the business does well, both split the increased revenue.

Rita terdiman, of Garther, noted this phenomenon at a speech to the sourcing In-terests Group. As shown in 8-3, BPO deals have aimed to more like joint ventures and alliances, moving them to the right side of the chart where trust, joint financial investments, and “partnering” are part of the deal.

Even though BPO deals are difficult to structure and then manage, they are growing significantly, partly due to e-business.

E-business Outsourcing: With the arrival of business use of the internet, outsourcing has actually become the leading–edge way to run a company. In large companies, it started with marketing departments outsourcing the development of their corporate Web site. Once developed, IT took over operations. However, in dot-coms and Internet-based companies, outsourcing all or most of the IT function is the preferred mode of operation, outsourcing all or most of the IT function is preferred mode of operation, for several reasons.

One, they need to move fast. They cannot spend a year developing a system; they need it up and running within months, or even weeks. Two, they want to remain flexible, which means staying small and focusing only on a few key functions. Generally, IT has not been seen as a core differentiating area because tailorable off-the-shelf products and services have rapidly become available. Three, they do not want to tie venture capital funds in computer and networking equipment, knowing it will become obsolete fairly soon. They would much rather rent than buy. And they want to draw on best-of-breed as well as be able to change course quickly if need be, swapping out one ESP and swapping in another, to keep pace with the market.

Major differences between e-business outsourcing and traditional IT outsourcing include: no need to buy machines from the client, no personnel to move, and no software licenses to takes over. The outsourcing starts from the scratch.

Few large companies have followed this route, mainly because they have invested in ESP and other large systems and have not wanted these investments away. However, those that start internet-based spin-offs have often followed the dot-coms and relied on ESPs for their IT needs.

Operating on the Web is coming to mean working closely with ESPs, of which there are now many kinds. Suppliers have jumped on the e-business band wagon by providing their services over the Internet or via private IP networks. Besides being able to quickly draw on expertise via a net-based package or

service, utilizing ESPs also reduces the burden of maintaining systems, which has accounted for up to80 percent of IS departmental budgets. So the outsourcing model allows IT departments to move more at the speed of the business, which is an absolute necessity these days.

Application Service providers (ASPs). In 1999 a new terms surfaced: application service provider, which is a company that rents software to the other Internet. ASPs are not outsourcers in the traditional sense of the terms because they do not takes over a company's data centre or manage its desktops. But, they are being seen as the next step in outsourcing nonetheless.

ASPs began offering software-for-rent over the internet to smaller and medium-sized firms that did not want to invest in buying large systems. Large firms had the money to invest, so they kept the work in-house. ASPs charge a per-month, per-user rate to handle, say, benefits administration via their Web site. Now some external service providers sell specialized services only to ASPs, giving these ASPs are even offering ERP services over the net. Companies do not have to spend the millions (or tens of millions) of dollars to install ERP; they can rent the functions over the net.

The ASP model is expanding rapidly. One offshoot is corporate portals. Rather than house commonly used software on PCs, and have the headache of upgrading copies with fixes and new versions, employees can get their software off their corporate portal, which is hosted and supplied by an ASP. In short, ASPs are yet another step to ward IS life. Thus, in 10 years' time, It outsourcing has changed significantly, from big-bang 10-years deals that took a year to negotiate to renting software over the net, by user and by the month.

Managing Outsourcing

Numerous aspects to managing outsourcing need to be taken into an account to a successful working relationship. Here are just four---organizational structure, governance, day-to-day working, and supplier development. All are based on

research reports published by the Sourcing Interests Group, headed by Barry Wiegler.

Organizational structure:

Managing out sourcing is different from managing internal staff because for one thing, it is a joint effort between parties that may not have the same goals, as noted earlier. Therefore during contract negotiations, the two parties need to figure and negotiate how they are going to jointly manage the contract they sign. In fact, governance needs to be explicitly addressed in the contract.

Typically parties establish layers of joint teams. A top-level of a couple executives from both companies has the final word on conflict resolution. An operational team, with members from both companies, overseas day-to-day functioning. They formally meet periodically, say, once in a week to once in a month, but they are generally in daily contract Also, some joint special purpose teams may be created from time to time to deal with pressing issues. Some companies have ongoing standing committees, such as pricing committee or a change management committee, to oversee the use of formal change management procedures.

Although joint committees are a common management structure, each side needs a single executive in charge of their side of the relationship. On the client side these people are coming to be known as relationship managers. This job position has not been prevalent in IS departments, but we believe it is going to become the norm as a company's move toward IS Lite. Needless to say the, the skills of a relationship manager are far different from those of a data centre manager. A relationship manager needs to be good at negotiating, cajoling, and being an effective liaison between the end user and service providers. An operations manager needs to know how to hire the right people and keep the system up and running----like a factory manager, as Congleton has pointed out.

To illustrate how one company has managed its outsourcing, we look at Eastman Kodak company because it created thoughtful and effective governance structure.

The following description comes from the Sourcing Interests Group; it focuses on the alliance between Kodak and IBM Global Services, which provides outsourcing services.

Governance:

The foundations of governing an outsourcing relationship are laid out in the contract, which can be hundreds of pages long (with appendixes). A major governance item in the contracts is the service level agreements (SLAs) because they are used to gauge supplier performance. For every contracted service, its spells out responsibilities, performance requirements, penalties, bonuses, and so on.

Another important component of SLAs is metrics. An SLA needs to be measurable to be of use. Establishing metrics can be tricky because, in many cases, IS departments have not kept good measures on their own performance. Such measures are needed to establish benchmarks, against which vendors want to demonstrate improvements. Clients also need metrics to negotiate better deals. Clients who do not now their own performance levels negotiate from weakness; they know less than the vendor because they have not kept track of details, and vendors are not apt to correct mistaken impressions. Furthermore, they are likely to overlook important details, which will later cost them money.

In addition to SLAs, parties establish simple governance rules to be used when either party is making a decision, so that “both are singing from the same hymnal.” Most parties in strong relationships say they put the contract in the drawer after it has been signed and work from trust and agreed upon rules. It is only when trust in one another breaks down that they turn to the contract. Figure 8-4 lists some governance rules from a number of different enterprises.

Day-to-day working:

The Sourcing Interest Group reports provide advice from outsourcing executives on how to manage the day-to-day interactions of the two parties. Here are a few of those recommendations.

Manage expectations not staff. The outsourcer's staff is no longer under the purview of the client, so command-and-control is not a wise option---it results in an acrimonious relationship. Facilitation becomes the mode of working. Rather than say "do this" the approach becomes "how can we solve this together?" Furthermore, the re3lationship managers have the important role of influencing the operations of the users so that delivery meets business objectives.

Realize that informal ways of working may disappear. More formality is inevitable as outcomes are measured and more tightly controlled, especially if the relationship is handled strictly by the book, which happens in some cases. This change can be a real shock to people who are used to, say, getting a small job done by calling their friend "Joe" in the IS department. Once Joe works for the supplier, he may no longer be able to provide that service; he must follow the work authorization process defined in the contract. This can cause unhappiness as users see providers as "them" making them the scapegoat. The two parties need to find ways to reduce this tendency.

FIGURE 8-4 Examples of Outsourcing Governance Rules

- Service levels must stay in the top 25 percent, as benchmarked against the client's peers.
- Escalation of problems gets more painful as it goes higher, to encourage early resolution.
- The supplier is the grand project manager and is responsible for managing multiple vendors.
- Work style is based on respect and confidence; there should be no personalization of problems.

- Add significant value
- Ain to operate in an “open book” manner, sharing key operating information with each other.
- New services can be put out for bid.
- No exclusive agreements.
- Meet our standards.
- Let us know about potential problems before they happen.
- Spend our money as if it were your own.

Loss of informal ways of working can cause rigor. Rigor frequently improves work quality. Users may think twice before requesting changes, preparing better definitions of what they want. Furthermore, better processes can streamline work, improve effectiveness, and potentially cut out unnecessary work. Service providers do introduce new discipline; the client should prepare employees for this change and assist them in changing because it is generally best to take on the provider’s processes. It is why transition planning is so important: to help the client move to new procedures with the least disruption and disgruntlement.

Integration of the two staffs requires explicit actions. Some example are to (1) grant outsourcing staff access to appropriate work, not unduly restrict them; (2) hold joint celebrations and social events; (3) invite each other to meetings; and (4) perhaps even have a client executive move on two-year loan to the provider in a management to learn first-hand how they work internally. But integration generally can only go so far ; the client still need to remain in control and provide the guidance. Furthermore, the more side-by-side the parties work, the more likely they are to experience “scoop creep” in which the provider takes on more work.

The best way to manage day-is to communicate frequently. One executive said he carried around a top-10 list in his shirt pocket, which he revised every

week. They were the most important items he had to handle. They kept him on focus and turned out to his best informal management technique.

Supplier development:

A topic that is receiving increased attention in the production sourcing arena---that is, buying parts and services that go into one's own products and services---is supplier development. It means assisting one's suppliers to improve their products and services, generally by improving their processes. Although supplier development has not been pre4valent in IT sourcing, we think it will be.

Here is an example from manufacturing from a Sourcing Interest Group research report.

4.0 CONCLUSION

In conclusion, outsourcing has become a crucial operational alternative for companies. With the pace of charge so rapid in IT and e-business, the only hope of many enterprises is to top the expertise of companies that are keeping pace with the change, rather than trying to do every thing themselves.

5.0 SUMMARY

In summary, outsourcing does not mean relinquishing responsibility. In fact, taken to its extreme, it can mean devoting resources to assist suppliers improve their processes. It is believed is a coming focus in the world of information system life.

6.0 TUTOR MARKED ASSIGNMENT

1. What are the driving force of outsourcing according to Bergstein
2. What are the five customer-vendor relationships?
3. What are IT outsourcing, transitional outsourcing, best-of-breed outsourcing, shared services, business outsourcing, e-business outsourcing, and application service providers?

7.0 **REFERENCE/FURTHER READING**

Hughes Network Systems, www.hns.com

UNIT 3: SECURITY IN THE INTERNET AGE

1.0 Introduction

2.0 Objectives

3.0 Main Content.

3.1 The Threats

3.2 Security's Five Pillars

3.3 Counter measures

4.0 Conclusion

5.0 Summary

6.0 Tutor Marked Assignment

7.0 References/ Further Reading

1.0 INTRODUCTION

When establishing network connections, the firm's starting point is deny all access to and from the internet. Form there, it opens portals only where required and each opening has a firewall and only permits specific functions, such as file transfer protocol or e-mail.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Explain and identify the fire pillars that make up today's security techniques
- Understand the threats faced by most organisations from inside and outside their electronic perimeters.

THE THREATS

Since 1996, the Computer Security Institute and San Francisco Federal Bureau of Investigation Computer Intrusion Squad have conducted an annual survey of U.S. security managers to uncover the types of computer crimes committed. The 2000 survey, with responses from 643 managers in corporations and government, confirmed that (1) organisations are under cyber attack from inside and outside their electronic perimeters; (2) a wide range of attacks have been detected; (3) attacks can result in significant losses, and (4) defending against attacks requires more than the use of information security technologies.

Some 70 percent of the respondents noted in the 2000 survey that they had experienced a security breach within the past 12 months. Because most breaches go unnoticed, the percentage is likely to be quite a bit higher. However, Richard Power, editorial director of CSI, notes that the number answering "no" fell to just 16percent in 2000, from 37 percent in 1996. He view this decrease as heartening because it means fewer are living in denial and are more closely scrutinising their network activity. He believes the only honest answers to the question are "yes" and "don't know." No one can ensure that they have not had a breach.

Furthermore, he notes that the conventional wisdom that most attacks come from within may no longer be true. The number of respondents stating that their Internet connections were a frequent point to attack has risen year, from 37 percent in 1996 to 59 percent in 2000. While attacks through internet systems fell to 38 percent, from 53 percent in 1996. Figure 8-5 shows the kinds of attacks experienced, from highest number of attacks to lowest. Remote dial-in was the third attack approach; it accounted for 22 percent in 2000, versus 39 percent in 1996.

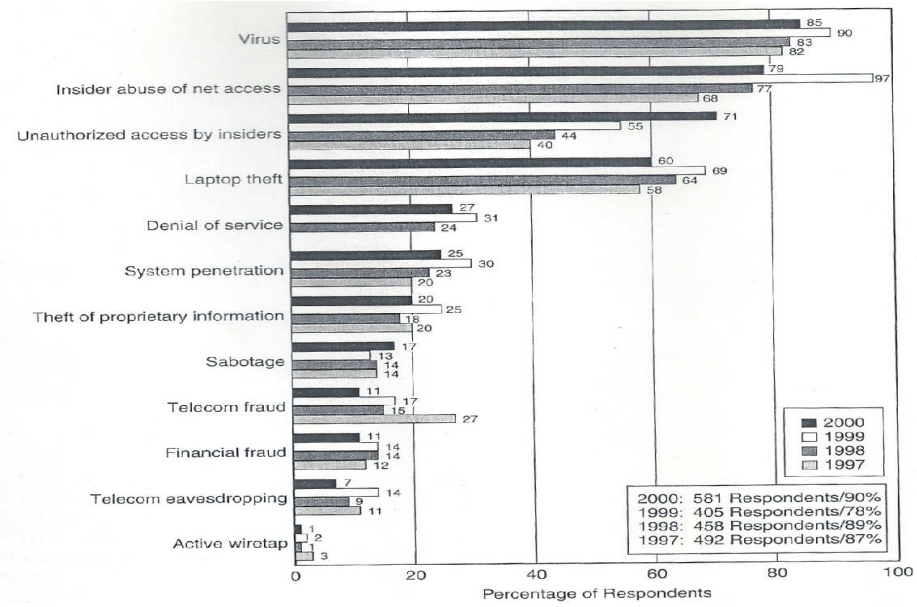


FIGURE 8-5 Types of Attack or Misuse Detected in the last 12 Months (by percent)

Source: Reprinted with permission of Richard Power, "2000 CSI/FBI Computer Crime and Security Survey," Computer Security Institute, San Francisco, CA, www.gosci.com, Spring 2000.

But number of attacks does not necessarily correlate with financial losses. Figure 8-6 shows the survey's estimate of losses in the same order as Figure 8-5. Note that theft of spondents. Second highest came from financial fraud, reported by only 11 percent. This discrepancy between number of attacks and loss

indicates that companies need to thinks about where they are truly most vulnerable. The estimates are not conclusive, notes Power because not every company reporting a theft quantifies it, and those who do generally can only estimate losses.

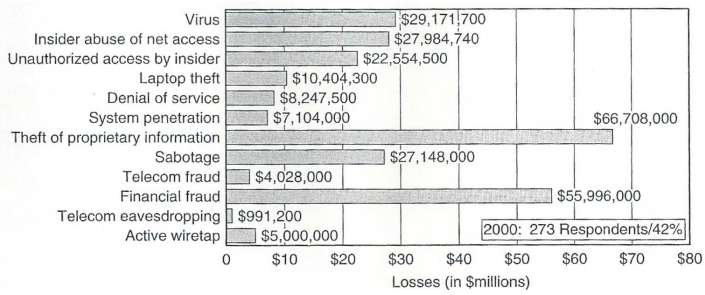


FIGURE 8-6 Dollar Amount of Losses by Types

Source: Reprinted with permission of Richard Power, "2000 CSI/FBI Computer Crime and Security Survey," Computer Security Institute, San Francisco, CA, www.gosci.com, Spring 2000.

What about e-commerce? For the second year, the CSI/FBI survey asked about unauthorised access or misuse of Web site. 93 percent of the respondents had Website and 43 percent of them conducted e-commerce over those sites. Some 19 percent reported unauthorised access or misuse; another 32 percent said they did not know. Some 64 percent of the attacks were vandalism, 60 percent were denial of service that blocked the site from use by legitimate Web site visitors, 8 percent reported theft of transaction information and 3 percent reported financial fraud.

The good news, says Power, is that financial fraud or theft of proprietary information via Web sites dropped from the previous year. Yet, the fact that some 30 percent did not know whether they have been attacked was unsettling. The report lists just a few cases of massive numbers of illegally accessed credit card numbers from Web sites in the first quarter of 2000 alone (25, 000 in case, 20,

000 in another, 485, 000 in another, for a total of 809, 000). E-commerce crime, is a reality, notes Power.

Information crimes are on the rise, says RSA security Inc., a prominent long-time network security firm, for a number of reasons. One is the rise of distributed computing. RSA's analogy: It is easier to guard a bank vault than to guard every house in town. That's why many companies are outsourcing their data centre operations to data centre specialists with vault0like security.

Mobile computing and telecommuting also increase the possibility for crime because the greater number of network openings provides more opportunities for illegal entry. Needless to say, the rise of ecommerce and e-business put more communications online to the Internet, which is open to everyone, including hackers. And because the Internet does not have intrinsic security protocols, this public space is vulnerable.

In addition, the hacker community has become "a public club," says RSA, with hacker Web sites and newsgroups available to anyone who wants to learn hackers' tricks. Furthermore, hacker tools are becoming increasingly sophisticated and easier to use; and they are continually being revised to outsmart the countermeasures used by companies to protect themselves, it has become a cat-and-mouse game of a continual one-upmanship. So securing an e-business is not a one-shot deal; it requires constant vigilance.

RSA describes the following nine approaches hackers use:

1. Cracking the password: Guessing someone's password is easier than most people think, says RSA, because one people don't use passwords, other use the word "password," and still other use easy –to remember words such as their child' s name, a sports team, or a meaningful data. Hackers also use software that can test out all combinations, which is called "brute force" password detection.
2. Tricking someone: To get users to divulge their passwords, a "con artist" calls up an employee posing as a network administrator who needs the employee's

password to solve an immediate (fictitious) network problem. It happens more than you think says RSA.

