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Enterprise Resource Planning (ERP) System: An Effective Tool for Production Management

by *A.P. Kakouris* and *G. Polychronopoulos*

Abstract

Independent of the size of the company, an Enterprise Resource Planning (ERP) system can either boost or doom a company, if implemented successfully or unsuccessfully. There is a great deal of supporting evidence from the literature, mainly from large manufacturing and service organisations. This article adopts a case study approach to investigate the selection and implementation activities in a manufacturing company in Greece focusing mainly on production management aspects. The goal is to provide insight into the ERP functionality with respect to production and thus the selection of an actual business case proves how the enterprise successfully implemented and integrated such a system, highlighting the processes used, the obstacles faced and how they were overcome, as well as the gains achieved. Finally, it provides useful information and practical suggestions that may help production managers and users to get a better understanding of how to deploy such systems.

Keywords: ERP, SAP, Production, Implementation.

Introduction

Nowadays, manufacturing is faced with a constantly changing, uncertain environment that compliments the intensifying and competitive environment in which companies operate in general. Competition is accelerating and requirements are becoming more demanding. It is a customer's market. The pressure on manufacturing companies is to reduce costs and increase the quality of products and services. Production management (Neely, 1991) is essential to cope with the demanding nature of the business and in order to be successful; it must successfully manage the manufacturing of the saleable products. This is accomplished by:

> Understanding how planning, scheduling, shop floor control and stocks affect manufacturing
>
> Integrating manufacturing with other functions, such as supply chain, etc.
>
> Having in place an effective and efficient[1] manufacturing set up.

On the other hand, for some years now companies have been searching frantically for tools to gain better control of their business. The utilisation of the

continuous changes in technology, in order to satisfy the continuous needs and demands of prospective business, has been the greatest challenge for every company that wants to lead in the years ahead. The correct selection and implementation of such technologies are the key drivers that will certainly lead to success. Materials Requirements Planning (MRP), its extension Manufacturing Resources Planning (MRP II) [Ang, *et al.,* 1990; Primrose, 1990; Burns, *et al.,* 1991; Salaheldin and Francis, 1998; Wong and Kleiner, 2001] and the later ERP systems are some of the technologies that support towards this direction [Muscatello, *et al*., 2003). However, there are many cases, as the relevant literature reveals, when such software projects fail; and it is not always because the applications did not work (Bicknell, 1998; Boudette, 1999), but because the enterprise rejected them [Laughlin, 1999].

The objectives of this article are:

To show the evolution of enterprise software and how each evolutionary step has been built on the fundamentals and principles developed within the previous one, so that this knowledge will stand us in good stead for future solutions.

To support all the people involved in implementing such solutions

To provide useful information and practical suggestions that may help production managers and users to get a better understanding of such systems

To present some of the lessons learned from the effect that this project has had on the implementation on the company and the individuals, as understanding of these effects can provide a blueprint for a higher level of success in similar projects in the future.

The article is not primarily about computers and software. Rather, its focus is on people: how to provide them with decision-making processes for software selection and how to integrate it into a production orientated environment. A real case study has been selected and presented showing how a manufacturing company had successfully implemented and integrated such a system. Moreover, it highlights the processes used, the obstacles faced and the gains achieved. Finally, it helps plot a decision path forward, based on the objective and thorough analysis necessary for the selection of the company's system(s), always bearing in mind that people, costs and technology must be simultaneously managed through changes to ensure success (Nah, *et al*., 2001).

Evolution of ERP

In the 1960s, no company could afford to own a computer. Therefore, both manufacturing and inventories were handled on the basis that companies

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must hold enough stocks to satisfy customer demand, and that customers would order what they had ordered in the past, quantity-and time-wise. In the 1970s and 1980s, when computers became small and affordable, attention was focused on *materials requirements planning [MRP] and master production schedule [MPS]*. MRP started as a system for planning raw material requirements in a manufacturing environment; an idea that was later extended to the "closed loop MRP." Soon it evolved into *manufacturing resource planning (MRP-II)*, which used the MRP system as a basis and added scheduling and capacity planning activities. In the early 1990s, MRP-II was further extended into *enterprise resource planning (ERP),* incorporating all the MRPII functionality, in addition to Finance, Supply Chain, Human Resources and Project Management functionality. Figure 1 illustrates the gradual evolution of the ERP with respect to time.

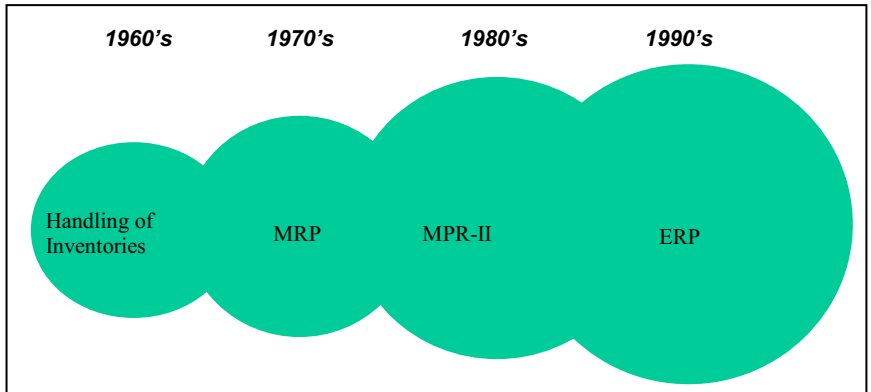

Figure 1: Evolution of ERP systems

ERP integrates key business and management functions and provides a view of the happenings in the company, in the areas of finance, human resources, manufacturing, supply chain, etc. (Davenport, 1998; James and Wolf, 2000). An ERP software solution is valuable when it embodies the characteristics illustrated in Figure 2. ERP software can be built up either by purchasing the whole package from a single vendor or by using pieces of software from different supplier(s). In the first category, the leader is the German company SAP AG with its R/3 software, together with PeopleSoft Inc., Oracle Corp., Baan Co. NV and J.D. Edwards & Co. (Jenson and Johnson, 1999). Any company considering investing in one of these softwares is faced with a serious decision as to whether to actually invest or spend the resources on improving other parameters of the company. If the decision is in favour of software-implementation, the next step is to select the most appropriate one from a broad choice of equally good solutions, ensuring at the same time that the selected system will fulfill the planned objectives.

