

Functional Analysis of Enterprise Resource Planning Systems

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Abstract: *An analysis of the general functions of the Enterprise Resource Planning (ERP) systems is performed. Historical development of ERP is given. Analysis and comparisons of three open source ERP are provided.*

Key words: *Enterprise Resource Planning, functional analysis*

INTRODUCTION

The paper provides brief introduction to ERP (Enterprise Resource Planning) software systems. ERP software attempts to integrate all departments and functions of a company onto a single integrated computer system by automating the workflows so that the various departments can more easily share information and communicate with each other [2]. A simple ERP software is typically divided into one module per department, e.g. finance, human resources, helpdesk, marketing, sales, production, warehouse, etc. It supports workflows internal to each module but can manage the customer orders between departments. ERPs were originally part of the back-office and did not handle front-office processes like customer selling or customer trouble ticketing. All these front-office customer related processes can be designated under the term of Customer Relationship Management (CRM) and should be ideally integrated in ERPs.

OVERVIEW OF ENTERPRISE RESOURCE PLANNING SYSTEMS

ERP works as a central system, which integrates all traditional enterprise management functions: finance, human resources management, project management, data management, warehouse management, customer relationship management, supplier relationship management, e-business and the internet function [2]. An ERP system can provide the organization with central availability of information and efficiently provisioning of accurate data, communication and service to all customers. ERP systems use database technology and control the information for the company business [4]. ERP applies client/server architecture, using Internet, relational databases and mainframe operating systems [3].

Enterprise resource planning targets the optimisation of the company management. The software is decentralised, connects the departments of the enterprise and shares common data with an integrated ERP. When data as sales become available, they are automatically calculated for the effects on other areas, such as manufacturing, inventory, procurement, invoicing.

The root of ERP systems began in the manufacturing industry, where software was developed during the 1960's and 1970's to track the production. The first software was called Materials Requirements Planning (MRP). It allowed plant managers to coordinate the planning of production and raw material requirements. MRP was the first attempt at an integrated information system [2]. It has been

implemented with mainframe computers, handling software functions, file processing and electronic data interchange (EDI). Since 1980's, the idea of MRP was expanded into second generation MRP, where the goal was to have all company's departments running on a same set of data [7].

The first true ERP system began development in 1972 when five former IBM systems analysts formed a company that later became Systems, Applications and Products in Data Processing (SAP) enterprise. SAP started with development of accounting packages. This package has been elaborated with additional modules for Purchasing, Inventory Management, Invoice Verification. In 1978, SAP developed a more integrated version of its software products, called the SAP R/2 system, which allowed interactivity between modules and additional capabilities like order tracking [2]. In 1992, SAP released its SAP R/3 system, which features were the application of client-server hardware architecture allowing the system to run on a variety of computer platforms such as Unix and Windows NT. R/3 was also designed with an open-architecture approach, allowing third-party companies to develop software that will integrate with SAP R/3 [2]. During the 1990's, ERP competition increased dramatically, with companies such as Oracle Corporation, PeopleSoft, J.D. Edwards and Baan producing such systems. Currently, SAP and Oracle are the two leading ERP system developers.

EVOLUTION OF ERP AND ITS COMPONENTS

The systems integration across the various ERP modules allows managers to know what's going on in their businesses [5]. The ERP applications passed through four stages of functional developments.

Stage 1: Manufacturing Integration (MRP)

The historical origin of ERP is started 1960s with the development of business oriented software. In 1970s it has been realised the importance of integrating the material requirements planning (MRP) and distribution resource planning (DRP). The target was to automate all aspects of production scheduling and production planning. Since 1980s, the second generation MRP systems extended functionalities with order processing, manufacturing, and distribution. The MRP's contributions became apparent and the corporate managers started to integrate other company functions, including finance, human resources, project management. As a result, the MRP was renamed ERP, Figure 1.