3. Network sniffing: Hackers launch software that monitors all traffic looking for passwords or other valuable information. Because most network traffic is in "clear text rather than encrypted (to appear as gibberish), sniffing ca fin information and write it to a file for later use.
4. Misusing administrative tools: Can be turned against a network. For example, a well-know program written to uncover weak spots in a network, which is important for network administrators, has been used by hackers to find weak spots in target companies' network. Interestingly, that program's name is Satan.
5. Playing middleman: Placing oneself between two communicating parties and either substituting one's own information in place of one of the parties' information or denying one party access to a session such as denying a competitor access to an important online auction is another common ploy.
6. Denial of service: This tactic floods a party, such as a web site, with so much useless traffic that the site becomes overwhelmed and freezes. Legitimate message are locked out, essentially shutting for a period of time.
7. Trojan horse: A malicious program can be housed inside an innocent one or, better yet, that appears to b helpful.
8. Viruses: These pieces of software run without permission their most common entry point has been as e-mail attachments. Once such an attachment is opened, the program is released and perform is task, such as destroying files (a worm) or replicating itself in e-mail sent to everyone in the e-mail directory. Internet-based viruses have attracted lots of attention, not just for PCs but for wireless devices as well.
9. Spoofing: by masquerading as a legitimate IP address, hackers can gain access to a site, masquerading as a Web site and redirecting traffic to a fraudulent

look alike which, for example, allows credit card information to be captured for letter use.

The major problem these days, notes RSN, is that enterprise cannot have both access to information and airtight security at the same time. Due to e-commerce, companies want unimpeded information flow among a complex Web of alliance partners. Thus, it is no longer feasible to define "good" as "inside the network" "bad" as "outside the network," as in the past. Today, companies must make tradeoffs between absolute information security and the efficient flow of information. And although they might think technology can solve security loopholes, the human dimension is equally important making employees cognizant of security threats they may encounter and teaching them how to how to strengthen the company's security measure. Today due to the importance of computers in company operations, securities are not just technical. They are being influenced by business managers, which affect the bottom line.

Because airtight security is not possible, companies need to prioritize their risk and work on safe guarding against the greatest threats. To give an example of one company's approach to over network security, consider this case from a Gartner executive programs report.

SECURITY'S FIVE PILLARS

Five pillars make up today's security technique, says RSA

1. Authentication: verifying the authenticity of users
2. identification: identifying users to grant them appropriate access
3. privacy: protecting information from being seen
4. integrity: keeping information in its original form
5. Nonrepudiation: preventing parties from denying actions they have taken.

Authentication:

It means verifying someone's authenticity: they are who they are people can authenticate themselves to a system in three basic ways, says RSA: by something

they know, something they have and something they know "really means something only they know" general a possession." In computer security. One possibility is a "token" that generates a code a user enter into the computer to gain access to, say, an e-mail system. Users just have to remember not to lose the token. Or they may have a digital certificate, such as a finger print, retinal scan, or voice these characteristics fall under the area called biometrics.

Each type of user authentication its strength and weakness, so RSA recommends choosing two of the three, called two-factor authentication.

Identification:

It is the process of issuing and verity access privilege. RSA say it is like being a driver's license. First, you must show proof of identity to get your driver's license. Once you receive your license, it become your proof of identity, but it also states your driving privileges (drive an automobile but not a truck or a bus). So identification is like certified to be able to do certain things.

In the internet world, identification is moving toward application-level security, say RSA, that is, authentication for each application. It requires users to sign on for each application, which many fell is a large burden. Single sign-on is an approach some companies are taking.

Data privacy and data integrity:

These mean keeping information from being seen (privacy) or changed (integrity). Both are especially important when information travels through the Internet because it is a public space where interception is more possible.

The most common method of protecting data is encryption. The most common is public key encryption.

Non-repudiation:

It means neither party in sale or communication of sensitive information can later that the transaction or information exchange took place. Non-repudiation services can prove that someone was the actual sender and the other the receiver; no imposter was involved on either side.

COUNTER MEASURES

The trend in computer security is toward defining security policies and then centrally managing and enforcing those policies via security management products and services, or policy-based management. Hence, for example, a user authenticates to a network once, and then a “right based system” gives that user access only to the systems to which he has been the rights. A finance employee might have the rights to company finance recoads but a manufacturing employ might not.

From the CSI/FBI survey, shows the types of security technologies used by the 643 security managers in the 2009 survey. All of them used antivirus software, 93 percent had success control, and 90 percent used physical security around data and network centres.

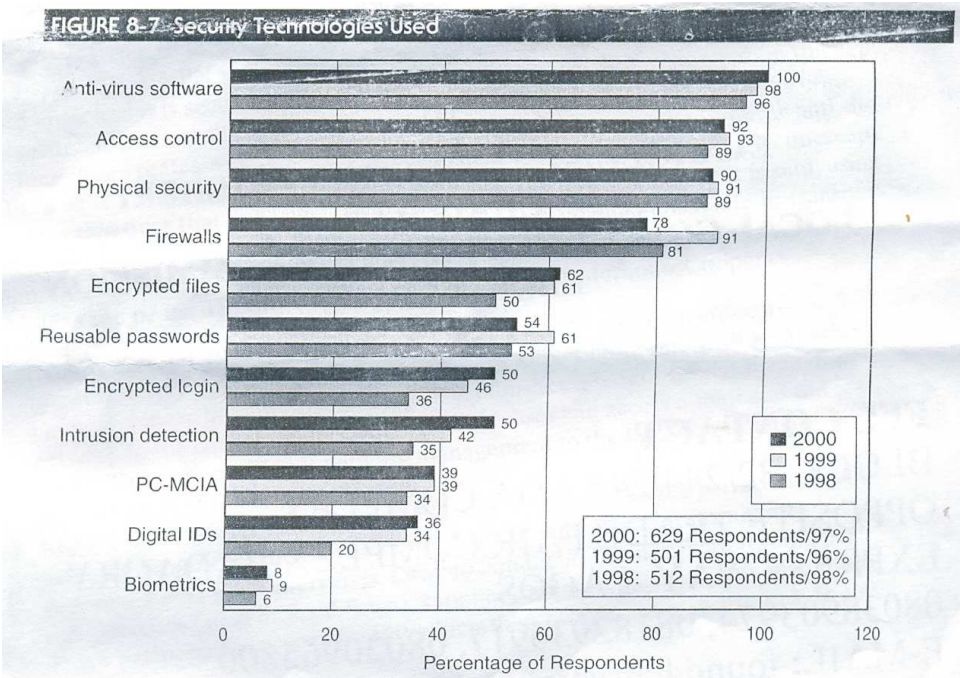
To explain a bit more about countermeasures, following are the three technique used by companies to protect themselves: firewalls, public key encryption and virtual private networks.

Firewalls:

This hardware or software controls access between networks. It is widely used to create intranets and extranets, which only employee and authorized business partners can access. Typically implanted on a router, firewalls perform their job by (1) packet filtering to back “illegal” traffic, which is defined by the security policy, or (2) using a proxy server, which acts as an intermediary between, say, the Internet and the intranet. Proxy servers can look deeper into traffic than do packet filters, which just look at the header information on each packet. But proxy servers are slower. Some product do both. Without policy management, say RSA, firewalls may not be effective because they may just be treated as stand-alone devices. The most effective security programs create layers of security.

Public key encryption:

This technologies is a powerful countmeasure for reaching all five goals of authentication, identification, privacy, integrity, and non-repudiation, but it requires significant administration. The solution has been to subscribe to a public key management service. This third party issues two keys for a person and then manages the keys. One key is the private key; it is meant to be kept secret and is used by person to both send encrypted messages and receive encrypted messages. The second key is the public key; it is made public and can thus be used by anyone to send an encrypted message to the person with the private key or to read massages from that person, and know that the sender is not an imposter.



Source: Reprinted with permission of Richard Power, "2000 CSI/FBI Computer Crime and Security Survey," Computer Security Institute, San Francisco, CA, www.gosci.com, Spring 2000.

Authentication is accomplished through a digital certificate, which is a type of online identity. As RSA explains, it is a special file issued by a public key system that attests to the authenticity of the bearer. Proof that it is legitimate occurs when that person's public key properly decodes a message sent from that person. An entire industry has grown up around public key technology.

Virtual private networks:

Most offices now have a local ISP, so no matter where they are located in the world, the least costly way to create companywide networking is to utilize IP and the Internet. However, the Internet is not secure because, for one thing none of the TCP/IP protocols authenticates the communicating parties.

One approach to security has been to obtain virtual private network, (VPN) from a CLEC or ISP. A VPN runs over a private IP network, so it is more affordable than leased lines, and it is secure. VPNs use "tunnelling" technology and encryption to keep data secure as it is transmitted.

Tunnelling creates a temporary connection between a remote computer and the CLEC's or ISP's local data centre, which blocks access to anyone trying to intercept message sent over that link. Encryption scrambles the message before it is sent, using an encryption algorithm and then decodes it at the receiving end. While in transit, it cannot be read or changed; hence, it is protected.

VPNs can be used in three ways according to price waterhouseCoopers.

1. ***Remote access VPNs*** gives remotes employee a way to access an enterprise's intranet securely by dialling a specific ISP, generally a large one with local telephone numbers in many cities. The ISP establishes a secure tunnel through its network to the corporate network, where the user can access e-mail and the intranet. This option offloads network, management to the ISP, something most IP executive want to do.
2. ***remote offices VPNs*** give enterprises a way to create a secure private network with remote offices. The ISP's VPN equipment encrypts all transmissions.
3. ***Extranet VPNs*** give enterprise a way to conduct e-business with trading partners, advisers (such as legal firms), suppliers, ISP, which then establishes a secure link to the extranet.

As an example of using a VPN, consider Plymouth Rock Assurance Corporation.

4.0 CONCLUSION

Conclusively, it is too costly to provide all the security a company wants and performing security checks on packets takes a lot of processor power, which can slow down performance. Ever with world-class technical security, management needs to make sure all employees follow security policies because companies are only as safe as their weakest link.

In fact, that weakest link could be a supplier or contractor who has secure across to a company's system, yet has poor security of its own. The final thought, security is as much a human problem as a technical problem.

5.0 SUMMARY

People view security on the interest as a war of escalation. Every few weeks someone finds a clever new way to penetrate software and a new type of attack is launched. Once the security team has closed one hole, attackers will find and attack another. The best the security team can hope to achieve is to defer attackers by closing more and more holes. The security needs constantly "to check and locks", which it does in the following way:

- The team keeps track of the latest bugs found in the systems
- The team keeps up-to-date on the latest security attacks that have taken place around the world by subscribing to security organisations and constantly visiting their website for the latest news.
- The team subscribes to hacker e-mail lists and bulletin boards to see what the bad guys are doing and talking about.
- The team logs and monitors all incoming and outgoing traffic
- A senior security checks to ensure that no servers are running known compromised software.

6.0 TUTOR MARKED ASSIGNMENT

1. Describe the give pillars of information security.
2. What ways does the Internet Service Company checks it locks?

7.0 **REFERENCE/FURTHER READING**

"A guide to Security Technologies," RSA Security Inc, Bedford, MA 01730, www.rsasecurity.com, 1999.

UNIT4: DISASTER RECOVERY FOR DISTRIBUTED SYSTEMS

1.0 INTRODUCTION

Although information systems are just one part of a company operation, they have become a crucial part. Thus; disaster recovery for information systems is imperative. Disaster recovery practitioners agree that:

- Contingency planning needs to be an integral part of doing business
- Commitment of resources to a disaster recovery process must be based on an assessment by top management of cost versus risk. Infact, two options for disaster recovery in most companies will be treated inn the unit

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Explain internal resources for disaster recovery
- Explain external resources for disaster recovery

3.0 USING INTERNAL RESOURCES

Organizations that can rely on internal resources for disaster recovery generally see this planning as a normal part of system planning and development. They cost-justify backup processing and telecom based on company needs during foreseeable emergencies. We found companies using the following approaches to backing up their computer systems, data, and communication links with company resources.

- Multiple data centres
- Distributed processing
- Backup telecom facilities
- Local area networks

Multiple Data Centres.

Organizations with large IT budget have had multiple computer centres, although less so now with consolidation and outsourcing. These centres can provide at least some emergency backup for critical services. Organizations that do not have

multiple data centres have backup telecom equipment and links to outside disaster recovery centres and service bureaus from their various operating site.

For backing up data, companies create protected disk storage facilities, sometimes called direct access data storage, or "DASD farms." These farms are regularly refreshed with current operating data to speed recovery at an alternate data center. They are normally company owned, unattended sites, and remote from the primary data centre. They house disk controllers and disk drive that can be accessed either online or in batch mode.

Distributed processing.

Other organizations use distributed processing to deal with disaster recovery. They perform critical processing locally rather than at a data center so that operations can continue uninterrupted when a disaster hits a data center. Companies that use this approach standardize hardware and applications at remote locations, so that each local processing site can provide backup for others.

Distributed processing solution to disaster recovery can be quite costly when data redundancy between central and remote sites is required. Therefore, this alternative is most commonly used for application that must continue to operate, such as order entry and financial transaction systems. Until true distributed database technology be comes available, files cannot be distributed cost effectively.

Backup telecom facilities.

Companies appear to be handling telecom in two ways (1) by building duplicate communications facilities, and (2) by using alternate technologies that they redeploy in case of an emergency.

Depository Trust Company (DTC) of New York City is a cooperative owned by financial industry clients. It serves as a clearing house for the settlement of securities trades, and provides services to the banking and brokerage industry. The company uses Sungard Disaster Recovery Service facilities for processing backup. DTC operates a large telecom network, linking its users at remote site to

its data centre in New York City through leased and dial-up lines. DTC is expanding its network with a complete duplicate backup communication centre at an alternate location in New York City. This centre includes duplicate line telecom switches, modems, and multiplexors that can be quickly linked to disaster recovery facilities at Sungard to keep the remote sites online if the corporate computer centre becomes in operable.

Other companies turn to alternate communication technology when their communication links fail, such as when the infamous Hinsdale fire destroyed the Hinsdale Illinois Bell Telephone Company central office switching station. The station handled 118,800 long distances lines, 30,000 data lines, and 35,000 local voice lines, reported Jeff Bozman. It served as a hub for some 30 local exchanges in northeastern Illinois. The fire disrupted telephone service to the area for four weeks. Local companies used at least two alternative technologies to handle their telecommunications needs in this emergency.

Crockett reported that MONY Financial Services in Syracuse, New York, switched a satellite link from its smaller San Juan, Puerto Rico, office to its large Hinsdale office by installing a very small aperture terminal (VSAT) dish on the roof. It was used to communicate via satellite to a communication hub in New York City, and from there via lines to Syracuse. The San Juan office then instituted its own communication backup plan: using terrestrial lines to communicate to Syracuse.

Zurich Insurance Company in Schaumburg, Illinois, used a different alternative, reported Crockett. They established a line-of-site microwave link between their headquarters office and an AT&T switching office located about two miles away. A number of companies turned to microwave to bypass the Hinsdale centre. Crockett reports that 38 temporary microwave links were establish either by AT&T or MCI in the Chicago area.

One way to avoid being dependent on one switching office is to have communication links to two local switching centres. This option appeared

unnecessary and too expensive for many companies, until the Hinsdale fire. More recent outrage, especially in New York City, have made most top executive aware of the danger of depending on one common carrier.

Local area network.

Server on one LAN can be used to backup servers for other networks. As with mainframe DASD farms, data servers used for such backup need to be refreshed on a regular basis to keep their data up-to-date. Keeping up-to-data is accomplished by linking the networks through shared cabling. Network master control programs permit designating alternate devices when primary ones fail.

Using External Resources

In many cases, a cost-versus-risk analysis may not justify committing permanent resources to contingencies; therefore, companies use the services of a disaster recovery firm. These services include:

- Integrated disaster recovery services
- Specialized disaster recovery services

Online and off-line data storage facilities

Integrated disaster recovery services.

In North America, major suppliers of disaster recovery services offer multiple recovery sites interconnected by high-speed telecom lines. Services at these locations include fully operational processing facilities that are available on less-than-24-hours notice. These suppliers often have environmentally suitable storage facilities for housing special equipment for their client.

Subscription fees for access to fully operational facilities are charged on a per month basis. Actual use of the centre is charged each time a disaster is declared. Mobile facilities, with a mobile trailer containing computer equipment, can be moved to a client site and are available at costs similar to fully operational facilities. And empty warehouse space can be rented as well.

Recognizing the importance of telecom links, major disaster recovery suppliers have expanded their offerings to include smaller sites allow users to maintain telecom services when disaster recovery facilities are in use. They house control equipment and software needed to support communication lines connecting recovery sites with client sites.

Needless to say companies now in the business of hosting corporate Web sites also handle disaster recovery for those sites.

Specialized disaster recovery services:

Some suppliers of backup services can accommodate mainframe clients who also need to backup services can accommodate mainframe client who also need to back up midrange machines. In addition, a growing number of backup services are designed solely for midrange systems. Some will even deliver a trailer with compatible hardware and software to a client location.

Telecommunications backup has become an important consideration in many companies. In the United States, some of the regional Bell operating companies offer a type of recovery service, through network reconfiguration, where network administrators at user sites can reroute their circuits around lines with communication problems.

Other specialized telecom backup services are beginning to appear. For example, Hughes Network Systems, in Germantown, Maryland, helped a company that had 49 of its pharmacies affected by the Hinsdale telephone switching station fire. Within 72 hours, Hughes installed a temporary network of VSATs at 12 sites. The 37 remaining sites had small satellite dishes installed within two weeks. Other firms offer data communications backup programs, where they will store specific data communications equipment for a customer and deliver that equipment by air to the customer's recovery site when needed.

Online and off-line data storage:

Alternate locations for storage of tapes and other records have long been a part of disaster planning. Services generally consist of fire-resistant vaults with suitable

temperature and humidity controls. Several suppliers offer “electronic vaulting” for organizations that need to have current data off-site at the time a disaster occurs. These suppliers use two methods to obtain current data from their client. One method uses computer-computer transmission of data on a scheduled basis. The other uses dedicated equipment to capture and store data at a remote location as it is created on the client’s computer. This latter method assures uninterrupted access to data from an operationally ready disaster recovery facility selected by the client.

