

The Evolution of Enterprise Resource Planning Systems

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Abstract — *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. ERP (Enterprise Resource Planning) can be defined as a framework for organizing, defining and standardizing the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage. This paper presents the growth and success of ERP adoption and development through history. The evolution of ERP systems closely followed the spectacular developments in the field of computer hardware and software systems. There is still a never-ending process on the ERP market, of reengineering and development, bringing new products and solutions. The consolidations continue to occur and the key players continue to build out their products. The next phase of ERP systems will be the merged products.*

Keywords — *enterprise resource planning, evolution, history, management, organization.*

I. INTRODUCTION

ERP (Enterprise Resource Planning) can be defined as a “framework for organizing, defining, and standardizing the business processes necessary to effectively plan and control an organization so the organization can use its internal knowledge to seek external advantage”. [1] Enterprise resource planning (ERP) is an integral component of today’s complex global marketplace. ERP software helps companies streamline business processes. Even though there are several definitions from the published literature which explain the concept of Enterprise Resource Planning, there is still a need for a historical perspective on the complete ERP evolution. In the first section we will focus on IBM implication in setting up the base of ERP (Enterprise Resource Planning) – firstly with the computers like IBM7094, 360 and 370 series, System 34 or System/38, then by introducing COPICS (Communications Oriented

Production Information and Control System), MMAS (Manufacturing Management and Account System), MAPICS (Manufacturing, Accounting and Production Information and Control System) and CIM (Computer Integrated Manufacturing).

The second section includes the beginnings of the term ERP (Enterprise Resource Planning). In the Moving to cloud section we show how the cloud technologies and programming languages affected the ERP systems. We also introduce the term ERP II (Extended ERP – EERP) in this section.

The last section assumes some conclusions on the subject represented by the evolution of the ERP system from historical perspective and some possibilities for future development.

II. IBM – THE FIRST MAIN PLAYER ON THE MARKET

MRP (Material Requirements Planning) – the predecessor to and base of MRP II and ERP – was born in the late 1960s through a joint effort between J.I. Case, a manufacturer of construction machinery and IBM. At the time, the focus of manufacturing systems was on inventory control. Most of the software packages were designed to handle inventory based on traditional inventory concepts. This early MRP application software was the state-of-the-art method for planning and scheduling materials for complex manufactured products. [2]

Initial MRP solutions were big, clumsy and expensive. They required a large technical staff to support the mainframe computers — at first the IBM7094, for example, and later IBM’s 360s and 370s. The development of ever faster and higher capacity disk (random access) storage was a major enabling technology for the development of more integrated business information systems. [3]

In the late 1970s MRP systems fit the adoption of target-market strategies with an emphasis on greater production integration and planning because of the integration between forecasting, master scheduling, procurement and shop floor control. MRP systems

translated the master schedule build for the end items into time-phased net requirement for sub-assemblies, components, raw materials planning and procurement. MRP fairly quickly became established as the fundamental parts and materials planning concept used in production management and control. [4]

The year 1972 saw the introduction of IBM's COPICS (Communications Oriented Production Information and Control System), an eight-volume series with the objective of providing "a series of concepts that outline an approach to an integrated computer-based manufacturing control system" [5]. The COPICS software was designed to run on the IBM model 360 mainframe computer. The movement towards what would be called MRP II (Manufacturing Resource Planning) was underway.

In 1975 IBM offered its Manufacturing Management and Account System (MMAS) which is considered to be a true precursor to ERP. It created general journal notes and job costing plus forecasting updates emanating from both inventory and production transactions and could generate manufacturing orders from customer orders using either a standard bill of material or a bill of material attached to the customer order. Accounts receivable transactions were generated by customer order activity, as well as accounts payable transactions against purchase order activities. At the time, IBM tended to synchronize new software applications with the release of new hardware systems. [3]

In 1978 a new integrated suite of applications called Manufacturing, Accounting and Production Information and Control System (MAPICS) was released as was the IBM System 34 – a mini-computer smaller and less expensive than earlier mainframes. This integrated application took MMAS to another level with general journal, accounts payable, order entry and invoicing, accounts receivable, sales analysis, payroll, data collection systems support, product and production definitions (the old bill of materials processor), inventory management, material requirements planning (with a scaled-down master scheduling capability), production monitoring and control capabilities. In a second release, IBM added forecasting, capacity requirements planning, purchasing, and full-scale master production schedule planning modules to the application [6].

