

Operational support and enterprise systems

[Transaction processing](#) systems support the operations through which products are designed, marketed, produced, and delivered. In larger organizations, transaction processing is frequently accomplished with large [integrated](#) systems known as enterprise systems. In this case, the information systems that support various functional units—sales and marketing, production, finance, and human resources—are integrated into an enterprise resource planning (ERP) system, the principal kind of enterprise system. ERP systems support the value chain—that is, the entire sequence of activities or processes through which a firm adds value to its products. For example, an individual or another business may submit a custom order over the [Web](#) that automatically initiates just-in-time production to the customer’s specifications through an approach known as mass customization. This involves sending orders from the customers to the firm’s warehouses and perhaps to suppliers to deliver input materials just in time for a batched custom production run. Financial accounts are updated accordingly, and delivery [logistics](#) and billing are initiated.

Along with helping to [integrate](#) a firm’s own value chain, transaction processing systems can also serve to integrate the overall supply chain of which the organization is a part. This includes all firms involved in designing, producing, marketing, and delivering the goods and services—from raw materials to the final delivery of the product. A supply chain management (SCM) system manages the flow of products, data, money, and information throughout the entire supply chain, which starts with the suppliers of raw materials, runs through the intermediate tiers of the processing companies, and ends with the distributors and retailers. For example, purchasing an item at a major retail store generates more than a [cash register](#) receipt: it also automatically sends a restocking order to the appropriate supplier, which in turn may call for orders to the supplier’s

suppliers. With an SCM system, suppliers can also access a retailer's inventory [database](#) over the Web to schedule efficient and timely deliveries in appropriate quantities.

The third type of enterprise system, customer relationship management (CRM), supports dealing with the company's customers in marketing, sales, service, and new product development. A CRM system gives a business a unified view of each customer and its dealings with that customer, enabling a consistent and [proactive](#) relationship. In cocreation [initiatives](#), the customers may be involved in the development of the company's new products.

Many transaction processing systems support [electronic commerce](#) over the [Internet](#). Among these are systems for online shopping, banking, and securities trading. Other systems deliver information, educational services, and entertainment on demand. Yet other systems serve to support the search for products with desired attributes (for example, keyword search on search engines), price discovery (via an auction, for example), and delivery of digital products (such as software, music, movies, or greeting cards). Social network sites, such as [Facebook](#) and [LinkedIn](#), are a powerful tool for supporting customer [communities](#) and individuals as they [articulate](#) opinions, evolve new ideas, and are exposed to promotional messages. A growing array of specialized services and information-based products are offered by various organizations on the Web, as an [infrastructure](#) for electronic commerce has emerged on a global scale.

Transaction processing systems accumulate the data in databases and data warehouses that are necessary for the higher-level information systems. Enterprise systems also provide software modules needed to perform many of these higher-level functions.

Support of knowledge work

A large proportion of work in an information society involves manipulating abstract information and knowledge (understood in this [context](#) as an organized and [comprehensive](#) structure of facts, relationships, theories, and insights) rather than directly processing, manufacturing, or delivering [tangible](#) materials. Such

work is called [knowledge work](#). Three general categories of information systems support such knowledge work: professional support systems, collaboration systems, and knowledge management systems.

Professional support systems

Professional support systems offer the facilities needed to perform tasks specific to a given profession. For example, automotive engineers use [computer-aided engineering](#) (CAE) software together with [virtual reality](#) systems to design and test new models as electronic [prototypes](#) for fuel [efficiency](#), handling, and passenger protection before producing physical prototypes, and later they use CAE in the design and analysis of physical tests. Biochemists use specialized three-dimensional modeling software to visualize the molecular structure and probable effect of new drugs before investing in lengthy clinical tests. Investment bankers often employ financial software to calculate the expected rewards and potential risks of various investment strategies. Indeed, specialized support systems are now available for most professions.

Collaboration systems

The main objectives of collaboration systems are to [facilitate communication](#) and teamwork among the members of an organization and across organizations. One type of collaboration system, known as a workflow system, is used to route relevant documents automatically to all appropriate individuals for their contributions.

Development, pricing, and approval of a commercial insurance policy is a process that can benefit from such a system. Another category of collaboration systems allows different individuals to work simultaneously on a shared project. Known as [groupware](#), such systems accomplish this by allowing controlled shared access, often over an intranet, to the work objects, such as business proposals, new designs, or digital products in progress. The collaborators can be located anywhere in the world, and, in some multinational companies, work on a project continues 24 hours a day.

