《先进制造技术》论文

ERP的发展历史及应用

姓 名： 姚 胜 虎

学 号： SZ1505080

指导老师： 肖 冰

**The Evolution of ERP Systems**

**中文摘要：**企业资源计划（ERP）是指建立在信息技术基础上，以系统化的管理思想，为企业决策层及员工提供决策运行手段的管理平台。ERP 系统支持离散型、流程型等混合制造环境，应用范围从制造业扩展到了[零售业](http://baike.baidu.com/view/175601.htm" \t "http://baike.baidu.com/_blank)、[服务业](http://baike.baidu.com/view/154003.htm" \t "http://baike.baidu.com/_blank)、[银行业](http://baike.baidu.com/view/6353570.htm" \t "http://baike.baidu.com/_blank)、[电信业](http://baike.baidu.com/view/11678231.htm" \t "http://baike.baidu.com/_blank)、政府机关和学校等事业部门，通过融合数据库技术、图形用户界面、第四代查询语言、客户服务器结构、计算机辅助开发工具、可移植的开放系统等对企业资源进行了有效的集成。

**关键词：**信息技术 制造业 计算机 开放系统

**Abstract:** Enterprise resource planning (ERP) is a management platform which is based on the information technology and it is based on the systematic management thought which provides the decision-making level and the staff. It supports discrete and mixed flow type manufacturing industry which expand the range of applications from manufacturing to retail, services, banking, telecommunications, government agencies and other public sector through the integration of database technology, the graphical user interface, the fourth generation of query language, client server architecture, computer aided development tools and portable open system。

**Keywords:** information technology manufacturing industry computer

open system

**INTRODUCTION**

The unprecedented growth of information and communication technolo-gies (ICT) driven by microelectronics, computer hardware and software systems has influenced all facets of computing applications across organiza-tions. Simultaneously the business environment is becoming increasingly complex with functional units requiring more and more inter-functional data flow for decision making, timely and efficient procurement of product parts, management of inventory, accounting, human resources and distribution of goods and services. In this context, management of organizations needs efficient information systems to improve competitiveness by cost reduction and better logistics. It is universally recognized by large and small-to-medium-size enterprises (SME) that the capability of providing the right information at the right time brings tremendous rewards to organizations in a global competitive world of complex business practices.

Starting in the late 1980s and the beginning of the 1990s new software systems known in the industry as enterprise resource planning (ERP) systems have surfaced in the market targeting mainly large complex business organi-zations. These complex, expensive, powerful, proprietary systems are off-the-shelf solutions requiring consultants to tailor and implement them based on the company’s requirements. In many cases they force companies to reengineer their business processes to accommodate the logic of the software modules for streamlining data flow throughout the organization. These software solutions, unlike the old, traditional in-house-designed company-specific systems, are integrated multi-module commercial packages suitable for tailoring and adding “add-ons” as and when required.

The phenomenal growth of computing power and the Internet is bringing ever more challenges for the ERP vendors and the customers to redesign ERP products, breaking the barrier of proprietorship and customization, and embracing the collaborative business over the intranet, extranet and the Internet in a seamless manner. The vendors already promise many “add-on” modules, some of which are already in the market as a sign of acceptance of these challenges by the ERP vendors. It is a never-ending process of reengineering and development bringing new products and solutions to the ERP market. ERP vendors and customers have recognized the need for packages that follow open architecture, provide interchangeable modules and allow easy customization and user interfacing.

