

The information systems function in the organisation is composed of three distinct entities. The first is a formal organizational unit or function called an **information systems department**. The second consists of information systems specialists such as programmers, systems analysts, project leaders, and information systems managers. Also, external specialists such as hardware vendors and manufacturers, software firms and consultants frequently participate in the day-to-day operations and long term planning of information systems. A third element of the information systems package is the technology itself, both hardware and software.

Today the information systems group often acts as a powerful change agent in the organisation, suggesting new business strategies and new information based products and coordinating both the development of technology and the planned changes in the organisation.

The size of the information systems department can vary greatly, depending on the role of information systems in the organisation and on the organisations size. The size of the information systems group and the total expenditures on computers and information systems are largest in service organisations (especially those that sell information products such as Dow Jones News), where information systems can consume more than 40% of gross revenues.

In the early years of the computer, when the role of information systems was limited, the information systems group was composed mostly of **programmers**, highly trained technical specialists who wrote the software instructions for the computer. Today, in most information systems groups, a growing proportion of staff members are systems analysts. **Systems analysts** constitute the principle liaison between information systems group and the rest of the organisation. It is the systems analysts job to translate business problems and requirements into information requirements and systems.

Information Systems managers are leaders of teams of programmers and analysts; project managers; physical facility managers; telecommunications managers; heads of office automation groups and finally managers of computer operations and data entry staff.

End users are representatives of departments outside the information systems group for whom applications are developed. These users are playing an increasingly large role in the design and development of information systems. In many organisations the information systems department is headed by a **chief information officer (CIO)**. The CIO is a senior management position to oversee the use of IT in the firm.

The last element of the IS function is the technology itself – the hardware and software instructions.

Why build IS

Systems today are built to increase efficiency and save money but they have also become vitally important for staying in business and may even be a source of competitive advantage. However, this may not be the only or primary reason for adapting systems.

Some organisations build systems because they are simply more innovative than others. They have values that encourage any kind of innovation, regardless of its direct economic benefit to the company. In other cases, information systems are built because of the ambitions of various groups within an organisation. And in some cases changes in an organisations environment – including changes in government regulations, competitors' actions and costs – demand a computer system response.



This illustrates a model of the systems development process that includes many factors other than economic considerations. This model divides the explanations for why organisations adopt systems into two groups, external environmental factors and internal institutional factors (Laudon, 1985, King et al, 1994).

Environmental factors are factors that are external to the organisation that influence the adoption and design of IS. Some external environmental factors are rising costs of labour or other resources, the competitive actions of other organisations, and changes in government regulations. The environment also provides organisations with opportunities – new technologies, new sources of capital, the development of new production processes, the demise of a competitor or a new government program that increases the demand for certain products.

Institutional factors are factors internal to the organisation that influence the adoption and design of information systems. They include values, norms and vital interests that govern matters of strategic importance to the organisation. For instance the top management of a corporation can decide that it needs to exercise much stronger control over the inventory process and therefore decides to develop and inventory IS. The resulting system is adopted, developed and operated purely for internal, institutional reasons (for a similar model see Kraemer et al, 1989).

Centralised vs. Decentralised

Centralised systems are those in which systems development and operation occur totally at the domestic home base.

Duplicated systems are those in which development occurs at the home base but operations are handed over to autonomous units in foreign locations.

Decentralised systems are those in which each foreign unit designs its own unique solutions and system.

Changes in Computing Technology

Decline in **centralized** mainframe systems

- Growth of "desktop computing"
- Growth of Local & Wide Area Networks
- Growth of Client/Server Systems
- Relative decline of hardware companies
- Increasing dominance of software companies especially Microsoft (PC & Server software)
- Multimedia information requirements
- Increasingly interactive user interfaces
- Ever cheaper components
- Development of middleware
- Internet and Web technology

Changes in Business Environments

Business structures can be characterized in terms of 3 components

- Complexity the degree of differentiation of activities
- Formalization the extent to which processes and jobs are standardized and structured
- Centralization the degree to which decision-making is concentrated at single points

Centralized Organizations

- Highly structured Structure directly reflects function
- Multi-level hierarchy Multiple tiers of management
- Centralized authority Top-down control

Decentralized Organizations

- Flatter structure fewer tiers of "middle management"
- Less formalized structures More local autonomy and accountability
- Customer/market oriented -More responsive changing business to environment more like bottom-up

Advantages of Distributed Systems

Improved Flexibility • Resources can be located within the organization where they will be most effective utilized Resources can be relocated as required Components can be added and upgraded independently and incrementally Provides Scalability - the ability of an infrastructure to grow to meet increasing demand with minimal disruption

• Local Autonomy

Allows domains of control to be established

A domain of control covers purchasing, ownership, IT budgets, operating priorities, IS development, IT management, etc

Domains allow decisions about IT resources to be made where they are utilized

Autonomy is recognition of the distributed nature of many organizational activities

Increased Reliability & Availability

Component failure in a centralized system can mean total systems failure, in a distributed system, component failure is limited to that component usually means only limited service outage for limited group of users

Component replication can provide fault tolerance; failure modes can be planned for