In summary, when the disaster recovery ends do not shape the architecture of an architecture of an enterprise’s computer system’s, the cost of configuring the systems to provide the needed redundancy and backup can be prohibitive. In these cases, external backup alternatives may be more a more cost-effective form of “insurance.” For e-business, however, mere backup capability does not suffice. Disaster recovery must be an integral part of the system design because companies need immediate roll-over to backup facilities when operations are interrupted.

4.0 CONCLUSION

- Six lessons learn from disasters, which it offers as recommendations to others are:
- Consider the risks of a natural disaster in selecting a data center location. Areas with high exposure to flooding, heavy rainfall, fire hazards and earthquakes will be more costly to protect against these risks
- Create a plan to return to the primary site after the disaster. This plan is just as important as a plan to move an alternate site.
- Do not expect damaged equipment, disks and tapes to original condition. Therefore make plans for new configurations, and regularly monitor sources of equipment and supplies to assure early delivery of replacement.

- Test hot-site resources under full workload conditions to ensure that sufficient computer capacity is available to meet high priority needs.
- Plan for alternate telecommunication routing for multiple-site operations during a disaster
- Maintain critical data at the alternate site at another nearby location for fast system recovery.

5.0 SUMMARY

Finally disaster recovering is one of the important operational issues. Besides, it is an integral part of the system design.

6.0 TUTOR MARKED ASSIGNMENT

- Explain internal disaster recovery
- Explain external disaster recovery

7.0 REFERENCES/FURTHER READING

Comdisio Disaster Recovery Services at www.comdisco.com .

MODULE 6: OPERATION RESEARCH AND THE TOP INFORMATION SYSTEM JOB.

Unit 1: Mathematical Programming

Unit 2: Where is the Information System Department Headed?

Unit 3: The CID's Responsibilities

UNIT 1: MATHEMATICAL PROGRAMMING/LINEAR PROGRAMMING

1.0 Introduction

2.0 Objectives

1.0 INTRODUCTION

Operations research employed mathematical models to better analyze and understand specific problems. Assistance for decision making was the domain of management scientists and operations researchers who created structured models, for which computers served primarily as computation engines.

2.0 OBJECTIVES

At the end of this unit, you should be able to

- Understand the mathematical programming involved in operation research
- Identify the Chief Information Officer's (CIO's) responsibilities
- Explain the benefits of information technology.

3.1 OPTIMIZATION PROBLEMS

In an optimisation problem one seeks to maximize or minimize a specific quantity, called the objective, which depends on a finite number of input variables may be independent of one another, or they may be related through one or more constraints.

Example 1.1 The Problem

$$\text{Minimize: } Z = x^{2}/_{1} + x^{2}/_{2}$$

$$\text{Subject to: } x_1 - x_2 = 3$$

$$x_2 \geq 2$$

Is an optimization problem for the objective Z. The input variables are x_1 and x_2, which constrained in two ways: x_1 must exceed x_2 by 3, and also, must be greater or equal to 2. it is desired to find values for the input variables which minimize the sum of their squares, subject to the limitations imposed by the constraints.

A *mathematical program* is an optimization problem in which the objective and constraints are given as mathematical functions and functional

relationships (as they are in Example 1.1). Mathematical programs treated in this book have form

$$
\begin{array}{lll}
\text{Optimize:} & Z = f(x_1, x_2, \ldots x_n) & \\
\text{Subject to:} & g_1(x_1, x_2, \ldots x_n) \; \left\{ \begin{array}{c} \leq \\ = \\ \geq \end{array} \right. & b_1 \\
& g_2(x_1, x_2, \ldots x_n) \quad \leq & b_2 \\
& \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad = & \ldots \qquad (1.1) \\
& g_m(x_1, x_2, \ldots x_n) & b_m
\end{array}
$$

Each of the m constraint relationships in (1.1) involves one of the three signs ≤, =, ≥. Unconstrained mathematical programs are covered by the formalism (1.1) if each function g_1, is chosen as zero and each constant b_1 is chosen as zero.

Linear Programs

A mathematical program (1.1) is linear if $f(x_1, x_2, \ldots x_n)$ and each g_1 $(x_1, x_2, \ldots x_n)$ $(I = 1, 2 \ldots, m)$ are linear in each of their arguments – that is, if

$$f(x_1, x_2 \ldots x_n) = c_1 x_1 + c_2 x_2 + \text{---} + c_n x_n \qquad (1.2)$$

$$g_1(x_1, x_2 \ldots x_n) = a_{i1} x_1 + a_{i2} x_2 + \text{---} + a_{i1} x_n \qquad (1.3)$$

where C_j and a_{ij} (I = 1, 2 …., m; j = 1, 2, ….., n) are known constants.

Any other mathematical program is nonlinear. Thus example 1.1 describes a nonlinear program, in view of the from of z

Integer Programs

An *integer program* is a linear program with the additional restriction that the input variable be integers. It is not necessary that the coefficients in (1.2) and (1.3), and the constants in (1.), also be integers, but this will very be the case.

Quadratic Programs

A *quadratic program* is a mathematical program in which each constraint is linear – that is, each constraint function has the form *(1.3)* – But the objective is of the form

$$f(x_1, x_2 \ldots\ldots, x_n) = \sum_{i=1}^{n} \sum_{j=1}^{n} c_{ij} x_i x_j + \sum_{j=1}^{n} d_i x_i \qquad (1.4)$$

Where C_{ij} and d_i are known constants.

The program given in example 1.1 is quadratic. Both constraints are linear, and the objective has the form (1.4), with n = 2 (two variables), $C_{11} = 1$, $C_{1\,2} = 0$, $C_{2\,2} = 1$, and $d_1 = d_2 = 0$.

Problem Formulation

Optimization problem most often are stated verbally. The solution procedure is to model the problem with a mathematical program and then solve the program by the techniques described in this unit. The following approach is recommended for transforming a word problem into a mathematical program:

STEP 1: Determine the quantity to be optimized and express it as a mathematical function. Doing so serves to define the input variables.

STEP 2: Identify all stipulated requirements, restrictions, and limitations, and express them mathematically. These requirements, constitute the constraints.

STEP 3: Express any hidden conditions. Such conditions are not stipulated explicitly in the problem but are apparent from the physical situation being modelled. Generally they involve non-negativity or integer requirements on input variables

Solution Convention

In any mathematical program, we seek a solution. If a number of equally optimal solutions exist, then any one will do. *There is no preference between equally optimal solutions if there is no preference stipulated in the constraints.*

Solved Problems

1.1 The Village Butcher Shop traditionally makes its meat loaf from a combination of lean ground beef and ground pork. The ground beef contains 80 percent meat and 20 percent fat, and costs the shop 80$ per pound; the ground pork contains 68 percent meat and 32 percent fat, and costs 60$ per pound. How much of each kind of meat should the shop use in each pound of meat loaf if it wants to minimize its cost and to keep the fat content of the meat loaf to no more than 25 percent?

The objective is to minimize the cost (in dollars), z, of a pound of meat loaf, where z = 80 times the poundage of ground beef used plus 60 times the poundage of ground pork used

Defining

x_1 = poundage of ground beef used in each pound of meat loaf

x_2 = poundage of ground pork used in each pound of meat loaf

we express the objective as

$$\text{minimize:} \quad z = 80x_1 + 60x_2 \qquad (1)$$

Each pound of meat loaf will contain $0.20x_1$ pound of fat contributed form the beef and $0.32x_2$ pound of fat contributed from the pork. The total fat content of a pound of meat must be no greater than 0.25 1b. Therefore

$$0.2x_1 + 0.32x_2 \leq 0.25 \qquad (2)$$

The poundage of beef and pork used in each pound of meat loaf must sum to 1; hence

$$x_1 + x_2 = 1 \qquad (3)$$

Finally, the butcher should may use negative quantities of either meat, so that two hidden constraints are $x_1 \geq 0$ and $x_2 \geq 0$. Combining these conditions with *(1), (2),* and *(3),* we obtain

$$\begin{aligned} &\text{Minimize:} && z = 80x_1 + 60x_2 \\ &\text{Subject to:} && 0.2x_1 + 0.32x_2 \leq 0.25 \qquad (4) \\ & && x_1 + x_2 = 1 \\ &\text{with:} && \text{all variables nonnegative} \end{aligned}$$

System *(4)* is a linear program. As there are only two variables, a graphical solution may be given.

1.2 Solve the linear program *(4)* of problem 1.1 graphically.

See Fig 1.1. The *feasible region* – the set of points $(x_1 + x_2)$ satisfying all the constraints, including the non-negativity conditions – is the heavy line segment in the figure. To determine z*, the minimal value of z, we arbitrarily choose values of z and plot the graphs of the associated objectives. By choosing z = 70 and then z = 75, we obtain the objectives

$$70 = 80x_1 + 60x_2 \qquad \text{and} \qquad 75 = 80x_1 + 60x_2$$

Respectively. Their graphs are the dashed lines in figure 1.1. It is seen that z* will be assumed at the upper endpoint of the feasible segment, which is the intersection of the two lines

$$0.20x_1 + 0.32x_2 = 0.25 \text{and} \qquad x_1 + x_2 = 1$$

Simultaneous solution of these equations gives $x_1^* = 7/12$, $x_2^* = 5/12$; hence,

$$Z^* = 80(7/12) = 60(5/12) = 71.67\$$$

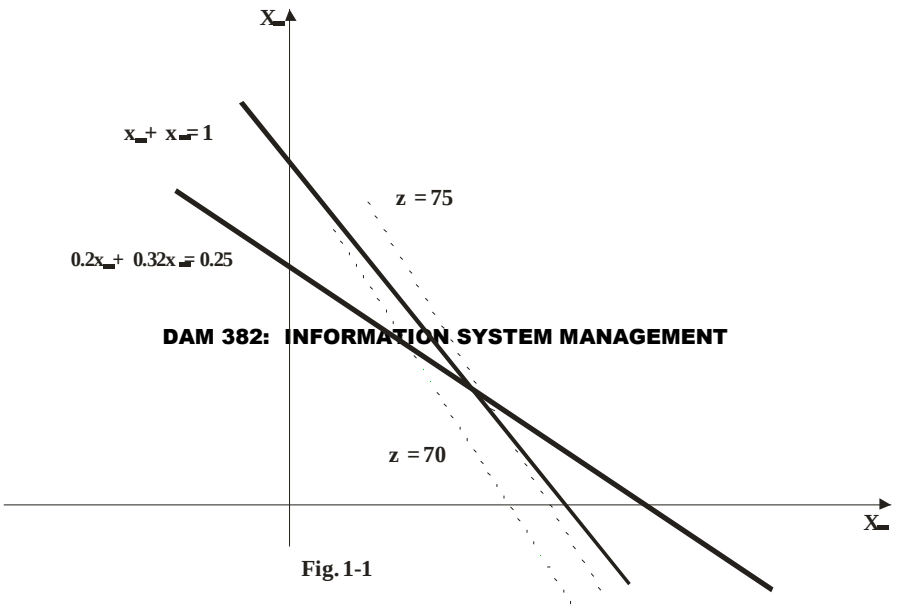


Fig. 1-1

1.3 A furniture marker has 6 units of wood and 28hrs of free time, in which he will make decorative screens. Two models have sold well in the past, so he will restrict himself to these two. He estimates that model I requires 2 units of wood and 7hrs of time, while model II requires 1 unit of wood and 8hrs of time. The prices of the models are $120 and $80, respectively, how many screens of each model should the furniture maker assemble if he wishes to maximize his revenue?

The objective is to maximize revenue (in dollars), which we denote as z:

z = 120times the number of model I screens produced plus 80 times the number of model II screens produced

Letting

x_1 = number of model I screens to be produced

x_2 =number of model II screens to be produced

we express the objective as

$$\text{maximize} \qquad z = 120x_1 + 80x_2 \qquad (1)$$

The furniture maker is subjected to a wood constraint. As each model I require 2 units of wood, $2x_1$ unit must be allocated to them; likewise, $1x_2$ units of wood must be allocated to the model II screens. Hence the wood constraints is

$$2x_1 + x_2 \leq 6 \qquad (2)$$

The furniture maker also has a time constraint. The model I screens will consume $7x_1$ hours and the model II screens $8x_2$ hours; and so

$$7x_1 + 8x_2 \leq 28 \qquad (3)$$

It is obvious that negative quantities of either screen cannot be produced, so two hidden constraints are $x_1 \geq 0$ and $x_2 \geq 0$. Furthermore, since there is no revenue derived from partially completed screens, another hidden condition is that x_1 and x_2 be integers. Combining these hidden conditions with *(1), (2)* and *(3),* we obtain mathematical program.

$$\begin{aligned} &\text{Maximize:} && z = 120x_1 + 80x_2 \\ &\text{Subject to:} && 2x_1 + x_2 \leq 6 \qquad (4) \\ & && 7x_1 + 8x_2 \leq 28 \\ &\text{With:} && \text{all variables nonnegative and integral} \end{aligned}$$

System *(4)* is an integer program. As there are only two variables, a graphical solution may be given

1.4 Give a graphical solution of the integer program *(4)* of problem 1.3.

See Fig 1-2. The feasible region is set of integer point (marked by crosses) within the shaded area. The dashed lines are the graph of the objective function when z is arbitrarily given the values 240, 330, and 380. It is seen that the z-line through the point (3.0) will furnish the desired maximum; thus, the furniture maker should assemble three model I screens and no model II screens, for a maximum revenue of

$$Z^* = 120(3) + 80(0) = \$360$$

Observe that the optimal answer is not achieved by first soling the associated linear program (the same problem without the integer constraints) and then moving to the closest integer point. In fact, the feasible region for the associated linear program is the shaded area of Fig 1-2, so the optimal solution occurs at the circled corner point. But at the closest feasible integer point, (2,1), the objective function has the value $z^* = 120(2) + 80(1) = \$320$ or \$40 less than the true optimum.

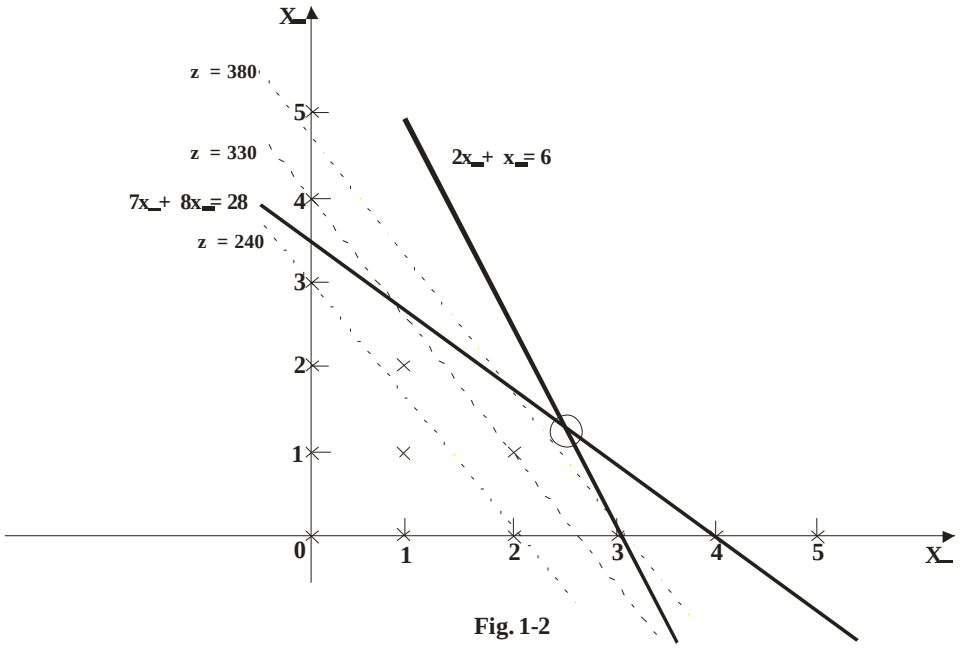


Fig. 1-2

3.2 LINEAR PROGRAMMING: BASIC CONCEPT

A method for solving linear programs involving many variables is described in 3.3. To initialize the method, one must transform all inequality constraints into equalities and must know one feasible, nonnegative solution.

Nonnegativity Conditions

Any variable not already constrained to be nonnegative is replaced by the difference of two new variables which are so constrained.

Linear constraints are of the form:

$$\sum_{j=1}^{n} a_{ij} x_j \sim b_i \qquad (2.1)$$

where ~ stands for one of the relations $\leq$, $\geq$, = (not necessarily the same one for each i). The constraints b_i may always be assumed nonnegative.

Example 2.1 The constraint $2x_1 - 3x_2 + 4x_3 \leq -5$ is multiplied by -1 to obtain $-2x_1 + 3x_2 - 4x_3 \geq -5$, which has a nonnegative right-hand side.

Slack variables and surplus variables

A linear constraint of the form $\sum a_{ij} x_j \leq b_i$ can be converted into an equality by adding a new, nonnegative variable to the left-hand side of the inequality. Such a variable is numerically equal to the difference between the right- and left-hand sides of the inequality and is known as a *slack variable.* It represents the waste involved in that phase of the system modelled by constraint.

Example 2.2 The first constraint is

$$4x_1 + 5x_2 + 3x_3 + 5x_4 \leq 30\,000$$

The left-hand side of this inequality models the total number of hours used to assemble all television console, while the right-hand side is the total number of hours available. This equality is transformed into the equation

$$4x_1 + 5x_2 + 3x_3 + 5x_4 + x_5 = 30\,000$$

by adding the slack variable x_5 to the left-hand side of the inequality. Here x_5 represents the number of assembly hours available to the manufacturer but not used.

