Evolution of Information Systems
(Relevant to AAT Examination Paper 8: Principles of Auditing and Management Information Systems)
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This article discusses the evolution of information systems, levels of management decision-making and information systems that enhance the value of information. Students are encouraged to understand the reasons for the development of an information system and its replacement; these will help you identify the benefits and limitations of each type of information system.

From EDP to MIS

Until the 1960s, the role of most information systems was simple. They were mainly used for electronic data processing (EDP),purposes such as transactions processing, record-keeping and accounting. EDP is often defined as the use of computers in recording, classifying, manipulating, and summarizing data. It is also called transaction processing systems (TPS), automatic data processing, or information processing.

> **Transaction processing systems** – these process data resulting from business transactions, update operational databases, and produce business documents. Examples: sales and inventory processing and accounting systems.

In the 1960s, another role was added to the use of computers: the processing of data into useful informative reports. The concept of management information systems (MIS) was born. This new role focused on developing business applications that provided managerial end users with predefined management reports that would give managers the information they needed for decision-making purposes.

> **Management information systems** – provide information in the form of prespecified reports and displays to support business decision-making. Examples: sales analysis, production performance and cost trend reporting systems.

By the 1970s, these pre-defined management reports were not sufficient to meet many of the decision-making needs of management. In order to satisfy such needs, the concept of decision support systems (DSS) was born. The new role for information systems was to provide managerial end users with ad hoc and interactive support of their decision-making processes.

> **Decision support systems** – provide interactive ad hoc support for the decision-making processes of managers and other business professionals. Examples: product pricing, profitability forecasting and risk analysis systems.

In the 1980s, the introduction of microcomputers into the workplace ushered in a new era, which led to a profound effect on organizations. The rapid development of microcomputer processing power (e.g. Intel's Pentium microprocessor), application software packages (e.g. Microsoft Office), and telecommunication networks gave birth to the phenomenon of end user computing. End users could now use their own computing resources to support their job requirements instead of waiting for the indirect support of a centralized corporate information services department. It became evident that most top executives did not directly use either the MIS reports

or the analytical modelling capabilities of DSS, so the concept of executive information systems (EIS) was developed.

> **Executive information systems** – provide critical information from MIS, DSS and other sources, tailored to the information needs of executives. Examples: systems for easy access to analysis of business performance, actions of all competitors, and economic developments to support strategic planning.

Moreover, breakthroughs occurred in the development and application of artificial intelligence (AI) techniques to business information systems. With less need for human intervention, knowledge workers could be freed up to handle more complex tasks. Expert systems (ES) and other knowledge management systems (KMS) also forged a new role for information systems. ES can serve as consultants to users by providing expert advice in limited subject areas.

> **Expert systems** – knowledge-based systems that provide expert advice and act as expert consultants to users. Examples: credit application advisor, process monitor, and diagnostic maintenance systems.

> **Knowledge management systems** – knowledge-based systems that support the creation, organization and dissemination of business knowledge within the enterprise. Examples: intranet access to best business practices, sales proposal strategies and customer problem resolution systems.

The mid- to late 1990s saw the revolutionary emergence of enterprise resource planning (ERP) systems. This organization-specific form of a strategic information system integrates all facets of a firm, including its planning, manufacturing, sales, resource management, customer relations, inventory control, order tracking, financial management, human resources and marketing – virtually every business function. The primary advantage of these ERP systems lies in their common interface for all computer-based organizational functions and their tight integration and data sharing needed for flexible strategic decision making.

From MIS to e-commerce

The rapid growth of the Internet, intranets, extranets and other interconnected global networks in the 1990s dramatically changed the capabilities of information systems in business. Internet-based and web-enabled enterprise and global electronic business and commerce systems are becoming commonplace in the operations and management of today's business enterprises.

Indeed today's information systems are still doing the same basic things that they began doing over 50 years ago. We still need to process transactions, keep records, provide management with useful and informative reports, and provide support to the accounting systems and processes of the organization. However, what has changed is that we now enjoy a much higher level of integration of system functions across applications, greater connectivity across both similar and dissimilar system components, and the ability to reallocate critical computing tasks such as data storage, processing, and presentation to take maximum advantage of business and strategic opportunities. With increasing capabilities, future systems will focus on

increasing both the speed and reach of our systems to provide even tighter integration combined with greater flexibility.

The Internet and related technologies and applications have changed the way businesses operate and people work, and how information systems support business processes, decision-making and competitive advantage. Today many businesses are using Internet technologies to web-enable business processes and to create innovative e-business applications.

E-business is the use of Internet technologies to work and empower business processes, electronic commerce and enterprise collaboration within a company and with its customers, suppliers and other business stakeholders. The Internet and Internet-like networks – those inside the enterprise (intranet) and those between an enterprise and its trading partners (extranet) – have become the primary information technology infrastructure that supports the e-business applications of many companies. These companies rely on e-business applications to (i) reengineer internal business processes, (ii) implement electronic commerce systems with their customers and suppliers, and (iii) promote enterprise collaboration among business teams and workgroups.

Level of management decision-making

Information systems can support a variety of management decision-making levels and decisions. These include the three levels of management activity: strategic management, tactical management, and operational management.

(i)   Strategic management
      It is typical for a board of directors and an executive committee of the CEO and top executives to develop the overall organization goals, strategies, policies and objectives as part of a strategic planning process. They also monitor the strategic performance of the organization and its overall direction in the political, economic and competitive business environment.

(ii)   Tactical management
      Increasingly, business professionals in self-directed teams as well as business unit managers develop short- and medium-range plans, schedules and budgets and specify the policies, procedures and business objectives for their sub-units of the company. They also allocate resources and monitor the performance of their organizational sub-units, including departments, divisions, process teams and other workgroups.

(iii)   Operational management
      The members of self-directed teams or operating managers develop short-range plans such as weekly production schedules. They direct the use of resources and the performance of tasks according to procedures, and within budgets and schedules they establish for the teams and other workgroups of the organization.

Information systems that enhance value of information

(i)   Data warehouse (DW)
      A data warehouse stores data that have been extracted from the various operational, external and other databases of an organization. It is a central source of the data that have been cleaned, transformed and catalogued so they can be used by managers and other business professionals for data mining, online analytical

processing and other forms of business analysis, market research and decision support.

(ii)   Data mining (DM)
         Data mining is a major use of DW databases and the static data they contain. In data mining, the data in a DW are analyzed to reveal hidden patterns and trends in historical business activity. This can be used to help managers make decisions about strategic changes in business operations to gain competitive advantages in the marketplace. DM software analyzes the vast stores of historical business data that have been prepared for analysis in corporate DW and tries to discover patterns, trends, and correlations hidden in the data that can help a company improve its business performance.

> **Data mining** – analyzes the vast amounts of historical that have been prepared for analysis in data warehouses.

(iii)   Online analytical processing (OLAP)
         Online analytical processing enables managers and analysts to interactively examine and manipulate large amounts of detailed and consolidated data from many perspectives. OLAP involves analyzing complex relationships among thousands or even millions of data items stored in data marts, DW and other multi-dimensional databases to discover patterns, trends and exceptional conditions. An OLAP session takes place online in real time, with rapid responses to a manager's or analyst's queries, so that their analytical or decision-making process is undisturbed.

> **Online analytical processing** – interactively analyzes complex relationships among large amounts of data stored in multi-dimensional databases.