Other types of collaboration systems include [enhanced](#) e-mail and videoconferencing systems, sometimes with telepresence using avatars of the participants. Yet another type of collaboration software, known as [wiki](#), enables multiple participants to add and edit content. (Some online encyclopaedias are produced on such platforms.) Collaboration systems can also be established on [social network](#) platforms or virtual life systems. In the open [innovation initiative](#), members of the public, as well as existing and potential customers, can be drawn in, if desired, to enable the cocreation of new products or projection of future outcomes.

Knowledge management systems

Knowledge management systems provide a means to assemble and act on the knowledge accumulated throughout an organization. Such knowledge may include the texts and images contained in patents, design methods, best practices, competitor intelligence, and similar sources, with the elaboration and commentary included. Placing the organization's documents and communications in an indexed and cross-referenced form enables rich search capabilities. Numerous application programs, such as [Microsoft](#)'s SharePoint, exist to [facilitate](#) the implementation of such systems. Organizational knowledge is often tacit, rather than explicit, so these systems must also direct users to members of the organization with special expertise.

Management support

A large category of information systems [comprises](#) those designed to support the [management](#) of an organization. These systems rely on the data obtained by transaction processing systems, as well as on data and information acquired outside the organization (on the [Web](#), for example) and provided by business partners, suppliers, and customers.

Management reporting systems

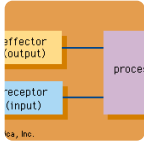
Information systems support all levels of management, from those in charge of short-term schedules and budgets for small work groups to those concerned with

long-term plans and budgets for the entire organization. Management reporting systems provide routine, detailed, and voluminous information reports specific to each manager's areas of responsibility. These systems are typically used by first-level supervisors. Generally, such reports focus on past and present activities, rather than projecting future performance. To prevent information overload, reports may be automatically sent only under exceptional circumstances or at the specific request of a manager.

Decision support systems and business intelligence

All information systems support [decision making](#), however indirectly, but [decision support systems](#) are expressly designed for this purpose. As these systems are increasingly being developed to analyze massive collections of data (known as big data), they are becoming known as [business intelligence](#), or business [analytics](#), applications. The two principal varieties of decision support systems are model-driven and data-driven.

In a model-driven decision support system, a preprogrammed model is applied to a relatively limited data set, such as a sales [database](#) for the present quarter. During a typical session, an analyst or sales manager will conduct a [dialog](#) with this decision support system by specifying a number of what-if scenarios. For example, in order to establish a selling price for a new product, the sales manager may use a marketing decision support system. It contains a model relating various factors—the price of the product, the cost of goods, and the promotion expense in various media—to the projected sales volume over the first five years on the market. By supplying different product prices to the model, the manager can compare predicted results and select the most profitable selling price.



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The primary objective of data-driven business intelligence systems is to analyze large pools of data, accumulated over long periods of time in data warehouses, in a process known as data mining. [Data mining](#) aims to discover significant

patterns, such as sequences (buying a new house, followed by a new dinner table), clusters, and correlations (large families and van sales), with which decisions can be made. Predictive analytics attempts to forecast future outcomes based on the discovered trends. Data-driven decision support systems include a variety of statistical models and may rely on various [artificial intelligence](#) techniques, such as [expert systems](#), [neural networks](#), and [machine learning](#). In addition to mining numeric data, text mining is conducted on large [aggregates](#) of unstructured data, such as the contents of [social media](#) that include [social networks](#), [wikis](#), [blogs](#), and microblogs. As used in [electronic commerce](#), for example, text mining helps in finding buying trends, targeting advertisements, and detecting fraud.

An important variety of decision support systems enables a group of decision makers to work together without necessarily being in the same place at the same time. These group decision systems include software tools for brainstorming and reaching [consensus](#).

Another category, geographic information systems, can help analyze and display data by using digitized maps. Digital mapping of various regions is a continuing activity of numerous business firms. Such data visualization supports rapid decision making. By looking at a geographic distribution of mortgage loans, for example, one can easily establish a pattern of [discrimination](#).

Executive information systems

Executive information systems make a variety of critical information readily available in a highly summarized and convenient form, typically via a graphical digital dashboard. Senior managers characteristically employ many informal sources of information, however, so that formal, computerized information systems are only of partial assistance. Nevertheless, this assistance is important for the [chief executive officer](#), senior and executive vice presidents, and the board of directors to monitor the performance of the company, assess the business [environment](#), and develop strategic directions for the future. In particular, these executives need to compare their organization's performance with that of its competitors and investigate general economic trends in regions or countries. Often individualized and relying on multiple media formats, executive

information systems give their users an opportunity to “drill down” from summary information to increasingly focused details.