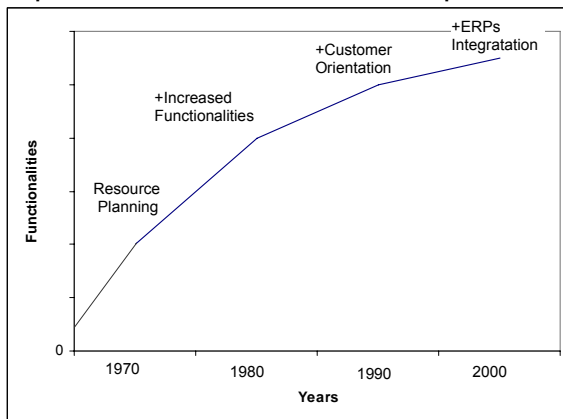
Stage 2: Enterprise Integration (ERP)

The structural migration from MRP to ERP was followed with possibilities, which the ERP systems gave for the business management:

- **Replacing legacy systems.** The deployment of modern application frameworks reflects the current business practices and adapts the enterprise to changes in the business environment.
- **Gaining greater control.** Managers want to know how much their business has sold, what's been shipped, and a complete inventory status. Most legacy applications cannot provide such information.

- **Managing global operations.** The company can manage its local activities and coordinates its worldwide operations, having accurate and timely information process.
- **Handling industry deregulation and regulatory change.**
- **Improving integration of decisions across the enterprise.** The ERP model attempts to minimize information coordination problems by creating an integrated core of administrative and financial applications for all enterprise applications.

Stage 3: Customer-Centric Integration (CRP). The customer becomes the most important factor in the business process.



ERP's business requirements have evolved from cost cutting, increase of efficiency, and productivity towards focusing on customer value, effectiveness, and enhanced service delivery. The CRP strategies assume that companies must plan continuously instead of the classic ERP assumption of long planning cycles.

Fig. 1: Evolution of Business Models

Stage 4: Interenterprise Integration (XRP)

This fourth stage of ERP development extended the resource planning (XRP to the groups of customers, suppliers, and trading partners. Examples of XRP are B2B systems. A main goal of an XRP implementation is to provide better synchronization with trading partners in order to reduce production costs, to perform strategic pricing, to improve times constraints, to increase customer satisfaction throughout the supply chain. XRP systems complement traditional ERP systems by providing intelligent decision support capabilities. An XRP system is designed to overlay existing systems, pulling data from every step in the supply chain and providing a clear, global picture of where the enterprise is heading. XRP-generated plans allow companies to quickly assess the impact of their actions across the entire supply chain, including the company's impact on customer demand. Figure 2 illustrates the core applications that participate in an ERP framework.

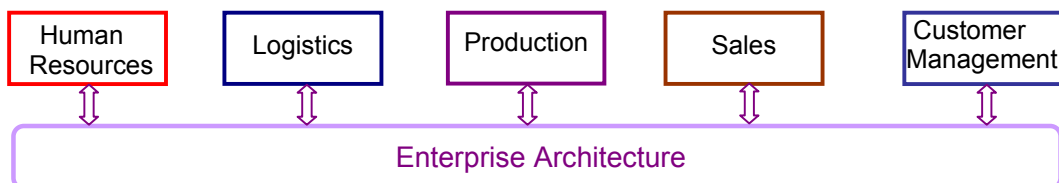


Fig. 2: Elements of Enterprise Resource Management [5].

Some examples of SAP functional modules [6].

SAP AG is based in Walldorf, Germany and is the world's largest enterprise software company. SAP's is built upon the concepts of specialization and integration. Each component within the SAP family addresses specific functionality. For instance, SAP R/3 and its successor, SAP ERP Central Component (ECC), are comprised of modules like Financials, Sales & Distribution, Materials Management, Warehouse Management.

Four strong players dominate the market of ERPs: SAP, Oracle, PeopleSoft and JD Edwards. They share 50% of the big companies market. A list of open source and commercial ERPs are given in tables 1 and 2.