A linear constraint of the form $\sum a_{ij} x_j \geq b_i$ can be converted into an equality by subtracting a new, nonnegative variable from the left-hand side of the inequality. Such a variable is numerically equal to the difference between the left- and right-hand sides of the inequality and is known as a *surplus variable.* It represents excess input that phase of the system modelled by the constraint.

Example 2.3 The first constraint is

$$4x_1 + 6x_2 + x_3 \leq 54$$

The left-hand side of this inequality represents the combined output of high-grade ore from three mines, while the right-hand side is the minimum tonnage of such ore required to meet contractual obligations. This inequality is transformed into equation

$$4x_1 + 6x_2 + x_3 + x_4 = 54$$

by subtracting the surplus variable x_4 from the left-hand side of the inequality. Here x_4 represents the amount of high-grade ore mined over and above that needed to fulfill the contract.

GENERATING AN INITIAL FEASIBLE SOLUTION

After all linear constraints (with nonnegative right-hand sides) have been transformed into equalities by introducing slack and surplus variables where necessary, add a new variable, called an *artificial variable,* to the left-hand side of each constraint equation that does not contain a slack variable. Each constraint equation will then contain either one slack variable or one artificial variable. A nonnegative initial solution to this new set of constraints is obtained by setting each slack variable and each artificial variable equal to the right-hand side of the equation in which it appears and setting all other variables, including the surplus variables, equal to zero.

Example 2.4 The set of constraints

$$x_1 + 2x_2 \leq 3$$

$$4x_1 + 5x_2 \leq 6$$

$$7x_1 + 8x_2 = 15$$

is transformed into a system of equations by adding a slack variable, $x_{3,}$ to the left-hand side of the first constraint and subtracting a surplus variable, $x_{4,}$ from the left-hand side of the second constraint. The new system is

$$\begin{aligned} x_1 + 2x_2 + x_3 &= 3 \\ 4x_1 + 5x_2 - x_4 &= 6 \\ 7x_1 + 8x_2 &= 15 \end{aligned} \qquad (2.2)$$

If now artificial variables x_5 and x_6 are respectively added to the left-hand sides of the last two constraints in system (2.2), the constraints without a slack variable, the result is

$$x_1 + 2x_2 + x_3 = 3$$

$$4x_1 + 5x_2 \quad - x_4 + x_5 \quad = 6$$
$$7x_1 + 8x_2 \quad + x_6 = 15$$

A *nonnegative* solution to this last system is 3, $x_5 = 6$, $x_6 = 15$, $x_1 = x_2 = x_4 = 0$. (Notice, however, that $x_1 = 0$, $x_2 = 0$ is not a solution to the original set of constraints.)

Occasionally, an initial solution can be generated easily without a full complement of slack and artificial variables. An example is 2.5.

Penalty Cost

The introduction of slack and surplus variables alters neither the nature of the constraints nor the objective. Accordingly, such variables are incorporated into the objective function with zero coefficients. Artificial variables, however, do change the nature of the constraints. Since they are added to only one side of an equality, the new system is equivalent to the old system of constraints if and only if the artificial variables are zero. To guarantee such assignments in the optimal solution (in contrast to the initial solution), artificial variables are incorporated into the objective function with very large positive coefficients in a minimization program or very large negative coefficients in a maximization program. These coefficients, denoted by either M or $-M$, where M is understood to be a large positive number, represent the (severe) penalty incurred in making a unit assignment to the artificial variables.

In hand calculations, penalty cost can be left as $\pm M$. In computer calculations, M must be assigned a numerical value, usually a number three or four times larger in magnitude than any other number in the program.

Standard Form

A linear program is in *standard form* if the constraints are all modelled as equalities and if one feasible solution is known. In matrix notation, standard form is

$$\text{Optimize:} \qquad z = \mathbf{C}^T \mathbf{X}$$

$$\text{Subject to:} \quad \mathbf{AX} = \mathbf{B} \qquad (2.3)$$

$$\text{With:} \quad \mathbf{X} \geq \mathbf{0}$$

Where **X** is the column vector if unknowns, including all slack, surplus, and artificial variables; $\mathbf{C}^T$ is the row vector of the corresponding cost; **A** is the coefficient matrix of the constraint equations; and **B** is the column vector of the right-hand sides of the constraint equations. [*Note:* In the remainder of this book, vectors will normally by represented as one-columned matrices, and we shall simply say "vector" instead of "column vector." *T* designates transposition.] If $\mathbf{X}_0$ denotes the vector of slack and artificial variables only, then the initial feasible solution is given by $\mathbf{X}_0 = \mathbf{B}$ where it is understood that all variables in **X** not included in $\mathbf{X}_0$ are assigned zero values.

Linear Dependence And Independence

A set of *m*-dimensional vectors, $\{\mathbf{P}_1, \mathbf{P}_2, \ldots, \mathbf{P}_n\}$, is linearly dependent if there exist constants $\alpha_1, \alpha_2, \ldots, \alpha_n$, not all zero, such that

$$\alpha_1 \mathbf{P}_1 + \alpha_2 \mathbf{P}_2 + \text{- - -} + \alpha_n \mathbf{P}_n = \mathbf{0} \qquad (2.4)$$

Example 2.5 The set of 5-dimenstional vectors

$$\{[1, 2, 0, 0,]^T, [1, 0, 0, 0, 0]^T, [0, 1, 0, 0, 0]^T\}$$

is linearly dependent, since

$$-1\begin{bmatrix}1\\2\\0\\0\\0\end{bmatrix} + 1\begin{bmatrix}1\\0\\0\\0\\0\end{bmatrix} + 0\begin{bmatrix}0\\0\\1\\1\\0\end{bmatrix} + 2\begin{bmatrix}0\\1\\0\\0\\0\end{bmatrix} = \begin{bmatrix}0\\0\\0\\0\\0\end{bmatrix}$$

Theorem 2.1: Every set of *m*-dimensional vectors is linearly dependent.

A set of *m*-dimensional vectors, $\{\mathbf{P}_1, \mathbf{P}_2, \ldots, \mathbf{P}_n\}$, is *linearly independent* if the only constants for which (2.4) holds are $\alpha_1 = \alpha_2 = \text{- - -} = \alpha_n = 0$. (See Problems 2.7 and 2.8.)

Convex Combinations

An *m*-dimensional vectors **P** is a *convex combination* of the *m*-dimensional vectors $\mathbf{P}_1$, $\mathbf{P}_2$, ….., $\mathbf{P}_n$ if there exist nonnegative constants β_1, β_2, ….., β_n whose sum is 1, such that

$$\mathbf{P} = \beta_1 \mathbf{P}_1 + \beta_2 \mathbf{P}_2 + - - - + \beta_n \mathbf{P}_n \qquad (2.5)$$

Example 2.6 The 2-dimensional vector $[5/3, 5/6]^T$ is a convex combination of the vectors $[1, 1]^T$, $[3.,0]^T$, and $[1, 2]^T$ because

$$\begin{bmatrix} 5/3 \\ 5/6 \end{bmatrix} = \tfrac{1}{2}\begin{bmatrix} 1 \\ 1 \end{bmatrix} + {}^1/_3 \begin{bmatrix} 3 \\ 0 \end{bmatrix} + {}^1/_6 \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

Given two *m*-dimensional vectors $\mathbf{P}_1$ and $\mathbf{P}_2$, we call the set of all convex combinations of $\mathbf{P}_1$ and $\mathbf{P}_2$ the *line segment* between the two vectors. The geometrical significant of this term is apparent in the case $m = 3$.

Convex Sets

A set of *m*-dimensional vectors is *convex* if whenever two vectors belong to the set then so too does the line segment between the vectors.

Example 2.7 The disk shaded in fig 2-1 *(a)* is a convex set since the line segment between any two of its points (2-dimensional vectors) is wholly within the disk. Figure 2-1 *(b)* is not convex; although *R* and *S* belong to the shaded set,

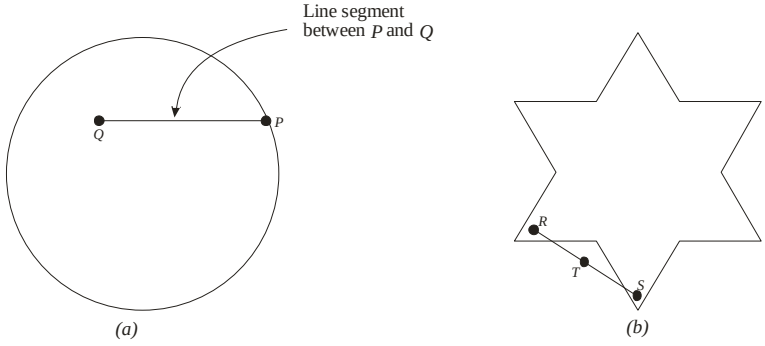


Fig. 2-1

there exist point, such as *T*, belonging to the line segment between *R* and *S* which are not part of the Star.

A vector **P** is an *extreme point* of a convex set if it cannot be expressed as a convex combination of two other vectors in the set; that is, an extreme point does not lie on the line segment between any other two vectors in the set.

Example 2.8 Any point on the circumference of the disk in Fig. 2-1 *(a)* is an extreme point of the disk

Theorem 2.2: Any vector in a closed and bounded convex set with a finite number of extreme points can be expressed as a convex combination of the extreme points.

Theorem 2.3: The solution space of a set of simultaneous linear equations is a convex set having finite number of extreme points.

Exterme-Point Solutions

Let □ designate the set of all feasible solutions to the linear program in standard form, *(2.3)*; that is □ is the set of all vectors **X** that satisfy **AX** = **B** and **X** ≥ **0**. From Theorem 2.3 and from the fact that convex sets intersect in convex sets, it follows that □ is a convex set having a finite number of extreme points.

Remark 1: The objective function attains its optimum (either maximum or minimum) at an extreme point of □, provided an optimum exist

Remark 2: If **A** has order *m* x *n* (m rows and n columns), with *m* ≤ n, then extreme points of □ have at least *n* – *n* zero components.

Basic Feasible Solutions

Denote the columns of the *m* x *n* coefficient matrix **A** in system *(2.3)* by $\mathbf{A}_1$, $\mathbf{A}_2$, ….., $\mathbf{A}_n$, respectively. Then the matrix constraint equation **AX = B** can be written in the vector form

$$x_1\mathbf{A}_1, x_2\mathbf{A}_2, \ldots\ldots, x_n\mathbf{A}_n = \mathbf{B} \qquad (2.6)$$

We emphasize that the **A**-vectors and **B** are known *m*-dimensional vectors, we wish to find nonnegative solutions for the variables $x_1, x_2 \ldots\ldots x_n$. We shall

suppose that $m \leq n$ and that rank $\mathbf{A} = m$, which means that at least one collection of m **A**- vectors is linearly independent.

A *basic feasible solution* to *(2.6)* is obtained by setting $n - m$ of the x-variables equal to zero and finding a nonnegative solution for the remaining x-variables not set equal to zero are linearly independent. The x-variables not initially set equal to zero are called *basic variables.* If one or more of the basic variables turns out to zero, the basic feasible solution is *degenerate;* if all the basic variables are positive, the basic feasible solution is *nondegenerate.*

Remarks 1 and 2 above can be strengthened as follows:

Remark 1: The objective function attains its optimum at a basic feasible solution.

Remark 2: The extreme points of □ are precisely the basic feasible solutions.

It follows that the standard linear program can be solved by seeking among the basic feasible solutions the one(s) at which the objective is optimized.

Solved Problem

2.1 Put the following program in standard matrix form:

$$\begin{aligned} \text{Minimize:} \quad & z = x_1 + x_2 \\ \text{Subject to:} \quad & x_1 - 5x_2 \leq 5 \\ & 2x_1 + x_2 \leq 4 \\ \text{with:} \quad & x_1 \text{ and } x_2 \text{ nonnegative} \end{aligned}$$

Adding slack variables x_3 and x_4 respectively to the left-hand sides of the constraints, and including these new variables with zero cost coefficients in the objective, we have

$$\begin{aligned} \text{Minimize:} \quad & z = x_1 + x_2 + 0x_3 + 0x_4 \\ \text{Subject to:} \quad & x_1 + 5x_2 + x_3 = 5 \qquad (1) \\ & 2x_1 + x_2 \qquad x_4 = 4 \\ \text{with:} \quad & \text{all variables nonnegative} \end{aligned}$$

Since each constraint equation contains a slack variable, no artificial variables are required; an initial feasible solution is $x_3 = 5$, $x_4 = 4$, $x_1 = x_2 = 0$. System *(1)* is in the standard form *(2.3)* if we define.

$$\mathbf{X} = [x_1, x_2, x_3, x_4]^T \qquad C = [1, 1, 0, 0]^T$$

$$\mathbf{A} = \begin{bmatrix} 1 & 5 & 1 & 0 \\ 2 & 1 & 1 & 1 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 5 \\ 4 \end{bmatrix} \qquad \mathbf{X}_0 = \begin{bmatrix} x_3 \\ x_4 \end{bmatrix}$$

2.1 Put the following program in standard form:

Minimize: $z = 80x_1 + 60x_2$

Subject to: $0.2x_1 + 0.32x_2 \leq 0.25$

$x_1 + x_2 = 1$

with: x_1 and x_2 nonnegative

To convert the first constraint into equally, add s slack variable x_3 to the left-hand side. Since the second constraint, an equation, does not contain a slack variable, add an artificial x_4 to its left-hand side. Both new variables are included in the objective function, the slack variables with a zero cost coefficient and the artificial variable with a very large negative cost coefficient, yielding the program

Minimize: $z = 80x_1 + 60x_2 + 0x_3 - Mx_4$

Subject to: $0.2x_1 + 0.32x_2 + x_3 = 0.25$

$x_1 + x_2 + x_4 = 1$

with: all variables nonnegative

This program is in standard form, with an initial feasible solution $x_3 = 0.25$, $x_4 = 1$, x_1, $= x_2 = 0$

2.3 Redo Problem 2.2 if the objective is to be minimized

The only change is in the coefficient associated with the artificial variable; it becomes + *M* instead of – *M*.

2.4 Put the following program in standard form:

Minimize: $z = 5x_1 + 2x_2$

Subject to: $6x_1 + x_2 \geq 6$

$$4x_1 + 3x_2 \geq 12$$

$$x_1 + 2x_2 \geq 4$$

with: x_1 and x_2 nonnegative

Subtracting surplus variables x_3, x_4, and x_5, respectively, from the left-hand sides of the constraints, and including each new variables with a zero cost coefficient in the objective, we obtain

Minimize: $z = 5x_1 + 2x_2 + 0x_3 + x_4 + x_5$

Subject to: $6x_1 + x_2 - x_3 = 6$

$4x_1 + 3x_2 - x_4 = 12$

$x_1 + 2x_2 - x_5 = 1$

with: all variables nonnegative

Since no constraint equation contains a slack variable, we next add artificial variables x_6, x_7, and x_8, respectively, to the left-hand sides of the equations. We also include these variables with very large negative cost coefficients in the objective. The program becomes

Minimize: $z = 5x_1 + 2x_2 + 0x_3 + 0x_4 + 0x_5 - Mx_6 - Mx_7 - Mx_8$

Subject to: $6x_1 + x_2 - x_3 + x_6 = 6$

$4x_1 + 3x_2 - x_4 + x_7 = 12$

$x_1 + 2x_2 - x_5 + x_8 = 1$

with: all variables nonnegative

This program is in standard form, with an initial feasible solution $x_6 = 6$, $x_7 = 12$, $x_8 = 4$, $x_1 = x_2 = x_3 = x_4 = x_5 = 0$.

2.5 Put the following program in standard matrix form:

Minimize: $z = x_1 + 2x_2 + 3x_3$

Subject to: $3x_1 + 4x_3 \leq 5$

$5x_1 + x_2 + 6x_3 = 7$

$8x_1 + 9x_3 \geq 2$

with: all variables nonnegative

Adding a slack variable x_4 to the left-hand side of the first constraint, subtracting a surplus variable x_5 from the left-hand side of the third constraint, and then adding an artificial variable x_6 only to the left-hand side of the third constraint, we obtain the program

$$\begin{aligned} \text{Minimize:} \quad & z = x_1 + 2x_2 + 3x_3 + 0x_4 + 0x_5 + Mx_6 \\ \text{Subject to:} \quad & 3x_1 + 4x_3 + x_4 = 5 \\ & 5x_1 + x_2 + 6x_3 = 7 \\ & 8x_1 + 9x_3 - x_5 + x_6 = 2 \end{aligned}$$

with: all variables nonnegative

This program is in standard form, with an initial feasible solution $x_4 = 5$, $x_2 = 7$, $x_6 = 2$, $x_1 = x_3 = x_5 = 0$. It has the form of system *(2.3)* if we define

$$\mathbf{X} \equiv [x_1, x_2, x_3, x_4, x_5, x_6]^T \qquad \mathbf{C} \equiv [1, 2, 3, 0, 0, M]^T$$

$$\mathbf{A} \equiv \begin{bmatrix} 3 & 0 & 4 & 1 & 0 & 0 \\ 5 & 1 & 6 & 0 & 0 & 0 \\ 8 & 0 & 9 & 0 & -1 & 1 \end{bmatrix} \qquad \mathbf{B} \equiv \begin{bmatrix} 5 \\ 7 \\ 2 \end{bmatrix} \qquad \mathbf{X}_0 \equiv \begin{bmatrix} x_4 \\ x_2 \\ x_6 \end{bmatrix}$$

In this case x_2 can be used to generate the initial solution rather than adding an artificial variable to the second constraint to achieve the same result. In general, whenever a variable appears in one and only one constraint equation, and there with a positive coefficient, that variable can be used to generate part of the initial solution by first dividing the constraint equation by the positive coefficient and then setting the variable equal to the right-hand side of the equation; an artificial variable need not be added to equation.

