

# Enterprise Resource Planning and Integration

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## INTRODUCTION

Enterprise resource planning (ERP) is a state-of-the-art approach to running organizations with the help of comprehensive information systems, providing support for key business processes and more general, for electronic business (e-business). ERP has evolved from earlier approaches, in particular, materials requirement planning (MRP) and manufacturing resource planning (called MRP II) in the 1980s. The focus of MRP and MRP II was on manufacturing firms. The essential problem that MRP attacked was to determine suitable quantities of all parts and materials needed to produce a given master production schedule (also called a “production program”), plus the dates and times when those quantities had to be available. Application packages for MRP have been available from the 1960s on. In the beginning, they were mostly provided by hardware vendors like IBM, Honeywell Bull, Digital Equipment, Siemens, etc. MRP was later expanded to *closed-loop MRP* to include capacity planning, shop floor control, and purchasing, because as Oliver Wight (1884) puts it: “Knowing what material was needed was fine, but if the capacity wasn’t available, the proper material couldn’t be produced” (p. 48).

The next step in the evolution was *MRP II (manufacturing resource planning)*. According to the father of MRP II, Oliver Wight, top management involvement in the planning is indispensable. Therefore, MRP II expands closed-loop MRP “to include the financial numbers that management needs to run the business and a simulation capability” (Wight, 1984, p. 54).

Enterprise resource planning (ERP) has its roots in the earlier MRP II concepts, but it extends those concepts substantially into two directions. ERP takes into account that other types of enterprises than those producing physical goods need comprehensive information system (IS) support as well, and even in the manufacturing industry, there are more areas than those directly related to the production of goods that are critical for the success of a business.

## BACKGROUND OF ERP

The key issue of ERP is integration (Langenwaller, 1999). While stand-alone solutions—sometimes quite sophisticated information systems—for various areas of a

business have been available before, ERP takes a holistic approach. Instead of isolated views—on procurement, on manufacturing, on sales and distribution, on accounting, etc.—the focus is now on integrating those functional areas (Scheer & Habermann, 2000). The need for integrated systems has been recognized by many, but Germany-based SAP AG was the first to put them into reality. SAP’s early success as worldwide market leader comes largely from the fact that this company actually designed and implemented business-wide integrated information systems. The lack of integration of information systems has created a variety of problems. The most serious ones are the following:

- Redundancy (i.e., the same information is stored and maintained several times)
- Inconsistency (i.e., information about the same entity stored in different places is not the same)
- Lack of integrity (i.e., databases where such information is stored are not correct)

Mistakes, wrong decisions, and additional work are some of the consequences resulting from these problems. Consider, for example, data about customers. Such data are often entered and maintained in a sales and distribution information system (customer orders), then again in the dispatching system (delivery orders), and perhaps once more in a financial accounting system (invoices). Not only is this redundant and means additional work, but also the same attributes may even stand for different things. For example, an “address” field in the sales and distribution system may represent the address of the customer’s procurement department, whereas “address” in the dispatching system is the place where the goods have to be delivered.

Integration of information systems can be considered from several perspectives: from the data, the functions, the operations, the processes, the methods, and the software perspectives. The most important aspects are data integration, operations integration, process integration, and software integration:

- **Integration of data** means that data models and databases are unified so that all departments of an enterprise use the same data entities, with the same values.

- **Integration of operations** requires connecting individual operations, or steps of a business process, with preceding or succeeding operations, respectively.
- **Integration of processes** means that interfaces between different business processes are explicitly considered (e.g., connections between order processing and flow of material control).
- **Integration of software** means that different programs (e.g., information systems for different business functions, can run together and use each other's data and operations.

Those aspects of integration have always been considered important requirements for effective business information processing, but how does one actually obtain enterprise-wide integrated information systems?

Because most organizations have been using information systems in various business areas for quite some time, one way is to integrate those stand-alone systems subsequently. This approach has been discussed and practiced under the concept of “software reengineering,” often related to the term “legacy systems” for the information systems to be integrated (Miller, 1997; Seacord et al., 2003).

The other approach to obtain integrated information systems is obviously to start developing them from scratch. In such a situation, information structures can be modelled and designed on the drawing board in an enterprise-wide manner, at least in theory. Practical experiences have shown that developing comprehensive information systems for all areas of a business is a giant task. That is why such systems have rarely been developed as individual solutions. Not only is the investment needed very high, but also manpower and know-how to develop such systems are often beyond the means of a single company. Therefore, comprehensive integrated information systems have mostly been developed by dedicated software and consulting companies. In the 1970s and 1980s, those systems were named with rather general terms, like standard packages or integrated business information systems, until the terms “enterprise resource planning” and “ERP system” emerged in the 1990s. In fact, the term “enterprise resource planning” has been coined by the software industry and not by academia.

Today there is a common understanding of what the term stands for. The definition used in this article is as follows: An enterprise resource planning system (ERP system) is a comprehensive information system that collects, processes, and provides information about all parts of an enterprise, automating business processes and business rules within and across business functions partly or completely.

Alternatively, an ERP system may be defined as a set of integrated information systems rather than as one system. This depends on the perspective of the viewer. For the user, an ideal ERP system will behave like one

enterprise-wide information system, with one database, and one common user interface. Nevertheless, such a system may be composed of many subsystems and many databases, as long as they are well integrated.



## COMPONENTS OF AN ERP SYSTEM

### Horizontal and Vertical Views of Enterprise Resource Planning

An ERP system integrates information, processes, functions, and people into one coherent system (Brady et al., 2001). Such a system supports all horizontal business functions and all vertical levels of a business (operational, tactical, and strategic). Figure 1 illustrates this view in a simplified information systems pyramid. Each component may be seen as a functional subsystem. In a horizontal perspective, systems are integrated along the value chain. The vertical direction asks for integration of operative systems with their corresponding value-oriented accounting systems; reporting and controlling systems; analysis and management information systems; and long-term planning and decision support systems (Scheer, 1994, p. 5).

A typical ERP system provides components like the ones shown in Figure 1, arranged and extended in one way or another. As an example of integrated information systems, the mySAP ERP system is described subsequently.

### An Example: SAP ERP

SAP ERP has evolved from SAP R/3 which is still the most frequently installed ERP system. SAP ERP is based on SAP NetWeaver as technology platform (SAP, 2006b). Encompassing all levels of the pyramid, SAP ERP is logically structured into the following modules (short descriptions are taken from SAP, 2006a, 2006b):

#### Analytics

- **Strategic enterprise management**—Supports the top level of the pyramid in Figure 1: integrated strategic planning, performance monitoring, business consolidation, and stakeholder communication; provides tools for planning and executing the strategies: balanced scorecard, value-based management, financial statement planning, risk management, investment planning, and more
- **Business analytics (financial, operations, workforce analytics)**—Supports managers with methods and tools for financial and management reporting, financial planning, budgeting and forecasting, profitability management, product and service cost management,

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