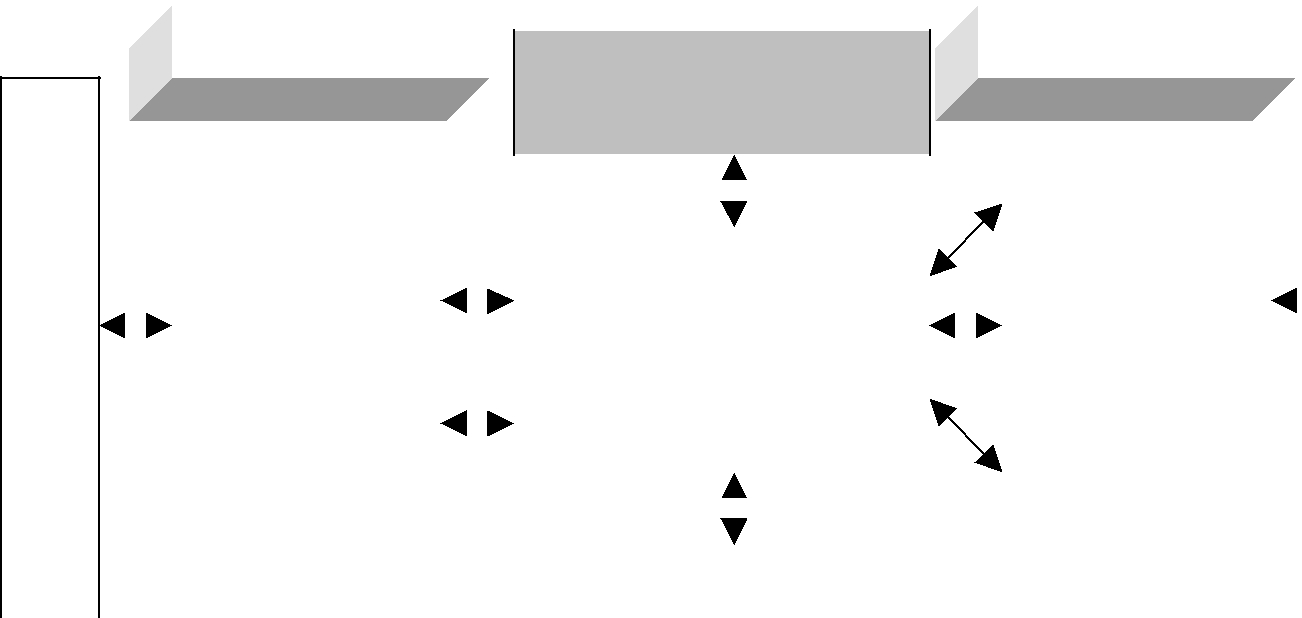
**ERP SYSTEMS DEFINED**

Enterprise resource planning systems or enterprise systems are software systems for business management, encompassing modules supporting func-tional areas such as planning, manufacturing, sales, marketing, distribution, accounting, financial, human resource management, project management, inventory management, service and maintenance, transportation and e-busi-ness. The architecture of the software facilitates transparent integration of modules, providing flow of information between all functions within the enter-prise in a consistently visible manner. Corporate computing with ERPs allows companies to implement a single integrated system by replacing or re-engineering their mostly incompatible legacy information systems. American Production and Inventory Control Society (2001) has defined ERP systems as “a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company.” We quote several definitions from the published literature to further explain the concept: “ERP (enterprise resource planning systems) comprises of a commercial software package that promises the seamless integration of all the information flowing through the company–financial, accounting, human re-sources, supply chain and customer information” (Davenport, 1998). “ERP systems are configurable information systems packages that integrate informa-tion and information-based processes within and across functional areas in an organization” (Kumar & Van Hillsgersberg, 2000). “One database, one applica-tion and a unified interface across the entire enterprise” (Tadjer, 1998). “ERP systems are computer-based systems designed to process an organization’s transactions and facilitate integrated and real-time planning, production, and customer response” (O’Leary, 2001). The concept of the ERP system can be illustrated, following Davenport (1998), with the diagram in Figure 1.

**EVOLUTION OF ERP SYSTEMS**

The evolution of ERP systems closely followed the spectacular develop-ments in the field of computer hardware and software systems. During the

*Figure 1: ERP systems concept*

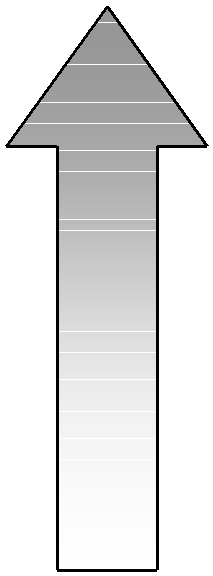
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1960s most organizations designed, developed and implemented centralized computing systems, mostly automating their inventory control systems using inventory control packages (IC). These were legacy systems based on pro-gramming languages such as COBOL, ALGOL and FORTRAN. Material requirements planning (MRP) systems were developed in the 1970s which involved mainly planning the product or parts requirements according to the master production schedule. Following this route new software systems called manufacturing resources planning (MRP II) were introduced in the 1980s with an emphasis on optimizing manufacturing processes by synchro-nizing the materials with production requirements. MRP II included areas such as shop floor and distribution management, project management, finance, human resource and engineering. ERP systems first appeared in the late 1980s and the beginning of the 1990s with the power of enterprise-wide inter-functional coordination and integration. Based on the technological foundations of MRP and MRP II, ERP systems integrate business processes including manufacturing, distribution, accounting, financial, human resource management, project management, inventory management, service and main-tenance, and transportation, providing accessibility, visibility and consis-tency across the enterprise.

During the 1990s ERP vendors added more modules and functions as “add-ons” to the core modules giving birth to the “extended ERPs.” These ERP extensions include advanced planning and scheduling (APS), e-business solutions such as customer relationship management (CRM) and supply chain management (SCM). Figure 2 summarizes the historical events related with ERP.