2.6 Putting the following program in standard form:

$$\begin{aligned} \text{Minimize:} \quad & z = 25x_1 + 30x_2 \\ \text{Subject to:} \quad & 4x_1 + 7x_3 \leq 1 \\ & 8x_1 + 5x_2 \geq 7 \\ & 8x_1 + 9x_3 \geq -2 \end{aligned}$$

with: all variables nonnegative

Since both x_1 and x_2 are unrestricted, we set $x_1 = x_3 - x_4$ and $x_2 = x_5 - x_6$, where all four new variables are required to be nonnegative. Substituting these quantities into the giving program and then multiplying the last constraint by – 1 to force a nonnegative right-hand side, we abtain the equivalent program:

Minimize: $z = 25x_3 - 25x_4 + 30x_5 - 30x_6$

Subject to: $4x_3 - 4x_4 + 7x_5 - 7x_6 \geq 1$

$8x_3 - 8x_4 + 5x_5 - 5x_6 \geq 3$

$-6x_3 + 6x_4 - 9x_5 + 9x_6 \leq 2$

with: all variables nonnegative

This program is converted into standard form by subtracting surplus variables x_7 and x_8, respectively, from the left-hand sides of the first two constraints; adding a slack variable x_9 to the left-hand side of the third constraint; and then adding artificial variables x_{10} and x_{11}, respectively, to the left-hand sides of the first two constraints. Doing so, we obtain

Minimize: $z = 25x_3 - 25x_4 + 30x_5 - 30x_6 + 0x_7 + 0x_8 + 0x_9 + Mx_{10} + Mx_{11}$

Subject to: $4x_3 - 4x_4 + 7x_5 - 7x_6 - x_7 + x_{10} = 1$

$8x_3 - 8x_4 + 5x_5 - 5x_6 - x_8 + x_{11} = 3$

$-6x_3 + 6x_4 - 9x_5 + 9x_6 + x_9 = 2$

with: all variables nonnegative

An initial solution to the program in standard form is

$x_{10} = 1 \quad x_{11} = 3 \quad x_9 = 2 \quad x_3 = x_4 = x_5 = x_6 = x_7 = x_8 = 0$

3.3 LINEAR PROGRAMMING: THE SIMPLEX AND THE DUAL SIMPLEX METHODS.

The Simplex Tableau

The *simplex method* is a matrix procedure for solving linear programs in the standard form

$$\begin{aligned} \text{optimize:} \quad & z = \mathbf{C}^T \mathbf{X} \\ \text{subject to:} \quad & \mathbf{AX} = \mathbf{B} \\ \text{with:} \quad & \mathbf{X} \geq \mathbf{0} \end{aligned}$$

where $\mathbf{B} \geq \mathbf{0}$ and a basic feasible solution $\mathbf{X_0}$ is known. Starting with $\mathbf{X_0}$, the method locates successively other basic feasible solutions having better values of the objective, until the optimal solution is obtained. For minimization programs, the simplex method utilizes Tableau 3-1, in which $\mathbf{C_0}$ designates the cost vector associated with the variables in $\mathbf{X_0}$.

		$\mathbf{X}^T$	
		$\mathbf{C}^T$	
$\mathbf{X}_0$	$\mathbf{C}_0$	$\mathbf{A}$	$\mathbf{B}$
		$\mathbf{C}^T - \mathrm{C}^T_0\mathbf{A}$	$-\mathrm{C}^T_0\mathbf{B}$

Tableau 3-1

For maximization programs, Tableau 3-1 applies if the elements of the bottom row have their *signs reversed*.

Example 3.1: For the minimization program of problem 2.5, $\mathrm{C}_0 = [0, 2, M]^T$.

Then

$$\mathbf{C}^T - \mathrm{C}^T_0\mathbf{A} = [1, 2, 3, 0, 0, M] - [0, 2, M]\begin{bmatrix} 3 & 0 & 4 & 1 & 0 & 0 \\ 5 & 1 & 6 & 0 & 0 & 0 \\ 8 & 0 & 9 & 0 & -1 & 1 \end{bmatrix}$$

$$= [1, 2, 3, 0, 0, M] - [10 + 8M, 2\ 12, + 9M, 0, -M, M] = [-9 - 8M, 0, 9 - 9M, 0, M, 0]$$

$$-\mathrm{C}^T_0\mathbf{B} = -[0, 2, M]\begin{bmatrix} 5 \\ 7 \\ 2 \end{bmatrix} = -14 - 2M$$

and Tableau 3-1 becomes

		x_1	x_2	x_3	x_4	x_5	x_6	
		1	2	3	0	0	M	
x_4	0	3	0	4	1	0	0	5
x_2	2	5	1	6	0	0	0	7
x_6	M	8	0	9	0	–1	1	2
		$-9 - 8M$	0	$-9 - 9M$	0	M	0	$-14 - 2M$

A Tableau Simplification

For each j ($j = 1, 2, \ldots, n$), define $z_j \equiv C^T_0 \mathbf{A}_j$, the dot product of C_0 with the j th column of **A**. The j th entry in the last row of Tableau 3-1 is $c_j - z_j$ (or, for a maximization program, $z_j - c_j$), where c_j is the cost in the second row of the tableau, immediately above $\mathbf{A}_j$. Once this last row has been obtained, the second row and second column of the tableau, corresponding to $\mathbf{C}^T$ and $\mathbf{C}_0$, respectively, become superfluous and may be eliminated.

The Simplex Method

STEP 1: Locate the most negative number in the bottom row of the simplex tableau, excluding the last column, and call the column in which this number appears the *work column.* If more than one candidate for most negative numbers exists, choose one.

STEP 2: Form ratios by dividing each *positive* number in the work column, excluding the last row, into the element in the same row and last column. Designate the element in the work column that yields the *smallest* ratio as the *pivot element*. If more than one element yields the same smallest ratio, choose one. If no element in the work column is positive, the program has no solution.

STEP 3: Use elementary row operations to convert the pivot element to 1 and then to reduce all *other* elements in the work column to 0.

STEP 4: Replace the *x*-variable in the pivot row and first column by the *x*-variable in the first row and pivot column. This new first column is the current set of basic variables.

STEP 5: Repeat Step 1 through 4 until there are no negative numbers in the last row, excluding the last column.

STEP 6: The optimal solution is obtained by assigning to each variable in the first column that value in the corresponding row and last

column is current. All other variables are assigned the value zero. The associated z^*, the optimal value of the objective function, is the number in the last row and last column for a maximization program, but the *negative* of this number for a minimization program.

MODIFICATIONS FOR PROGRAMS WITH ARTIFICAL VARIABLES

Whenever artificial variables are part of the initial solution $\mathbf{X}_0$, the last row of Tableau 3-1 will contain the penalty cost *M*. To minimize round off error , the following modifications are incorporated into the simplex method; the resulting algorithm is the *two – phase method.*

Change 1: The last row of Tableau 3-1 decomposed into rows, the first of which involves those terms not containing *M,* while the second involves the coefficients of *M* in the remaining terms.

Example 3.2: The last row of the tableau in Example 3.1 is

$$-9-8M \quad 0 \quad -9-9M \quad 0 \quad M \quad 0 \quad -14-2M$$

Under Change 1 it would be transformed into the two rows

$$\begin{array}{cccccccc} -9 & 0 & -9 & 0 & 0 & 0 & -14 \\ -8 & 0 & -9 & 0 & 1 & 0 & -2M \end{array}$$

Change 2: Step 1 of the simplex method is applied to the last row created in Change 1 (followed by Steps 2, 3, and 4), until this row contains no negative elements. Then Step 1 is applied to those elements in the next-to-last row that are positioned over zero in the last row.

Change 3: Whenever an artificial variables cases to be basic – ie., is removed from the first column of the tableau as a result of Step 4 – it is deleted from the top row of the tableau, as is the entire column under it. (This modification simplifies hand calculations but is not implemented in many computer programs.)

Change 4: The last row can be deleted from the tableau whenever it contains all zero.

Change 5: If *nonzero* artificial variables are present in the final basic set, then the program has no solution. (In contrast, zero-valued artificial variables may appear as basic variables in the final solution when one or more of the original constraint equations is redundant.)

THE DUAL SIMPLEX METHOD

The (regular) simplex method moves the initial feasible but non-optimal solution to an optimal solution while maintaining feasibility through an iterative procedure. On the other hand, the dual simplex method moves the initial optimal but infeasible solution to a solution while maintaining optimality through an iterative procedure.

Iterative Procedure of the Dual Simplex Method:

STEP 1: Rewrite the linear programming problem by expressing all the constraints in $\leq$ form and transforming them into equations through slack variables.

STEP 2: Exhibit the above problem in the form of a simplex tableau. If the optimality condition is satisfied *and* one or more basic variables have negative values, the dual simplex method is applicable.

STEP 3: Feasibility Condition: The basic variable with the most negative value becomes the departing variable (D.V.). Call the row in which this appears the work row. If more than one candidate for D.V. exists, choose one.

STEP 4: Optimally Condition: Form ratios by dividing all but the last element of the last row of $c_j - z_j$ values (minimization problem) or the $z_j - c_j$ values (maximization problem) by the corresponding negative coefficients of the work row. The nonbasic variable with the smallest absolute ratio becomes the entering variables (E.V). Designate this element in the work row as the pivot element and the corresponding column the work row is negative, the problem has no feasible solution.

STEP 5: Use elementary row operations to convert the pivot element to 1 and then to reduce all the other elements in the work column to zero.

STEP 6: Repeat Step 3 through 5 until there are no negative values for the basic variables.

Solved Problems

3.1

maximise: $z = x_1 + 9x_2 + x_3$

subject to: $x_1 + 2x_2 + 3x_3 \leq 9$

$3x_1 + 2x_2 + 2x_3 \leq 15$

with: all variables nonnegative

This program is put into matrix standard form by first introducing slack variables x_4 and x_5 in the first and second constraint inequality, respectively, and then defining

$$\mathbf{X} \equiv [x_1, x_2, x_3, x_4, x_5]^T \qquad \mathbf{C} \equiv [1, 9, 1, 0, 0]^T$$

$$\mathbf{A} \equiv \begin{bmatrix} 1 & 2 & 3 & 1 & 0 \\ 3 & 2 & 2 & 0 & 1 \end{bmatrix} \quad \mathbf{B} \equiv \begin{bmatrix} 9 \\ 15 \end{bmatrix} \quad \mathbf{X}_0 \equiv \begin{bmatrix} x_4 \\ x_5 \end{bmatrix}$$

The costs associated with the components of $\mathbf{X}_0$, the slack variables, are zero; hence $\mathbf{C}_0 \equiv [0, 0]^T$. Tableau 3-1 becomes

		x_1	x_2	x_3	x_4	x_5	
		1	9	1	0	0	
x_4	0	1	2	3	1	0	9
x_5	2	3	2	2	0	1	15

To compare the last row of this tableau, we use the tableau simplification and calculate each z_j by inspection; it is the dot product of column 2 and the j th column of **A**. We then subtract the corresponding cost c_j from it (maximization program). In this case, the second column is zero, and so $z_j - c_j = 0 - c_j = - c_j$. Hence, the bottom row of the tableau, excluding the last element, is just the

negative of row 2. The last element in the bottom row is simply the dot product of column 2 and the final, **B**-column, and so it too is zero. At this point, the second row and the second column of the tableau are superfluous. Eliminating them, we obtain Tableau 1 as the complete initial tableau.

	x_1	x_2	x_3	x_4	x_5	
x_4	1	2	3	1	0	9
x_5	3	2	2	0	1	15
$(z_j - c_j)$:	–1	– 9	– 1	0	0	0

Tableau 1

	x_1	x_2	x_3	x_4	x_5	
x_2	1/2	1	2/2	1/2	0	9/2
x_5	2	0	– 1	– 1	1	6
	7/2	0	25/2	9/2	0	81/2

Tableau 2

We are now ready to apply the simplex method. The most negative element in the last row to Tableau 1 is – 9, corresponding to the x_2- column; hence this column becomes the work column. Forming the ratios 9/2 = 4.5 and 15/2 = 7.5, we find that the element 2, marked by the asterisk in Tableau 1, is the pivot element, since it yields the smallest ratio. Then, applying Steps 3 and 4 to Tableau 1, we obtain Tableau 2. Since the last row of Tableau 2 contains no negative elements, it follows from step 6 that the optimal solution is $x^*_2 = 9/2$, $x^*_5 = 6$, $x^*_1 = x^*_3 = x^*_4 = 0$, with $z^* = 81/2$.

3.2

minimize : $z = 80x_1 + 60x_2$

subject to: $0.20x_1 + 0.32x_2 \leq 0.25$

$x_1 + x_2 = 1$

with: x_1 and x_2 nonnegative

Adding a slacking variable x_3 and an artificial variable x_4 to the first and second constraints, respectively, we convert the program to standard matrix form with

$$\mathbf{X} = [x_1, x_2, x_3, x_4]^T \qquad \mathbf{C} = [80, 60, 0, M]^T$$

$$\mathbf{A} = \begin{bmatrix} 0.20 & 0.32 & 1 & 0 \\ 1 & 1 & 0 & 1 \end{bmatrix} \qquad \mathbf{B} = \begin{bmatrix} 0.20 \\ 1 \end{bmatrix} \qquad \mathbf{X}_0 = \begin{bmatrix} x_3 \\ x_4 \end{bmatrix}$$

Substituting these matrices, along with $\mathbf{C}_0 = [0, M]^T$. into Tableau 3-1, we obtain Tableau 0. Since the bottom row involves M, we apply Change 1; the resulting Tableau 1 is the initial tableau for the two-phase method.

		x_1	x_2	x_3	x_4	
		80	60	0	M	
x_3	0	0.20	0.32	1	0	0.25
x_4	M	1	1	0	1	1
		$80 - M$	$60 - M$	0	0	$-M$

Tableau 0

	x_1	x_2	x_3	x_4	
x_3	0.20	0.32	1	0	0.25
x_4	1*	1	0	1	1
$(z_j - c_j)$:	80	60	0	0	0
	–1	– 1	0	0	– 1

Tableau 1

	x_1	x_2	x_3	
x_3	0	0.12*	1	0.05
x_1	1	1	0	1
	0	– 20	0	– 80
	0	0	0	0

Tableau 2

Using both Step 1 of the simplex method and change 2, we find that the most negative element in the last row of tableau 1 (excluding the last column) is – 1, which appears twice. Arbitrarily selecting the x_1- column, as the work column, we form the ratios 0.25/0.20 = 125 and 1/1 = 1. Since the element 1, starred Tableau 1, yield the smallest ratio, it becomes the pivot. Then applying Step 3 and 4 and change 3 to Tableau 1, we generate Tableau 2 Observe that x_1 replaces the artificial variable x_4 in the first column of Tableau 2, so that the entire x_4-column is absent from Tableau 2. Now, with no artificial variables in the first column and

the change 3 implemented, the last row of the tableau should be all zeros. It is; and by Change 4 this roe may be deleted, giving

$$0 \qquad -20 \quad 0 \qquad -80$$

as the new last row of Tableau 2.

Repeating Steps 1 through 4, we find that the x_2-column is the new work column (recall that the last element in the row is excluded under Step 1), the starred element in Tableau 2 is the new pivot, and the elementary row operations yield Tableau 3, in which all calculations have been rounded to four significant figures. Since the last row of Tableau 3, excluding the last column, contains no negative elements, it follows from Step 6 that $x^*_1 = 0.5833$, $x^*_2 = 0.4167$, $x^*_3 = x^*_4 = 0$, with $z^* = 17.67$. (Compare with Problem 1.2)

	x_1	x_2	x_3	
x_2	0	1	8.333	0.4167
x_1	1	1	– 8.333	0.5833
	0	0	166.7	– 71.67

Tableau 3

3.3

maximize: $z = 5x_1 + 2x_2$

subject to: $6x_1 + x_2 \geq 6$

$4x_1 + 3x_2 \geq 12$

$x_1 + 2x_2 \geq 4$

with: all variables nonnegative

This program is put into standard form by introducing surplus variables x_3, x_4, and x_5, respectively, in the constraint inequalities, and then artificial variables x_6, x_7, and x_8, respectively, in the resulting equations. Then, applying the two-

phase method and rounding all calculations to four significant figures, we generate sequentially the following tableaux, in each of which the pivot element is marked by an asterisk.