In 1978 SAP also released a more highly integrated version of its software, called the SAP R/2 system. R/2 took full advantage of the mainframe computer technology at the time, allowing for interactivity between modules as well as additional capabilities such as order tracking. [7]

J.D. Edwards began to focus on writing MRP II software for the IBM System/38 in the early 1980s. This system was a much lower cost alternative to the mainframe computers: it offered flexible disk drives with

capacities useful for small and medium size businesses. Eventually the term manufacturing resource planning II (MRP-II) was conceived to identify the newer systems' capabilities. Manufacturing strategy emphasized greater process control, world class manufacturing and a focus on reducing overhead costs. The closed-loop scheduling, enhanced shop floor reporting, linkages to due date scheduling or procurement and detailed cost reporting features of the ever-developing MRP-II systems, were designed to support these new initiatives. These were character based system and had the capabilities to record transactions with low processing power computers. The heart of any MRP II system was still the fundamental MRP logic, now typically re-written in modern code. [8]

At the end of the 1980s IBM came out with an update to their COPICS software that introduced the new acronym CIM for Computer Integrated Manufacturing. This newer CIM framework offered a "comprehensive strategy to help integrate information in a consistent, effective manner across the enterprise". The framework had three levels of support: the top level supported the functional areas and included Marketing, Engineering and Research, Production Planning, Plant Operations, Physical Distribution and Business Management. Below this level, the CIM structure had a supporting layer, which included administrative support, application development and decision support. The bottom layer was a core series of applications including database, communications and presentation tools. [3]

III. INTRODUCING THE TERM ERP (ENTERPRISE RESOURCE PLANNING)

The term enterprise resource planning (ERP) was introduced in the early 1990s by the Gartner Group [9]. Their definition of ERP included criteria for evaluating the extent that software was actually integrated both across and within the various functional silos. **The year 1992 marked the release of SAP's R/3 product.** The main feature that distinguished R/3 from previous ERP systems was its use of client-server hardware architecture. This setup allowed 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 would integrate with SAP R/3. The ability to distribute the computer load to multiple small computers was particularly attractive due to the relatively low cost of the hardware employed. Client – server technology, with rapid growth of computers across organizations gained momentum allowing computers to communicate easily and that led to growth of ERP across the network.

Corporations as well as small to medium-sized enterprises (SMEs) were quick to adopt the new ERP

offerings as one way of addressing needed fixes to legacy system software that was not compliant with year 2000. In many respects, the technology advances hinted at the industry consolidation that was about to begin. Year 2000 has meant both the maturing of the ERP industry and the consolidation of large and small ERP vendors. By 2002, software companies were looking for ways to improve product offerings and increase market share. Between 2000 and 2002 software companies faced significant pressure to downsize following their amazing growth. With Internet flowing across the network, Cisco contributed to routers and switches that allowed people to connect across the world and gain access to ERP systems via remote connectivity such as Citrix and still use client-server technology or web based systems. The client-server had rich interfaces for users to use and mined data. However, the web based ERPs had browser restrictions due to components used and were limited to information that could be displayed to end-users and this space was evolving faster for vendors to keep up. [10]

IV. MOVING TO CLOUD

In 2010 the evolution of Internet technologies and programming languages has finally reached the cloud, where business can operate efficiently and have entire infrastructure taken care. Cloud ERP software are written in powerful web based languages. Cloud ERP makes it easier to access from anywhere, on any devices local or remote without trouble. [11]
ERP systems have reached a level of maturity where both software vendors and users understand the technical, human resource or financial resources required for implementation and ongoing use. Generic ERP software packages are already increasingly tailored to specific

market segments like refinery, hospital, automotive assembly and law office such that niche markets create niche products and vendors. Preconfigured software modules incorporating best practices and standard business processes are simplifying future implementations. Systems are much more intelligent. Data mining and intelligence tools including expert systems and advanced planning systems (with optimization) are used to make/suggest business decisions. Simulation is an important element of an integrated extended enterprise planning and execution system. Examples of major areas to receive the benefits of simulation include cost accounting, forecasting, capacity planning, order rate, lead time and supply network planning. Company cultures have obviously been affected by ERP consolidations. Current ERP technology provides an information rich environment that is ripe for very intelligent planning and execution logic. The current systems are now just executing the logic associated with such applications as forecasting, reorder point logic, MRP and production scheduling much faster than the ones in the late 1970s and in real-time. [12]

Now, the concept of ERP II (Extended ERP – EERP) is fast evolving, covering all the internal as well as external business functions such as SCM (Supply Chain Management) and CRM (Customer Relationship Management). ERP II is built on object technology or component architecture. These ERPs are cross-functional and enterprise wide. All functional departments that are involved in operations or production are integrated in one system. ERP II means open ERP architecture of components. The older, monolithic ERP systems became component oriented. [13]