Table 1. Open source ERPs

• TinyERP	• CK-ERP
• Compiere	• OfBiz
• iPyME	• Jerpa
• Fisterra	• SugarCRM
• Hipergate	• FacturaLUX
• ERP5	

Table 2. Commercial ERPs

• BPCS from SSA Global Technologies	• kVASy4 from SIV.AG
• Epicor Enterprise from Epicor	• Datasul EMS Framework from Datasul
• Infor XA ERP from Infor (formerly MAPICS)	• JD Edwards EnterpriseOne from Oracle
• Enterprise Business System from Made2Manage Systems	• Lawson Financials from Lawson Software
• Macola ERP from Exact Software	• MFG/PRO from QAD
• Microsoft Dynamics from Microsoft Business Division	• PeopleSoft from Oracle Corporation Oracle
• Oracle e-Business Suite from Oracle	• NetERP from NetSuite Inc.
• PROMIS MES from Brooks Automation	• Ramco e.Applications from Ramco Systems
• Sage MAS 500 from The Sage Group	• SAP R/3 from SAP
• SSA ERP LN from SSA Global Technologies	• SYSPRO ERP software from SYSPRO

Overview of SAP

The SAP's products are used to satisfy the needs of enterprises for managing production, tracking sales, delivering services, maximizing revenue, optimizing supply chains. SAP products enable these functionalities integrating many otherwise discrete functional modules under a single umbrella. Thus, a company

gains greater visibility into the management and estimates to make the business more economically, rapidly, and profitably [Anderson, 2005].

Overview of Oracle

The Oracle Enterprise Resource Planning (ERP) applications are an integrated suite of applications [Boss, 2001]. For example, the Receivables application is designed to bill customers, collect cash, and keep tracks. The reports are designed to list what transactions were made, control the processes, and show what balances remain after the transaction. The Oracle functional modules comprise:

- The financial applications of the Oracle ERP. It consists modules as General Ledger, Accounts Payable, Accounts Receivable, Fixed Assets, Projects.
- The Oracle manufacturing applications. It consists modules as Bills of Material, Engineering, Work in Process, Cost Management, Material Requirements Planning, Master Production Scheduling, Capacity Planning.
- The supply-chain management applications. It consists Purchasing, Order Management, Inventory.
- The Human Resources Applications. It consists modules Human Resource, Payroll, Advanced Benefits.

The Oracle 11i Applications use the three-tiered Internet computing architecture. The three tiers of the architecture include: the database tier is an Oracle 8i database; the application tier which manages the Oracle ERP Applications; the desktop tier which provides a plug-in for a browser user interface. Many Oracle 11i Applications use Oracle Workflow running on the Application tier through a connection to the HTTP Server with program logic controlled through stored procedures written in PL/SQL and Java [Boss, 2001].

OPEN SOURCE ERPs EVALUATION

The paper presents the evaluation results of three open source ERPs, considered as mature solutions for the business [8]. The evaluation was done according to functional criteria, presented in table 3. The results of the evaluations were assessed by Yes and No logic. The resulting list is given in table 3.

Table 3. Evaluation of three open source ERPs

Functionality	Compiere	Tiny ERP	OfBiz
Customer relationship management:			
• Customer interface management	Y	Y	Y
• selling	Y	Y	Y
• order handling	Y	Y	Y
• problem handling	Y	Y	N
Marketing and offer management			
• product portfolio planning	N	Y	Y
• product delivery	N	N	Y
• sales development	N	N	Y
Service management	Y	N	N
Service problem management	Y	Y	N
Resource planning	Y	Y	Y

Resource delivery	Y	N	Y
Resource performance management	Y	N	N
Supply chain management	Y	N	N
Business planning	Y	N	N
Business management	Y	N	N
Financial management	Y	Y	Y
Human resource management	N	Y	Y

CONCLUSIONS

The most functional open source ERP is Compiere and it supports functionalities for Customer Relationship Management, Enterprise Management and Services, Business management activities. Compiere seems to be one of the most mature, well-documented and supported Open Source ERPs. TinyERP is not mature ERP from the evaluated ERPs. But It has many advantages as extensibility and flexibility. Due to its modularity it can be easily adapted to different needs. OfBiz is a mature product, but it is appropriate for e-Commerce applications as online stores. Its functionality covers a bit more processes than TinyERP.

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