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	
	5	2	0	0	0	$-M$	$-M$	$-M$	
x_6 $-M$	6*	1	–1	0	0	1	0	0	6
x_7 $-M$	4	3	0	–1	0	0	1	0	12
x_8 $-M$	1	2	0	0	–1	0	0	1	4
$(z_j - c_j)$:	–5	–2	0	0	0	0	0	0	0
	–11	–6	1	1	1	0	0	0	–22

Tableau 1

	x_1	x_2	x_3	x_4	x_5	x_7	x_8	
x_1	1	0.1667	–0.1667	0	0	0	0	1
x_7	0	2.333	0.6668	–1	0	1	0	8
x_8	0	1.833*	0.1667	0	–1	0	1	3
	0	– 1.167	– 0.8335	0	0	0	0	5
	0	– 4.166	– 0.8337	1	1	0	0	–11

Tableau 2

	x_1	x_2	x_3	x_4	x_5	x_7	
x_1	1	0	– 0.1819	0	0. 09095	0	0.7271
x_7	0	0	0.4546	–1	1.273*	1	4.181
x_2	0	1	0.09094	0	– 0.1667	0	1.637

0	0	– 0.7274	0	– 0.6367	0	6.910
0	0	– 0.4548	0	– 1.273	0	– 4.180

Tableau 3

	x_1	x_2	x_3	x_4	x_5	
x_1	1	0	– 0.2144	0. 07144*	0	0.4284
x_5	0	1	0.3571	– 0.7855	1	3.284
x_2	0	1	0.2858	– 0.4286	0	3.429
	0	0	– 0.5000	– 0.5001	0	9.001
	0	0	– 0.0002	– 0.0001	0	0.0005

Tableau 4

	x_1	x_2	x_3	x_4	x_5	
x_4	14.00	0	– 3.001	1	0	6.000
x_5	11.00	0	2.000	0	1	7.997
x_2	6.000	1	1.000	0	0	6.001
	7.001	0	– 2.001	0	0	12.00

Tableau 5

Tableau 4 is the first tableau containing no artificial variables in its first column, hence with Change 3 implemented, the last row of the tableau should be zero. To within roundoff errors it is zero, so we delete it from the Tableau. Tableau 5, however, presents a problem that cannot be ignored: the work column is the x_3-column and all the elements in that column are negative! It follows from Step 2 that the original program has no solution. (It is easy to show graphically that the feasible region is infinite and that the objective function can be made arbitrarily large by choosing feasible points with arbitrarily large coordinates)

3.4 maximize: $z = 2x_1 + 3x_2$

subject to: $x_1 + 2x_2 \leq 2$

$6x_1 + 4x_2 \geq 24$

with: all variables nonnegative

This program is put in standard form by introducing a slack variable x_3 to the first constraint, and both a surplus variables x_4 and an artificial variable x_5 to the second constraint. Then Tableau 3-1, with Change 1, becomes Tableau 1.

		x_1	x_2	x_3	x_4	x_5	
		2	3	0	0	$-M$	
x_3	0	1*	2	1	0	0	2
x_4	$-M$	6	4	0	–1	1	24
$(z_j - c_j)$:		–2	–3	0	0	0	0
		–6	–4	0	1	0	–24

Tableau 1

	x_1	x_2	x_3	x_4	x_5	
x_1	1	2	1	0	0	2
x_5	0	–8	–6	–1	1	12
	0	1	2	0	0	4
	0	8	6	1	0	–12

Tableau 2

Applying the two-phase algorithm to Tableau 1 (the pivot element is starred), we generate Tableau 2. Now, there are no negative entries in the last row of Tableau 2, and in the next-to-last row there is no negative entry positioned above a zero of the last row. Thus, the two-phase method signals that optimality has been achieved. But the nonzero artificial variable x_5 is still basic! By Change 5, the original program has no solution. (In case □ is empty, as the constraint inequalities and the nonnegativity conditions cannot be satisfied simultaneously.)

4.0 Conclusion

Conclusively, both management information system (MIS) lacked some attributes needed to support decision making, such as focus, development methodology, handling of managerial data, use of analysis and dialog between user and the system operation research, which is concerned with allocation of scarce resources is both an art and a science. The art lies in the ability to depict the concept

efficient and scarce in a well defined mathematical model of a given situation. The science consists in the derivation of computational methods for solving such models.

5.0 Summary

Each unit is divided into two sections. The first deals with methodology. Exception is 3.1, which is concerned exclusively with the modelling aspects of mathematical programming. The second section consists of completely worked out problems. Besides clarifying the techniques presented in the first section, these problems may expand them and may also provide prototype situation for understanding the art of modelling.

6.0 Tutor Marked Assignment

(1) Put each of the following programs in matrix standard form.

Minimize: $Z = 2x_1 - x_2 + 4x_3$

Subject to: $5x_1 - 2x_2 + 3x_3 = 7$

$2x_1 - 2x_2 + x_3 \leq 8$

with: x_1 nonnegative

(2) Use the simplex or two-phase method to solve the following problem

Minimize: $Z = x_1 + x_2$

Subject to: $x_1 - 5x_2 \leq = 5$

$2x_1 - x_2 \leq 4$

with: x_1, x_2 nonnegative

(2) What is the definition of a decision support system?

7.0 Reference/Further Reading

Operations research second edition; Richard Bronson and Govindasami Naadimthu.

UNIT 2: WHERE IS THE INFORMATION SYSTEM (IS) DEPARTMENT HEADED?

1.0 INTRODUCTION

The management of information technology in organizations has changed drastically in the past 30 years. In the early years, the big job was to manage the technology was to get it to work, keep it running, and reduce the cost of doing business. Later, the main thrust was to manage the information resources of the organization, particularly to support management decision making by delivering information when and where needed. The responsibilities of the head of the information system function therefore now go far beyond operating highly efficient “production programming shops.” These executives must understand the goals of the enterprise and work in partnership with business unit peers to utilize IT to attain the Organizational Goals.

2.0 Objectives

At the end of this unit, you should be able to:

- Explain the major information systems activities
- Explain the roles of information system
- Mention the benefit of information technology

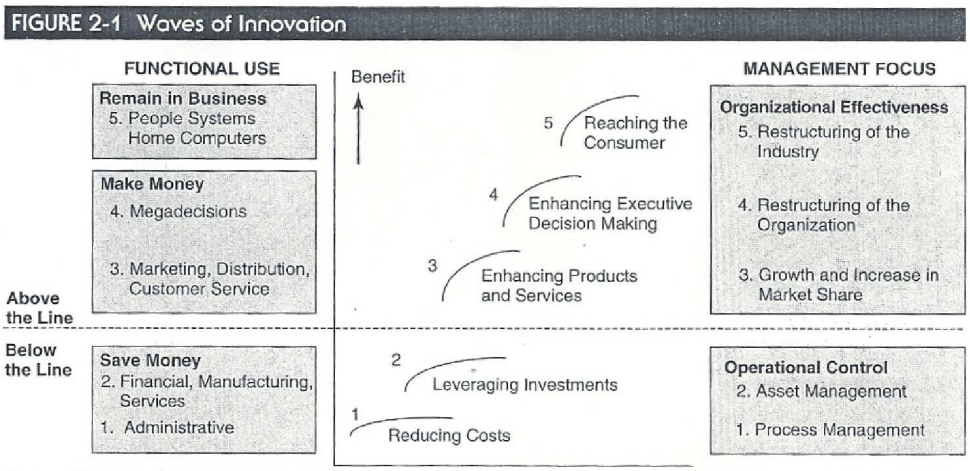
3.1 The Escalating Benefits Of Information Technology

Kenneth Primozic, Edward primozic, and joe leben, authors of strategic choices, present one view of the evolution of IT and the escalating benefits it provides organizations. They introduce the notion of " waves of innovation," which they definite as how IT is used by industries and by enterprises. They identify five waves of innovation, as shown in figure 2-1, with "time" on the horizontal axis and "benefit" on the vertical access. The wares are

- Waves 1: Reducing costs.
- Waves 2: Leveraging investments.
- Waves3:Enchancing products and services.
- Waves4: Enhancing executives decision making.
- Waves5: Reaching the consumer.

Waves1: Reducing Costs. This wave began in the 1960s when use of IT focused on increasing the productivity of individuals and business areas. The goal was to achieve clerical and administrative savings by automating manual processes.

Waves2: Leverages Investments. This waves began in the 1970s and concentrated on making money, more efficient and use of corporate assets, to increase profitability. Systems were justified on return on investment and increasing cash flow.



Source: Kenneth Primozic, Edward Primozic, and Joe Leben, *Strategic Choices: Supremacy, Survival, and Sayonara* (New York: McGraw-Hill, 1991).

As shown in figure 2-1, both waves 1 and waves 2 are "below the line, " which means both focused on saving money, not making money, through better management of processing and assets. Systems were developed mainly for administration, finance, and manufacturing.

Waves3: Enhancing Product and Services. This waves began in the 1980s and was the first time that attention shifted to using IT to produce revenue by gaining strategic advantages or by creating entirely entirely new business or increase market share, IT was used to improve outward-looking functions, such as marketing, distribution, and customer service.

Waves4: Enhancing Executive Decision Making. This waves began later in the 1980s and focused on changing the fundamental structure of the organisation as well as creating real-time business management systems.

The authors point out that waves1 and 2could be implemented at any time, because of their internal focus. But waves3 and 4 must be implemented once an industry leader has set the precedent. Companies that do not follow suit cease to be competitive.

Waves 5: Reaching the Consumer. This waves began in the 1990s, says the authors. It uses IT to communicate directly with consumers, leading to new

marketing, distribution, and service strategi4s . It changes the rules of completion, which has been precisely the focus of leading edge firms – to restructure their industry by focusing on creating new business using the internet, web technology, and electronic commerce.

Waves 3,4 and 5are "above the line" because they concentrates on making money and staying in business. Due to the world wide ubiquity of the internet and the standard browser interface to the web, most organizations have jumped to waves 5 in the past few years.

Once companies cross "the line" top management must be involved in guiding IT use, say the authors, they must steer the company in the new business environment. The risks of inappropriately using IT for competitive purposes are too great for the senior executives to abrogate leadership to the technicians. So joint planning by top management and IS management must takes place.

To illustrate how one company has maneuvered through these fives waves, consider the example of the American Airlines SABRE systems.

3.2 TRADITIONAL FUNCTIONS ARE BEING NIBBLED AWAY

IT has become an essential piece of business strategy, as SABRE demonstrates; therefore, the speed of IT deployment affects when and how companies can carry out their strategy. Not keeping up in IT may even mean going out of business. The role of the IT department is thus expanding and moving to center stage; in doing so, the job has become too large for one group. Thus, we see two phenomena occurring simultaneously: while the growing importance of IT is causing the IS department's work to expand into new areas of responsibility, management is realizing that the traditional and more operational portions of the job do not need to be performed by the IS department. They can be performed by others. The traditional set of responsibilities for IS has included:

- Managing operations of data centres, remotes systems and network.
- Managing cooperate data
- Performing system analysis and design, and constructing new systems.

- Planning systems
- Identifying opportunities for new systems

While all these functions still need to be performed, the following trends are moving their performance out of the IS department into other parts of the organization or to other enterprises:

- Distributed systems have led to software applications migrating to user areas, operated under the control of the users and generally purchased with their funds. Sometimes these applications are acquired following guidelines (or even standards) promulgated by the IS department; sometimes they are not.
- Ever more knowledgeable users have taken on increased IS responsibilities. They often identify high-leverage applications and lead the multifunctional teams (which include IS staff members) that acquire these systems.
- Better application packages have resulted in less need for armies of programmers and analysts to develop systems in house from scratch. The job of IS has changed to integrating purchased applications so they function together as a system, or "system integration." A case in point is enterprise resource planning (ERP) systems. Implementing these purchased systems has involved system integration rather than system development.
- Outsourcing has spread widely, perhaps more than most people expected, because companies see the value in drawing on the expertise of another company by turning IT functions over them. Outsourcing may be the most effective strategy, based on fiscal and managerial considerations, for handling data centre operations, application maintenance, network management, and PC support.

Thus, as shown in fig. 2-2, the work of the IS department is being "nibbled away." On the other hand, the IS job is also expanding.

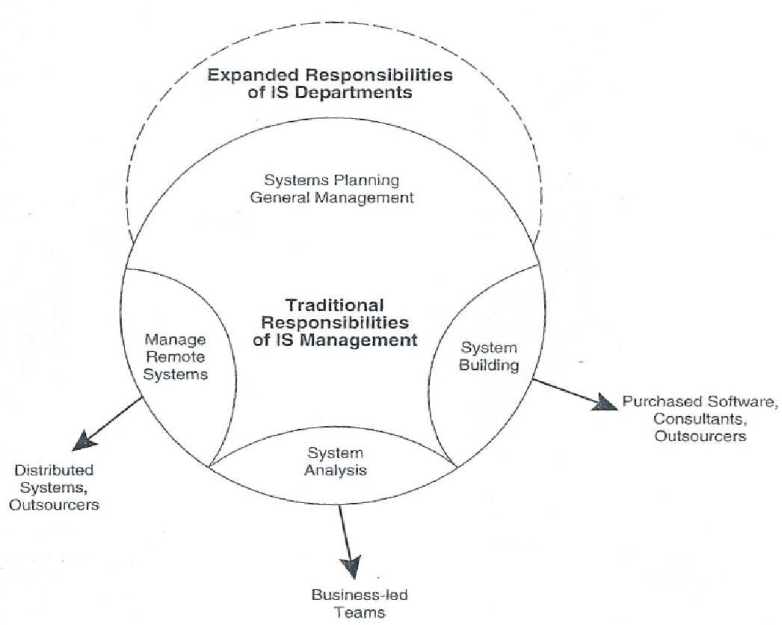


FIGURE 2-2 Traditional Responsibilities Being "Nibbled Away" from IS Departments

3.3 NEW TECHNOLOGY ARE EMERGING

Gartner Executive Programs (EXP), part of the well known Gartner IT analysis firm, presents complementary analyses of the situation and provides useful insights into the structure of IS organization and where they are likely to be headed. In one report, George Cox[3] states that IS is not a single monolithic organization, but rather a cluster of four functions:

- *Run operations*: Running the computers and networks
- *Develop systems*: Developing and maintaining systems, designing new systems, and updating existing ones
- *Develop architecture*: Setting a strategy and maintaining an architecture for both IT and information, providing a framework or standard for system operations.
- *Identify business requirements*: Helping articulate what the business needs from information technology.

Each of these functions requires a different set of skills and a different management strategy. A function that aims for cost efficiency and requires technical skills (such as running operations) needs to be managed differently from one that aims to add business value and requires business expertise (such as identifying business requirements).

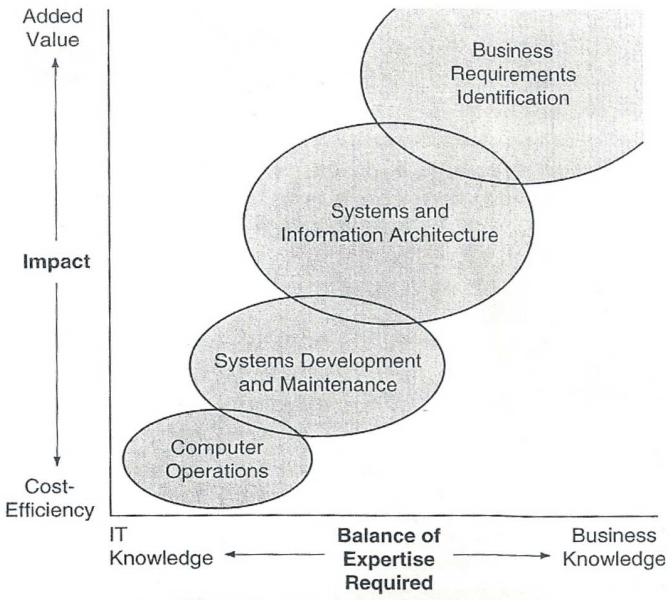


FIGURE 2-3 Four Major IS Activities

Source: George Cox, *Time to Reshape the IS Department?,* Wentworth Research Program (now part of Gartner Executive Programs), Egham, England, June 1994.

Fig. 2-3 shows the four functions on a matrix with two dimensions: the kind of impact an activity has on the organization (from cost efficiency to value added), and the type of expertise needed by the activity (from technical to business expertise).

Two technical activities that focus on cost efficiency – operations and systems development and maintenance 00 are of less importance to the business hence they are smaller bubbles. Meanwhile, the business-oriented activities that seek to add value to the enterprises are of far greater importance to the enterprise, hence the larger bubbles.

Companies that have failed to recognize the differences among these four areas – the relative importance of each and how to manage each properly – have, in some cases, misplaced their resources or underdeveloped their expertise. For example, most IS organizations have historically invested heavily in computer operations and system development/maintenance, while neglecting the other two (developing architectures and identifying business requirements). Unfortunately, operations and systems development can be purchased because they are commodity-like; architecture development and business requirements identification cannot because they are unique to each organization.

Most IS departments have had to re-skill their staff to those more value-added kinds of work. As they do, they are seeing a "squeeze" similar to the "nibbling" discussed earlier. As shown in fig. 2-4, external services in form of outsourcing are competing well in the lower left of the matrix, the technical arena. Meanwhile, increasingly knowledgeable users are assuming more of the responsibility and initiative in the upper right area of the matrix, the business-centric arena.

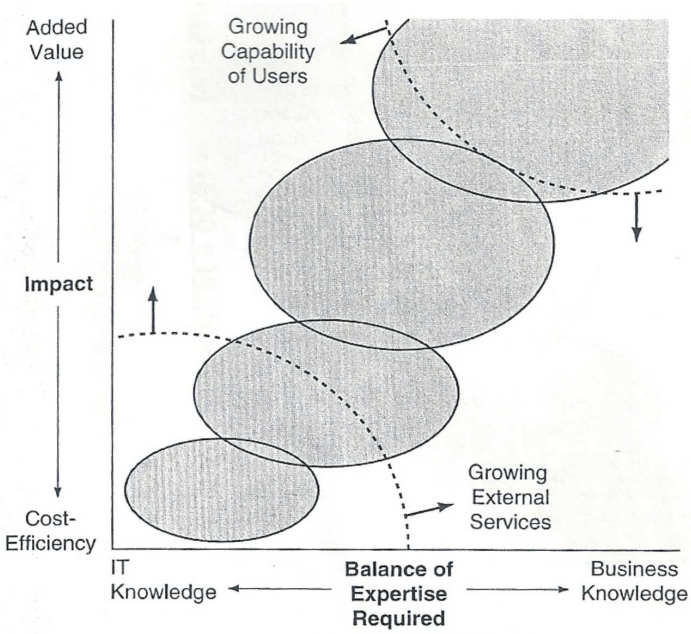


FIGURE 2-4 The Squeeze on Traditional IS Activities

Source: George Cox, *Time to Reshape the IS Department?,* Wentworth Research Program (now part of Gartner Executive Programs), Egham, England, June 1994.

Will these trends continue? Will the IS organization be squeezed into oblivion, out-sourced on one end and absorbed into business units on the other? Cox thinks not! Two roles will emerge as a dominant for the IS function.

First, it is not reasonable to expect an out-sourcing service provider to understand and satisfy all the needs of the organization without active management and counsel. They sell commodities. The IS organization therefore is needed to develop and manage these contract relationship with a variety of external suppliers. So the department will become a broker between technical service providers and business units, which is indeed happening.

Second, a crucial role for IS organizations is development and management of the IT architecture for the enterprise, providing the framework for information technology to support the business. It is the biggest challenge; especially given IS departments' systems development and operations heritage. As Cox notes, "The precious baby of a coherent framework for systems should be

differentiated from the bath water of system delivery and operation." Fig. 2-5 shows these two new roles and how they overlap the past roles.