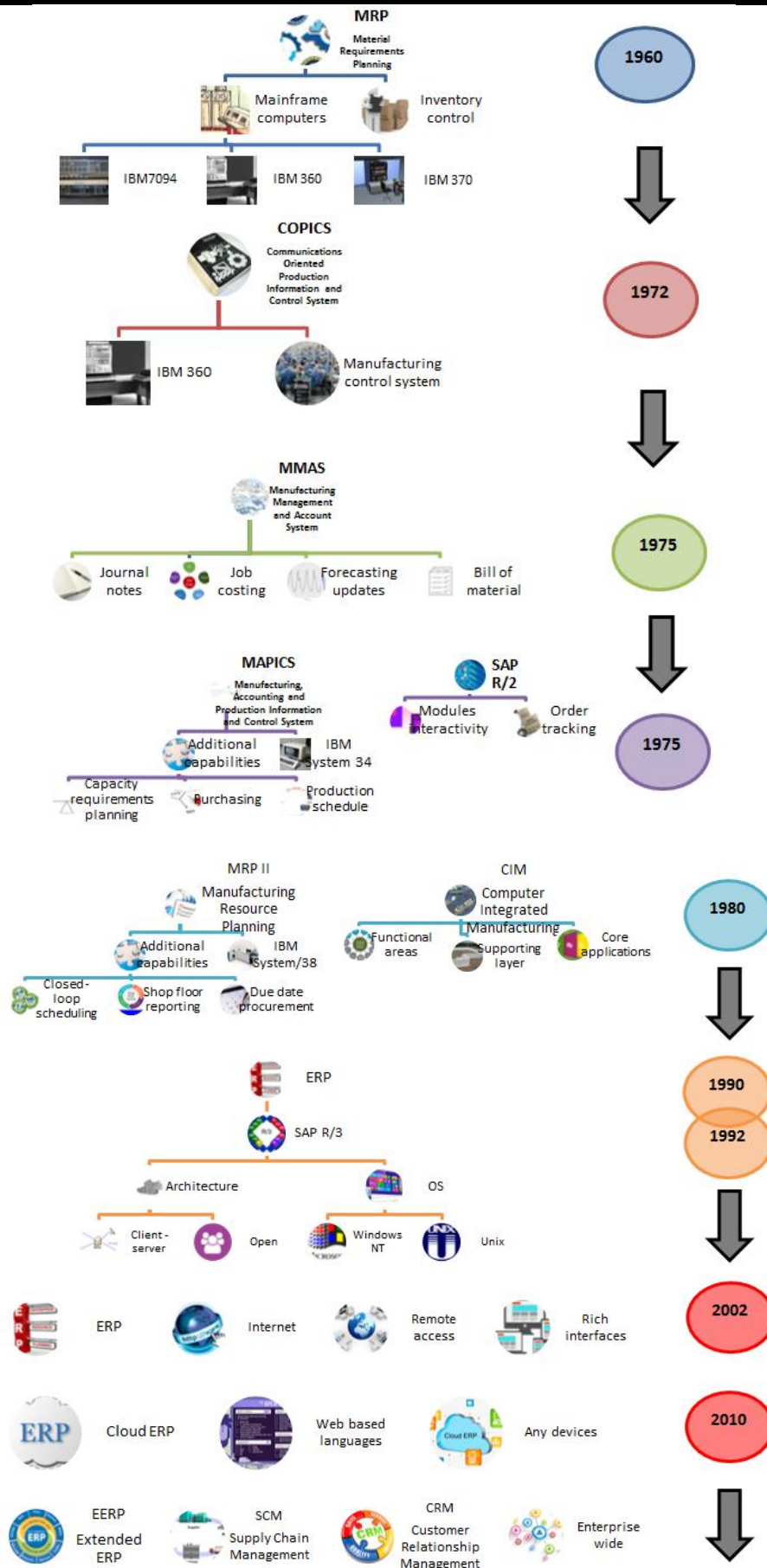


Fig. 1: Evolution of ERP systems from historical perspective

V. CONCLUSION

Even though there were several definitions from the published literature which explained the concept of Enterprise Resource Planning, there was still a need for a historical perspective on the complete ERP evolution (see Fig. 1) and we think that this need is now covered by this paper.

ERP systems are now ubiquitous in large businesses and the current move by vendors is to repackage them. This migration has many consequences that have to be addressed through understanding the history and evolution of ERP systems.

These days, ERP has expanded to encompass business intelligence (BI) while also handling “front-office” functions. With the product advancements and the success stories coming out of these systems, companies of all sizes and from every industry – from wholesale distribution to ecommerce – can implement and benefit from ERP systems. That’s why there are still opportunities for new ERP vendors to emerge from industries that so far have not contributed to the ERP phenomenon.

As ERP has evolved, its business case has also changed. Consequently, it has become even more important that companies get the right solution to suit their needs.

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