*Figure 2: ERP evolution*

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| **2000s** |  | **Extended ERP** |
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|  |  |  |
| **1990s** |  | **Enterprise Resource Planning** |
|  |  | **(ERP)** |
| **1980s** |  | **Manufacturing Resources Planning (MRP II)** |
| **1970s** |  | **Material Requirements Planning (MRP)** |
| **1960s** |  | **Inventory Control Packages** |

**ERP SYSTEMS AND ORGANIZATIONS**

It is generally a misleading perception that implementing an ERP system will improve organizations’ functionalities overnight. The high expectation of achieving all-round cost savings and service improvements is very much dependent on how good the chosen ERP system fits to the organizational functionalities and how well the tailoring and configuration process of the system matched with the business culture, strategy and structure of the organization. Overall an ERP system is expected to improve both backbone and front-end functions simultaneously. Organizations choose and deploy ERP systems for many tangible and intangible benefits and strategic reasons. In many cases the calculation of return on investment (ROI) is weighted against the many intangible and strategic benefits. The benefits that an industry standard ERP system may bring to organizations are shown in Table 1. To reap the benefits of ERP systems, however, organizations need to over-come certain problems and disadvantages, which are listed in Table 2.

It was estimated that the spending on ERP systems in 1998 was about US$17 billion following annual growth rates ranging from 30% to 50%. Companies also spend a multiple of licensing costs on services related to implementation and maintenance of the software. The worldwide license and maintenance revenue for ERP systems was US$21.5 billion in 2000, which represented a growth of 13.1% from the 1999 market value of $US19 billion (Broatch, 2001). The continued growth of the ERP systems market is

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| *Table 1: Advantages of ERP systems* | | |  |
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|  | **What benefit** | **How** |
|  |  |  |  |
|  | Reliable information access | Common DBMS, consistent and accurate |
|  |  |  | data, improved reports. |
|  | Avoid data and operations redundancy | | Modules access same data from the central |
|  |  |  | database, avoids multiple data input and |
|  |  |  | update operations. |
|  | Delivery and cycle time reduction | | Minimizes retrieving and reporting delays. |
|  | Cost reduction | | Time savings, improved control by |
|  |  |  | enterprise-wide analysis of organizational |
|  |  |  | decisions. |
|  | Easy adaptability | | Changes in business processes easy to |
|  |  |  | adapt and restructure. |
|  | Improved scalability | | Structured and modular design with “add- |
|  |  |  | ons.” |
|  | Improved maintenance | | Vendor-supported long-term contract as |
|  |  |  | part of the system procurement. |
|  | Global outreach | | Extended modules such as CRM and SCM. |
|  | E-Commerce, e-business | | Internet commerce, collaborative culture. |

Table 2: Disadvantages of ERP systems

attributed to the fact that the vendors are adding applications such as supply chain management, customer relationship management and the integration of Internet-enabled applications for e-business. More than 60% of the Fortune 1000 companies have installed or are in the process of implementing packaged ERP systems to support their back-end business activities (Kraft, 2001). These packages implemented by the Fortune 1000 companies run well over the IT budgets for most SMEs. ERP vendors are targeting this untapped SME market with supposedly scaled-back systems suitable for smaller firms by offering simple, cheaper and pre-configured easy-to-install solutions within budget and time constraints. For some vendors this may lead to offering centrally managed Internet-enabled ERP-system-based services for SMEs to access and use anytime from anywhere.

**ERP SYSTEMS ARCHITECTURE**

ERP vendors, mostly experienced from the MRP and financial software services fields, realized the limitations of the old legacy information systems used in large enterprises of the 1970s and 1980s. Some of these old systems were developed in-house while others were developed by different vendors using several different database management systems, languages and packages, creating islands of noncompatible solutions unfit for seamless data flow between them. It was difficult to increase the capacity of such systems or the users were unable to upgrade them with the organization’s business changes,strategic goals and new information technologies.An ERP system is required to have the following characteristics:

• Modular design comprising many distinct business modules such as

financial, manufacturing, accounting, distribution, etc.

• Use centralized common database management system (DBMS)

• The modules are integrated and provide seamless data flow among the

modules, increasing operational transparency through standard interfaces

• They are generally complex systems involving high cost

• They are flexible and offer best business practices

• They require time-consuming tailoring and configuration setups for

integrating with the company’s business functions

• The modules work in real time with online and batch processing

capabilities

• They are or soon they will be Internet-enabled

Different ERP vendors provide ERP systems with some degree of specialty but the core modules are almost the same for all of them. Some of the core ERP modules found in the successful ERP systems are the following:

• Accounting management

• Financial management

• Manufacturing management

• Production management

• Transportation management

• Sales & distribution management

• Human resources management

• Supply chain management

• Customer relationship management

• E-Business

The modules of an ERP system can either work as stand-alone units or several modules can be combined together to form an integrated system. The systems are usually designed to operate under several operating platforms such as UNIX, MS Windows NT, Windows 2000, IBM AIX, and HP-UX systems. SAP AG, the largest ERP vendor, provides a number of modules with its famous R/3 ERP system, which are shown in Table 3. New modules are introduced by SAP and other vendors in response to the market and technological demand such as the Internet technology.