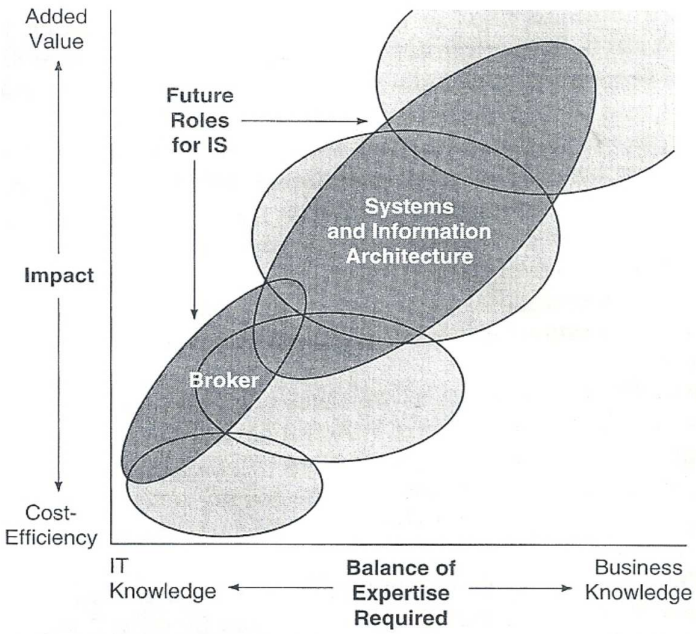


FIGURE 2-5 Future Roles for IS

Source: George Cox, *Time to Reshape the IS Department?,* Wentworth Research Program (now part of Gartner Executive Programs), Egham, England, June 1994.

In short, Cox describes the metamorphosis of IS departments as follows:

- *In computer network applications,* IS started out being the sole provider, then moved to being the preferred provider, next was seen as a competing supplier, and finally is becoming the broker and contract manager for outsourcing this work.
- *In system development and maintenance,* in-house programmers initially wrote the code, then they became software product specialist, next systems integrators, and finally brokers and contract managers for acquiring software. Most recently, for example, they contract with application server providers (ASPs) who rent software on a transaction basis.
- *In systems and information architecture,* IS began as the technology guru and standards setter, then evolved into being the custodian of technical

standards, later became the specialist in IT trends, and most recently morphed into information systems strategist.

- *In business requirements identification,* IS initially defined the species of computer programs, then focused on analyzing information flows and business systems, later moved to contributing multidisciplinary analysis teams, and finally has been partnering with the business in looking at business processes.

In short, IS departments have moved in fig, 2-3 from lower to upper right in their role in the business, from efficiency to value added and from technical to business expertise.

3.4 TOWARD INFORMATION SYSTEM (IS) LITE

More recently, Roger Woolfe has furthered the thinking at Gartner Executive Programs about the role of IS departments by studying how they have responded to this evolution. He notes that whereas IS may have started as a single centralized organization, it has evolved into a federal model, where some activities (such as standard settings and operations) are handled centrally because they can be leveraged across the enterprise, while other activities (such as application development) have been dispersed to business unit6s so they can best meet local needs. Unfortunately, making this has been far from easy, and has produced continual swings between centralizing and decentralizing specific activities to try to best fit the current business environment.

As an example, where should websites be developed? Initially, most of them were built by enterprising business people in marketing and other functions, without standards or guidance. When the importance of these sites was recognized, and the diversity began to impinge on “creating a single, powerful corporate image on the web,” Web site development was often pulled into a newly created electronic commerce group. Yet the job is too large for one group, so those with

responsibility for the content (in marketing, operations and other functions) have added web content management to their other job.

But the split continues to changes as web sites take on new uses and greater importance. In fact some companies outsource their web operations to others that specialize in handling spikes in demand, and they perhaps outsource the hosting of "events" on the site4s to others who specialize in that activity. In short, the federal model can become quite complex, and it has.

To make the federal model work better, companies are shifting attention from roles to processes. In this view, The IS department can be viewed as managing three overall processes:

- Driving innovation
- Managing change
- Supporting infrastructure

Applying the federal model to these processes sharpens the distinction between IT activities performed centrally and those performed in business units. Woolfe sees the division coming from distinguishing supply-side activities and demand-side ones. "Supporting infrastructure" and aspects of "managing changing" (such as delivering applications) are supply side. They involve providing the networks, databases and processing; they are best centralized because they gain from economies of scale.

Most of "managing change" and all "driving innovation" on the other hand, are demand side. They create the demand for IT services; they are best localized in business units, which can tailor services to their needs.

In conjunction, some IS departments are creating centres of excellence to pool expertise and leverage it across the enterprise. Such centres now exist for such areas as electronic commerce, supply chain management, policies and standards, help desk support, and systems integration.

The result is that much of the supply and demand sides of IS's work is being given up, as noted previously, to outsourcers and knowledgeable users. The result is that IS departments are moving to "IS Lite" as shown in fig. 2-6.

The remaining processes are driving innovation, which includes information and systems architecture, and managing supplier and user relationships, which include brokering.

A company that is moving in this direction is Life Scan. Here is what their information management (IM) department is doing, as described in the paper submitted to the society for Information Management's annual paper competition.

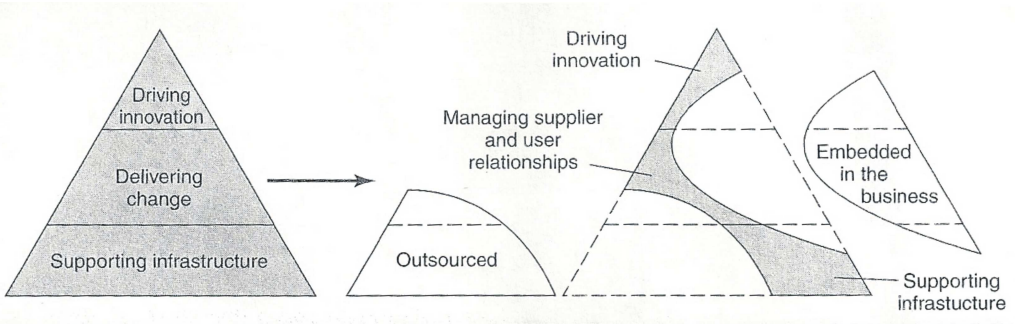


FIGURE 2-6 IS Lite

Source: Reprinted with permission from Roger Woolfe, *IS Lite,* Gartner Executive Programs, 56 Top Gallant, Stamford, CT 06904, July 2000.

3.5 DEATH OF INFORMATION SYSTEM (IS)

We cannot leave this subject of where IS department is going without presenting the provocative view of Forrester Research[6] in their report "Death of IT." Their premise is that IS departments as we know them today will not be able to keep up with the pace of change required by e-business models. Hence, IS departments will disappear; business process teams will take over the job of managing IT.

The key aspect of e-business is processes, especially processes that interconnect enterprises into "e-business networks," says Forrester. These networks will be dynamic, in that companies will plug into the one that best fits the situation at hand, and then unplug when it is no longer needed. They will collaborate with a continually changing mix of partners, using a variety of processes.

The enabler is information technology, but to keep pace, the technology needs to be managed at the process level, so that companies can plug and unplug from different processes quickly. Thus, the technology will be managed by business process owners who decide which process to use for a given situation.

These process owners, and their teams, will merge technology and business management within the processes they manage, such as supply chain management and customer services. In essence, they will manage the applications that automate their process. Furthermore, they are likely to draw on the technology services offered by external service providers, perhaps renting application service providers (ASPs) or reconfiguring automated processes leased from others.

Applications will be run by external service providers, who, in turn, may rely on other service providers for the electronic infrastructure and intervendor system connections that form the e-business networks.

Whether Forrester's vies of the future of the IS department comes true remains to be seen. Forecasts of the death of IS departments have been circulating for years. While computing power and network connections may look like commodities, applications and processes are not. They provide the source of competitive advantage, especially in the emerging e-economy. For this reason, the death knell for the IT department is premature.

Given these descriptions of where the IS department might be headed, we now look at the responsibilities of CIOs.

4.0 CONCLUSION

Today, Information Technology is pervasive in organizations, and is becoming a mandatory link between organizational performances and is leading to an "electronic ecosystem" in which organizations operate. Today, proper deployed of IT can determine and organizations growth, direction, structured and viability.

5.0 SUMMARY

As the benefits of IT increases, the importance of executive guidance also increases.

6.0 TUTOR MARKED ASSIGNMENT

What four trends are nibbling away at traditional information system functions?

7.0 REFERENCES/FURTHER READING

Cameron, Bobby, Ron Sherlin, and Aaron Hardisty, Death of IT, Research, January 2000, www.forrester.com

UNIT 3: THE CIO'S RESPONSIBILITIES

1.0 Introduction
2.0 Objectives
3.0 Main Content
3.1 Understanding the business
3.2 Establish System Department Credibility
3.3 Develop a competent information system staff and Information technology savvy users.
3.4 Create a vision of the future and sell it
3.5 Implement an Information System Architecture
3.6 Nurture relationships
4.0 Conclusion
5.0 Summary
6.0 Tutor Marked Assignment
7.0 Reference/ Further Reading

1.0 INTRODUCTION

Today, the Chief Information Officer is the technical member of the top management. The job is to make sure the electronic infrastructure for e-commerce and e-business is in place, to ensure that information system staff are working as partners with business units on value-adding initiatives, and to rapidly deploy new IT uses.

2.0 OBJECTIVES

At the end of this unit, you should be able to:

- Identify the primary responsibilities of information system executives.
- Understand the business use
- Understand how important an information system architecture

3.1 UNDERSTAND THE BUSINESS

If IS executive are to play an important role in reshaping a business's use of IT --- to leverage the internet with supply chain partners and customers, they must understand the business. In the past, studying business generally meant learning how part of it was run. However, studying internal operations is not enough nowadays. Today, it is also important to understand the environment in which the business operates, because the rules of competition have changed with electronic commerce and are likely to change even further as more ways of working move onto the web. Here are seven approaches CIOs are using to understand the business and its environment.

- Encourage project teams to study the marketplace
- Concentrate on lines of business
- Sponsor weekly briefings
- Attend industry publications
- Read industry publications
- Hold informal listening sessions

- Become a “partner” with a line executive

Encourage Project Teams to study the Marketplace. To learn about the business, broaden the kinds of information that project teams seek in their study of the business, and then have them describe their findings to IS management. For example, the project study might begin with a broad overview of the company, gathering the following information about the company and industry:

- Current industry environment
- Business goals and objectives
- Major practices of competitors
- Pertinent government regulations
- The inputs, outputs and resources of the firm

Such an overview study can be conducted for a business unit or a product in a few weeks. The study is apt to uncover some surprises, revealing things about the industry and company that even line people might not know, especially if, for example, a dot-com (an internet start-up) has moved aggressively into the company’s market space. IS management can be briefed on the findings, thus educating them about the environment in which their firms participate.

Concentrate on Line of Business.

Robert Benson and Marilyn Parker[7] have long studied how to manage information on an enterprise basis. They began thinking that they should develop data modelling tools. However, their thinking has broadened significantly. To help a company be successful, they found, IS needs to serve individual lines of business rather than the entire company. Planning for an entire enterprise without considering “lines of business” overlooks both competitive and individual matters. A line of business is where business and technology can be linked, they believe.

A line of business is an organizational unit that conducts business activities with common customers, products, and market characteristics, says Benson. For example, certain schools in a university have one line of business–

undergraduate education. Others have two—graduate and undergraduate education. The customers, products, and market characteristics for the two are different, thus they are different lines of business.

Information technology can serve lines of business in two ways. One is by supporting current operations, which Benson and Parker call "alignment." The second is by using systems to influence future ways of working. They recommend asking the following questions about each line of business, to decide what each one needs.

1. Are we organized to serve that line of business?
2. Do we have an account manager in IS who has responsibility for that line of business?
3. Do we have someone with that line of business who oversees IT activities and talks the language of business?
4. Do we have a sponsor in the line of business?
5. Do we have the attention of their management?
6. Does the line of business offer an opportunity to use systems in new ways?

By becoming familiar with lines of business, IS executive can better help them use IT to support current operations and influence the future, say Benson and Parker.

Sponsor Weekly Briefings.

Another way to learn about the business is to sponsor short briefings each week for IS management and staff, presented by *line* management or staff. We have attended such meetings and found them most informative. They were about one-half hour long, with one speaker describing the line of business. Managers and staff from different departments were invited to talk to a small group of IS managers and staff about their business and its marketplace: the products and services they offered versus what the competitors offered, the strengths and

weaknesses of the firm and competitors, growth projections, possible changes in the market and so on

For example, in the aircraft industry an engineer could give the basics of the commercial aircraft business: sizes of planes, passenger capacity, distance capability, expected competition, changes in the industry, 5-year market projections, and so on. In the financial services industry, a manager could describe various types of customers and how each is using the internet, products now offered by the firm and competitors, the impact of globalization and the internet on financial markets, and so on. At such briefings, it is helpful if the presenter provides a written summary of the ideas presented, so attendees can take something away with them. A brief question and answer period is also useful.

To understand the business, one needs to understand the marketplace. Few employees are given exposure to this breadth of knowledge. By sponsoring short presentations by the people closest to a business, IS management can help fix that problem without cutting into working time too greatly.

Attend Industry Meetings with Line Executives.

Another way to learn about the business is to accompany a line executive to an industry conference – not a computer conference. We have found that attending a conference is one of the quickest ways to uncover issues currently facing an industry. These conferences contain the jargon used in the industry and the approaches others have used to market products, handle regulations, respond to competition, and so on. Attending with a line executive can be even more enlightening, because he or she can explain what the company is or is not doing in areas discussed by the speakers. Such joint attendance is also likely to foster a new friendship.

Read Industry Publications.

One of the best ways to stay abreast of an industry is to read its publications a month. For example, news publications can provide information on new products, current issues, company changes, and so on. Newsletters, reports and research

journals generally provide better analyses of industry trends, discussions of ongoing research and projections about the future.

One information systems executive we know spreads this job around in his department. Every systems person is responsible for reading certain periodicals and routing interesting articles and web addresses to others.

Hold Informal Listening Sessions.

In his book, Thriving on Chaos,[8] consultant Tom Peters presents hundreds of suggestions on how managers can learn to not just cope with a chaotic business environment but thrive on it. In numerous places in his book, Peters urges people to dimply listen and learn. His ideas are appropriate for IS management in their dealings with their customers, both internal to the firm and external.

Yogi Berra, the famous baseball player, once said, "you can see a lot by observing." Similarly, Peters urges employees to learn a lot by listening to others' needs. Because product life cycles are shrinking, companies need to spot new trends earlier. Becoming a listening-intensive organization can help.

Peters recounts several instances where people have created informal "meetings" to break down barriers among people who usually do not talk to one another. These get-togethers are held in a setting that is not charged with tension, participation is voluntary, and their purpose is to "just chat." For instance, one hospital administrator set aside one early morning each week to having coffee and rolls available in her office with an open invitation for doctors and administrators to drop by and chat. She had some lonely breakfast at first, she told peters, but the chats eventually evolved into the real staff meeting of the week. Another hospital administrator held an informal

Staff meeting at lunch time every two weeks at a local pub and invited some doctors. The doctors felt honoured to be invited and their attendance helped breakdown stereotypes on both sides and improve communication.

Become a "partner" with a Line Manager.

The society for information management presents a partners in Leadership Award each year to honour an IS business executive team who, through their alliance, have achieved significant business results. This award has been well received and is highly sought. It reinforces the partnering needed to successfully guide and deploy IT these days. We discuss partnering in more depth later in this chapter.

Summary. Through these approaches, then, CIOs and their staff can learn the businesses of the organization. With this knowledge, CIOs are in a better position to foster a vision of IT's use in their firm. Unless these or similar specific steps or mechanisms are implemented and become commonplace, the job of learning the business will be displaced by urgent, but less important, day-to-day work.

3.2 ESTABLISH SYSTEMS DEPARTMENT CREDIBILITY

The second major responsibility of the CIO is to establish and then maintain the credibility of the IS organization. Before an IS executive and the department can be viewed as an important strategic voice, they must be viewed as a successful and reliable today.

Management consultant Joseph Izzo[9] suggests that IS departments have two missions: maintain today's systems and work on tomorrow's systems.

These two missions have distinctly different goals and therefore need to be managed separately and specifically. The "today" operation should concentrate on providing service, says Izzo, while the "tomorrow" operation needs to focus on helping the business operate better. The first job of IS management is to get the "today" operation in shape. Until that task is accomplished, CIOs will have little credibility with top management.

Managing the "today" Organization Better.

The "today" organization includes computer operations, technical support (including telecom network support), and maintaining and enhancing existing applications. Because its main mission is service, the service levels of these various operations need to be measured.

To run the “today” operation, Izzo suggests hiring managers for each of these functions who are like supervisors – that is, they are delivery oriented and demand a high level of service from their people.

Today, an increasing number of CIOs outsource these support functions to companies that specialize in this work. This outsourcing releases in-house staff to higher value work, generally reduces costs, and should result in gradually increasing levels of service. But reaping this enefits requires negotiating good contracts and managing the supplier.

Once the “today” organization is in shape, then IS management has the credibility to propose its new ideas for the future. In chapter 8, we further discuss running today’s operations.

Develop a Competent IS Staff and IT-Savvy Users

Managing IS operations once took an inordinate amount of management attention. Now that this supply side activity is being outsourced, staffing the IS department has become the activity that commands a larger-than-expected amount of management attention. And just like operations, if IS does not have the right staff, the entire enterprise suffers because the enterprise’s needs cannot be met fast enough. Not only does just about every IS department have some vacant positions, but staff turnover has skyrocketed in many companies, as staff members are lured to companies with more exciting New Economy plans.