Improved Performance

Centralized Systems can be performance bottlenecks. Increased transaction processing or volumes of data result in performance degradation. Distributed systems allow partitioned services

• Isolation of Security Problems

> A single centralized system provides a focus for security breaches. Anv breach potentially compromises the whole system. "Denial of service" attacks have maximum effect

> In a distributed system security can be addressed via domains of control. Limits impact of attacks. Each security domain can have varying degrees of authentication, access control and auditing

Disadvantages of Distributed Systems

• More difficult to manage and secure

Centralized systems are inherently easier to manage because there's only one of them

Centralized systems are inherently easier to secure - Only have to have to worry about one point of vulnerability

Distributed system introduce complexity require more resources and cost more to run

• Reduced reliability and availability

Centralized systems now benefit from years of experience and development in terms of physical, operational and environmental conditions usually single vendor systems

Distributed systems are inherently more complex, more to go wrong, usually heterogeneous systems, unpredictable interoperability

• Staff Shortages

Distributed systems suffer from a loss of economies of scale require more staff to achieve same support require higher "skill-mix" in staff. Vendor support not yet comparable to centralized systems support from many vendors required no one vendor has "big picture" systems integrator support also necessary problems often arise at interfaces between sub-systems

Three main elements of Distributed IS

- Distributed IT Infrastructure (Processing)
 The components that make up the "physical" system. Primarily concerns processing devices (e.g., PCs, servers) but includes storage (on and off-line, RAID), Communication & networks, Operating systems (usually NOS), DBMSs (e.g., relational, object), Services and utilities Assumes a model for process interaction
 E.g., master/slave or client/server
 Transparency the degree to which system complexity is hidden
 It is a design issue
 How transparent should distribution be?
 Full or Partial Distribution
- Data

Structures required for data storage Organizational data model Different levels of representation Data can be represented as objects data and associated processes; an object could be an RDBMS, an audio file, etc Database model of data is useful Physical - storage and retrievability issues Logical - data model - entities/objects, attributes, relationships User View - what each user needs to manipulate

• Presentation

The way in which data is made visible to the user and interactions are handled User Interface "look-and-feel" behaviour (consistency and predictability) Presentation Management User Interface Management Display Services - e.g., interface devices Dialogue Control - e.g., event handling API - e.g., interface libraries

End user development

Some types of information systems can be developed by end users with little or no formal training assistance from technical specialists. This phenomenon is called **end-user development**. Using 4GL, graphics languages and PC software bols end users can access data, create reports and develop entire IS on their own, with little or no help from professional systems analysts or programmers. Many of these end user developed systems can be created much more rapidly than with the traditional systems lifecycle.

Concept of end user development

Traditional systems lifecycle development



Minutes or days.

Benefits and limitations

Many organisations have reported gains in application development productivity by using 4GL tools that in a few cases have reached 300 - 500% (Glass, 1999, Green, '84 - '85). Allowing users to specify their own business needs improves requirements gathering and often leads to a higher level of user involvement and user satisfaction with the system. However 4GL tools still cannot replace conventional tools for some business applications because they cannot easily handle the processing of large numbers of transactions or applications with extensive procedural logic and updating requirements.

End user computing also poses organisational risks because it occurs outside of traditional mechanisms for IS management and control. When systems are created rapidly without a formal development methodology, testing and documentation may be inadequate. Control over data can be lost in systems outside the IS department.

Managing end-user development

To help organisations maximise the benefits of end user applications development, management should control the development of end-user applications by requiring cost justification of end-user IS projects and by establishing hardware, software and quality standards for user-developed applications.

When end-user computing first became popular, organisations used information centres to promote standards for hardware and software so that end-users could not introduce many disparate and incompatible technologies into the form (Fuller and Swanson, 1992).

Information centres are special facilities housing hardware, software and technical specialists to supply end users with tools; training and expert advice so they can create IS applications on their own or increase productivity. The role of information centres is diminishing as end-users become more computer literate, but organisations still need to closely monitor and manage end-user development.

Outsourcing

If a firm does not want to use internal resources to build or operate information systems, it can hire an external organisation that specialises in providing these services to do the work. The process of turning over an organisations computer centre operations, telecommunications networks or applications development to external vendors is called **outsourcing**.

ASPs (Application Service Providers) are one source of outsourcing. Subscribing companies would use the software and hardware provided by the ASP as the technical platform for their system. In another form of outsourcing a company would hire an external vendor to design and create software for its system, but that company would operate the system on its own computer.

Outsourcing has become popular because some organisations perceive it as more cost effective than maintaining their own computer centre or information systems staff. The provider of the outsourcing benefits from economies of scale and is likely to charge competitive prices for information systems services. It allows a company with fluctuating needs for computer processing to pay for only what it uses rather than to build its own computer centre which would be under-utilised when there is no peak load.

Not all organisations benefit form outsourcing. Many firms underestimate costs for identifying and evaluating vendors of information technology services, for

transitioning to a new vendor and for monitoring vendors to make sure that they are fulfilling their contractual obligations. These hidden costs can easily undercut anticipated benefits from outsourcing (Barthelemy 2001). If the form lacks a the expertise to negotiate a sound contract the dependency on the vendor could result in high costs or loss of control over technical direction.