Staffing quandaries can be relieved to some extent by outsourcing, which is one reason that option is growing. But suppliers in “hot technology” areas face the same dearth of talent. Ant because we are at the beginning of this Internet-based New Economy, where each new service or product opens up even more opportunities, this situation is likely to least for quite some time.

3.3 DEVELOP A COMPONENT INFORMATION SYSTEM STAFF AND INFORMATION TECHNOLOGY- SAVVY USERS

Managing IS operations once took an inordinate amount of management attention. Now that this supply –side activity is being outsourced, staffing the IS department has become the activity that commands a larger than expected amount of management attention. And just like operations, if IS does not have the right staff, the entire enterprise suffers because the enterprises needs cannot be met fast enough. Not only does just about every IS department have some vacant positions, but staff turnover has skyrocketed in many companies, as staff members are lured to companies with more exciting New Economy plans.

Staffing quandaries can be relived to some extent by outsourcing, which is one reason that option is growing. But suppliers in "hot technology" areas face the same dearth of talent. And because we are at the beginning of this internet-based New Economy, where each new service or product opens up even more opportunities, this situation is likely to last for quite some time. We discuss staffing in Chapter 10.

Besides staffing the IS department, CIOs also need to nurture an IT-knowledgeable workforce in business units, and then keep pace with those who have become IT-savvy. Thus, IS departments need to help line executives become comfortable managing the use of IT, enable employees to become comfortable using IT, and encourage every one to be comfortable exploring innovative new uses of IT, especially on the Web with personal digital assistants (PDAs) and handheld communicators, and in creating consumer connections to the firm, IT-savvy organizations are the ones most likely to excel in this Internet-based economy. In some cases, raising IT comfort levels means providing computers to those who do not have them, so they can explore the Web on their own. But with younger employees, who have been brought up with computers, IS department face the opposite challenge – providing the access speed and computer power they expect.

Few corporate executives need assistance these days keeping abreast of the IT field because the publications they read now continually report on new

developments. In fact many IS executives now face " airline magazine syndrome", where the CEO or other top executives sends an e-mail to the CIO that says, "What are we doing on this?" and references an article from an airline magazine or a Web site about a "hot new technology" or a competitor's new use of the Internet.

As the rate of change in the IT field has increased, we have heard IS executives says they need to encourage IT experimentation, especially by people in the operating units. Here are the ideas of two researchers and one user company on how to do that – by supporting information technology "champions."

Encourages Championing of IT Projects. A champion is someone with a vision who gets it implemented by obtaining the funding, pushing the project over hurdles, putting his or her reputation on the line, and taking on the risk of the project, state Professors Cynthia Beath and Blake Ives.

The first step in encouraging champions is to be able to recognize these people. They are likely to be people you already know about, and they may be doing things that make you uncomfortable, say Beath and Ives. For instance, they are probably already circumventing established project approval processes, they are creating isolated information systems, and they may be using non-standard equipment. They may already pursuing a vision of how IT can help their business, whether systems people help them or not.

These people are opinion leaders and they have a reputation for creative ideas or being involved with innovations. They also have developed strong ties to others in their organization, and they command respect within the firm. They have the organizational power to get strategic innovation, resources, and support.

They need information. "Championing" an IT innovation is an information-intensive activity, note Beath and Ives. Therefore, champions need information, facts and expertise for persuading others that the technology will work. Information systems people can help champions gather and access information about a technology's capabilities, its costs, risks of operation, and how it might be

used in an experiment. Information systems staff also can help by sharing their expertise and by putting champions in contact with other experts, such as vendors or users of a new technology

Information systems staff can assist champions in understanding current applications and data relevant to their project. Finally, they can help champions understand how the company manages change, because systems people are continually involved in implementing system changes throughout the enterprise.

They need resources. The authors cite Rosabeth Kanter, author of Change Masters, who says champions most need staff time. Giving champions "free" staff time is especially helpful during the evaluation and persuasion portions of a project. But systems management can go even further, by assigning, say, information center consultants to help champions.

In addition, to staff time, champions are likely to need material resources, such as hardware and software. These resources can be loaned to them free of charge or provided in some other way.

They need support: Finally, champions need supporters people who approve of what they are doing and give legitimately to their project. It is important that IS management corroborate statements made about the technology by the champion. The champion does not need to know how the technology works, only how it might be used. The systems department should handle the technical aspects. Beath and Ives urge demonstrating the champion's claims about the technology, and promoting the technology to build enthusiasm for it and to win support from others.

Finally, IS management can help a champion win endorsement of upper management by helping to create the plans for introducing the new technology. The IT department can assist by contacting vendors and in choosing an appropriate implementation approach. All these supportive actions will improve the quality of the proposal and strengthen it in the eyes of management.

So, Beath and Ives encourage information systems management to make it easier for IT champions to arise and succeed. One company that supported champions is Aetna Life and Casualty.

3.4 CREATE A VISION OF THE FUTURE AND SELL IT

Information System executives are no longer reactive, providing only support. They manage some of the most important tools for influencing the firm's future; therefore, they are becoming more "proactive" by helping to create a vision of the firm's future and its use of IT, and then selling those ideas to others.

What Is a Vision? It is a statement of how someone wants the future to be or believes it will be. It is used to set direction for an organization. One of the most often-cited examples is the compelling statement U.S. President John Kennedy made in 1961. "We will put a man on the moon, and return him safely to earth, by the end of the decade." And it did come to pass. On July 21, 1969, the United States landed a man on the moon. His vision provided a direction for the U.S space program for a decade.

Beath and Ives present several corporate visions:

- Otis Elevator: any salesperson can completely order an elevator in a day.
- USAA, an insurance company for current and retired military officers: Policy holders can accomplish their objective in a single phone call or Web site visit.
- Rittenhouse Homes: Customers can get a house designed and built form a retail store.
- Fidelity Investments: Mutual funds can be repriced on an hourly, rather than daily, basis.

Why Develop a Vision? The word is seen everywhere because in turbulent times such as we face today, people are looking for some stability. A vision of a desirable future can provide stability when it sets direction for an organization. In the past, long-term strategies were created. They told how

companies were going to get somewhere. Such multiyear plans are fine as long as the future is relatively predictable. But in today's environment, people cannot predict some of the most important future events because those events are likely to appear random, not linear or rational. In such times, direction setting and short-term explorations within that space are most appropriate. Today, most corporate vision have an IT underpinning -leveraging the Internet for business purposes. That vision sets their direction.

Who Should Create the Vision? Some CEOs are relying on there is executive to create the corporate vision for using IT, because innovative uses of computers provide ways to significantly change the way companies do business. However, in a growing number of cases, it is the management team, including the CIO, that creates the vision, together. How can they come up with such inspirations? Listen to all ideas, no matter how crazy they sound, recommends Joel Barker, a futurist.

Barker asks: What types of people are most likely to find new ways to solve problems? His answer: people who anticipate dramatic shifts that might occur in the future. These types of people are generally outsiders, he says, because they see things in different ways. They have faith in themselves but they are unpracticed in the field under question. So they bring a fresh viewpoint to problems in that field. They do not know what cannot be done, so they try many new things. These visionaries are generally young people just entering a field or older people who are changing careers – they both love to tinker.

Insiders have an investment in maintaining the status quo, because they understand the way a field operates. Outsiders do not have this investment, so they are more likely to come up with new solutions, says Barker.

Getting a Vision. We found two ways to create visions. One is to explore the present. Think about how it might be improved. Fro example, study the problems your company faces today and think of ways use of the Internet or handheld devices might solve those problems. A second approach to create a

vision is to “scout” the future. Look at trends that appear likely to continue as well as changes that might disrupt current trends. The Internet has disrupted every field through e-mail and the Web. Handheld devices will do the same, as will broadband service to the home. What other disruptions like ahead? People who uncover such shifts and take advantage of them early can give their firm a competitive edge.

Exploring the present. Peters suggest four approaches. One is to ask: What bothers you most about the organization? When people are (or are not) working well with one another, what seems to be going on? Based on answers to these and similar questions, fix things that are wrong. Second, try participation by involving people inside and outside the firm to uncover their top irritants and their 10 best experiences. Their ideas might inspire a vision. Third, clarify the vision, perhaps by meeting with subordinates to study the data an stories in detail, to refine shard views and values. And fourth, listen. Visions are seldom original. , notes Peters. A visionary may simply be the person who focuses attention on an idea at a point in time, but that visionary is likely to have heard the idea from someone else.

Scouting the future. The Institute for the Future studies trends and publishes a 10-year forecast. The Institute helps organizations plan their long-term futures by discussing near-term and long term outlooks in numerous areas such as the United States economy, demographics of the United States, U.S labour force, technology, U.S government, and international situations. They present issues that they see arising from the trends.

Another way to scout the future is to look for discontinuities, or shifts in trends. The people at the Institute for the Future call them “wild cards”, Joel Barker calls them “paradigm shifts” By whatever name, they create major changes in the way people think about the world. The cell telephone is such a shift, concern for privacy is another, and computer-based sensors could be another.

Barker encourages people to "scout" the future looking for discontinuities by listening to screwy ideas and new ways to solve existing problems**.** The more people a company has scouting the future, the better off they are, says Barker, because the future is more likely to be revolutionary than evolutionary. By spotting a revolutionary event early, a company has an advantage over competitors that are not thinking about the future.

At a conference held by the Dooley Group, attendees offered the following ideas on possible shifts that could change the way we live:

- Decline in the growth of cities
- Holograms to replace travel
- Small is better than big
- Personalized products (a market of one)
- Portable and personal two-way communications
- Small but powerful batteries
- Manufacturing in outer space
- A power shift from a manufacturing base to a knowledgeable base
- Deterring the aging process

Selling a Vision. Once you have a vision about how your think the business should operate in the future, you need to sell that idea to others. Here are some recommendations.

Selling an idea requires understanding the marketplace, meaning, what potential customers want rather than what they should have. To find out what they want, listen. Listening is actually a potent form of selling. By understanding and fulfilling someone's needs, you help them be successful. And, by making the buyer successful, the seller becomes successful.

Often, personal relationships are the key to successful selling an idea because people like to do business with people they know and trust. But if you believe you will not be effective, bring in a spokesperson.

Finally, to be a successful salesperson, keep your customers informed. If you can do nothing else to ease a bad situation, at least keep the other party informed. Customer care is important in selling products or ideas.

The following case example illustrates how one company developed and used a vision of IT to enhance its business performances.

3.5 IMPLEMENT AN INFORMATION SYSTEM ARCHITECTURE

An architecture is a blueprint. It shows how the overall system, house, vehicle, or other product will look and how the parts interrelate. Designing a system architecture used to be considered strictly a technical issue however, more and more it occurs when a company rethinks how it works, what it does, with whom it works, and so on, because the architecture needs to support new ways of operating. In e-commerce, it is a crucial component of the business planning. Let's return to SABRE's move onto the Web.

The Emerging Role of Chief Technology Officer (CTO). Due to the increased importance of information systems architectures caused by the rise of e-commerce and e-business, the new job title of chief technology officer has appeared in IS departments, during the past couple of years. Due to its newness, the role does not have one description it has several. In most cases, the CTO is in charge of the technology and its architecture, whereas the CIO is in charge of the use of information technology. Therefore, the CTO is the chief IT architect and generally reports to the CIO, although there are cases where the CTO reports to the CEO.

In a few cases, CIOs have changed their title to CTO to emphasize their role as the technical head within their firm. This has been fairly rare.

In the dot-com world, the tile CTO has been more prevalent than CIO. These CTOs have viewed the CIO as the one who runs a traditional IT department, including operations and maintenance. These CTOs preferred the title CTO to

reflect their seemingly more strategic roles as chief architect of the company's Web presence. Some even have taken on the title chief engineering officer, rather than CIO or CTO, to stress their job of "engineering" their firm's Web presence. Most dot-coms began life outsourcing all or most of the operational aspects of their IT department, so the CTO title might have appeared more appropriate than CIO. However, some dot-coms that have prospered have decided to bring their outsourced work in-house to gain more control of their own destiny. The role of these CTOs is morphing into that of CIO, as they broaden beyond the architectural aspects of IT to all the aspects discussed in this text. Yet, they may retain their CTO title, so the breadth of this new job title is likely to change as the field changes.

3.6 NURTURE RELATIONSHIPS

An increasingly important role for CIOs is to develop and nurture relationships. Leadership in the development and use of IT now requires a "partnering," as exemplified in the IS Lite model. Three sets of partnerships are of particular importance:

- Relationships with senior management: CEO, CFO, COO, division presidents, and other members of the top management team
- Relationships with customers: both internal and external
- Relationships with suppliers and other external partners

Relationships with Senior Management.

The relationship between CIOs and other senior executives, especially CEOs, is diversifying, says Chuck Gibson, who has presented executive education seminars for years and is co-author of an article on the Stages of Growth theory.

At one end of the the relationships spectrum is the traditional relationship between CEOs and CIOs. The CIO is expected to implement technology to support business plans in a boss-subordinate, and somewhat distant, relationship.

Behind this is the view and practice of business and IT services as separable, and IT in a support role.

The emergence of the dot-coms has demonstrated a much closer relationship between the technologists and CEOs , Gibson points out. This closeness represents the other end of the spectrum. In dot-coms, the business is inseparable from IT. Acting as a team to respond to change, and build the infrastructure and applications quickly, CEOs knows a lot about IT and dot-com CIO knows a lot more about running the business because they see thje two as inseparable. In fact, the CEO may be the CIO, or the operations vice president might be the CIO.

One of the reasons for the breadth of this relationship spectrum is our current place in history, says Gibson. We are at the technological discontinuity on the Stages of Growth diagram where the Micro Era is ending and the Network Era is beginning. Today, both eras co-exist, but the relationship issues, discussions of Micro Era executives are different from those of Network Era executives.
While Micro Era executives are talking about implementing and extending their ERP system (inside-out view).

Of course these approaches fall along a spectrum, but the point is that not all CEO-CIO teams today talk about the same issues as they did, same five years ago before the dot-coms merged IT and business. Moreover, there is a greater diversity of issues, roles for IT, and relationships required between CEOs and CIOs across businesses. As a result, it is far less appropriate to generalize about CEO-CIO discussions; the context now sets agenda and the agendas now vary widely. Gibson speculates that as established companies integrate their business operations with their Internet operations, the relationship between CEO and CIO will become closer and the discussion points may coalesce as the requirements of the Network Era come into clearer focus and apply generally to all businesses.

Relationships with Customers.

A major set of partnerships revolves around internal and external customers of the IS function. Line managers and other users are the internal customers. Increasingly the organization's customers, who buy services and products, are becoming customers of the IS function also.

The first job, as noted earlier, is to build credibility with business peers, at all levels. This move towards credibility is happening most often in companies that use multi-functional teams to run systems projects. Peer-to-peers working can break down stereotypes, improve relationships, and hopefully lead to a "partnering" mentality, which seems to be the goal of most IS departments these days. IT staff are participants but not the leaders.

As an example of getting in closer contact with internal customers, consider Federal-Mogul.

Relationships with Suppliers and Alliance Partners.

Due to the fast-moving changes in many industries driven by the move to e-commerce and the huge investments needed to react to these changes, IS departments are establishing cooperative external relationships with all sorts of suppliers to put in needed systems quickly. In such relationships, both supplier and customer know more about each other plans they work more closely on projects, and they may even undertake some joint ventures. Because it has not been the traditional mode of working between IS departments and vendors, some new forms of partnering mechanism need top be developed.

Another trend that has required IS has been supplier rationalization by businesses. IS must work more closely with the suppliers' executives to forge closer working relationships with suppliers that remain after their enterprise reduces suppliers from thousands to tens. Internally within IS departments, the same reduction is occurring. IS departments not only outsource their help desks, PC acquisitions-maintenance-disposal, data center, network management and other management, and other functions, they also establish "deeper" relationships with suppliers with these suppliers. They tell them of future plans, do joint

planning, perhaps work together on projects, and so forth. They treat these suppliers more as partners than as suppliers. This trend has opened up the need for vendor relationship management techniques training, pose managing suppliers will be a major job in the new IS department. In Chapter 8 we explain that Eastman Kodak has done to develop working procedures with its main outsourcers.

Summary of Responsibilities

These then are the six responsibilities of CIOs. Understanding the business, and requiring the staff to do the same, are preambles for becoming part of the business. Establishing credibility of the department, while it focuses mainly on the supply-side of job of keeping legacy systems up and running, can also foster the strategic role of bringing in new systems on time and on budget. It may mean outsourcing a major portion of the work, such as e-commerce links via the Net. Creating capable staff and fostering IT-savvy business people both portend closer IS-business ties. Visioning, too, is a joint IS business affair because it revolves around e-commerce. Implementing an architecture moves IS into a strategic role, as does nurturing relationships.

The role of IT is growing. The role of the IS department has gone through several stages of evolution, and will continue to evolve. It is possible that business teams will one day handle IT just as they now need to handle other resources—people and money.

4.0 CONCLUSION

The transformation information system departments are grappling with these days is learning how to create organizations where IT decision making is shared. The main responsibility for managing the use of IT needs to pass to the line, while the management of the IT infrastructure is retained by the information system group.

5.0 SUMMARY

Understanding the business and requiring the staff to do the same are preambles for becoming part of the business. Establishing credibility of the department, while it focuses mainly on the supply-side job of seeking legacy systems up and running can also foster the strategic role of bringing in new systems on time.

6.0 TUTOR MARKED ASSIGNMENT

1. Briefly summarize the CIO's six areas of responsibility
2. What is IS life?
3. What three kind of partnerships must be developed by the IS executive?

7.0 REFERENCE/FURTHER READING

Beath, Cynthia and Blake Ives, "the information technology champion. Aiding and abetting, care and feeding," Proceedings of the Twenty-First century Annual Hawaii International Conference on system Sciences, Vol IV. Pg 115-123, Available from the IEEE Computer Society, Los Alamitos, CA.

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