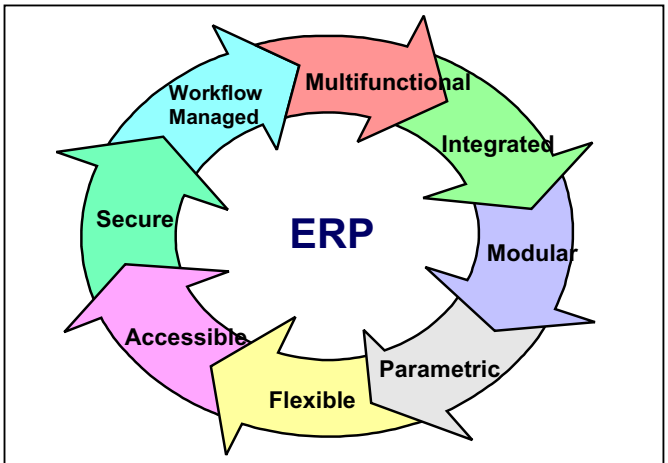

Figure 2: ERP Characteristics

Case Study

A. Objectives

The following case study presents the decision approach followed by a local company in implementing a new ERP system with the aim:

To integrate the information and software aided procedures in order to optimise performance and support decision-making.

To minimise the internal customer dissatisfaction

To achieve:

(a) ongoing cost-effective improvements in manufacturing services

(b) labour savings

(c) inventory reductions

(d) better management of the resources used, and

(e) better process execution through the efficient use of the ERP solution.

B. The Company and its Environment

The company is a holding of a group of companies, and has been in operation for nearly seventy years. During that period, it has been developed into a complex of agricultural companies providing farming supplies and services. It is a manufacturing and commercial company with more than 100 employees and subsidiaries in Bulgaria, Romania and Yugoslavia. Its strategic alliance with a Japanese multinational has pushed the company so that it is

amongst the leaders of its kind in Greece with significant export activities in the Middle East, Pakistan, etc. For its production facilities, it employs a staff of around 30 full-time employees and 30 part-time ones. It acts as a toll manufacturer providing service to both local and multinational clients such as Ciba, Dow, Monsanto, Basf, FMC, Syngenta, etc. The company is fully equipped to import/export, pack/re-pack, warehouse, physically distribute and administrate, or in short, manage its products on the request of its clients, using both make-to-stock and made-to-order processes.

C. Maximising Production Performance with a New ERP Solution

As a result of its successful strategy during the last few years, the company has grown substantially. Its strategic alliance with a Japanese multinational, which acquired an equity stake, has transformed and upgraded the company. This transformation, together with the requirements of the toll manufacturing activities has forced the company to implement a new ERP solution. Before the new ERP implementation the company had a tailor-made ERP solution, with some of its functions linked together. The system has been in existence for fifteen years.

Over the years, it has been modified and customised to functions' needs and facilitates the daily operation of the company, supported by an IT department, responsible for: the technical support of the system, its maintenance, and the extension and development of the applications. Manufactur-

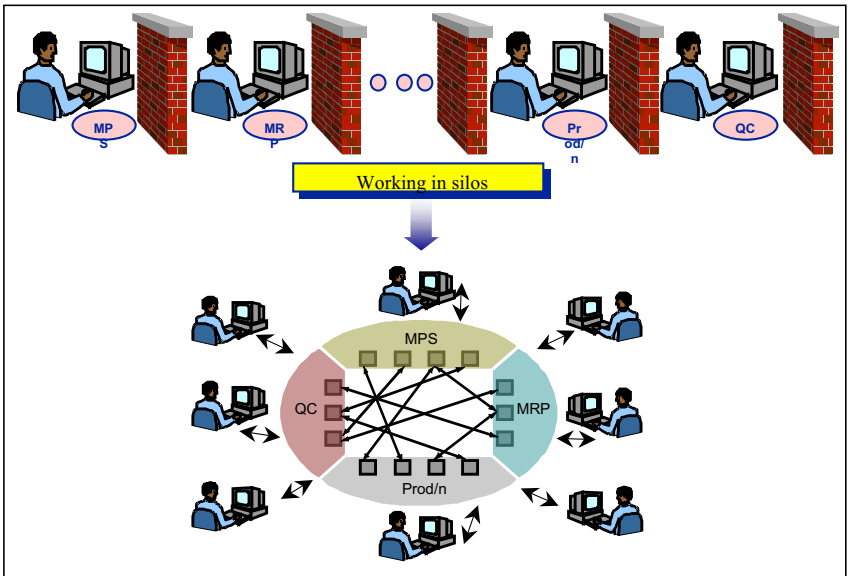

Figure 3: Production Management View

ing was deploying "a kind of MRP" and planning was done in silos. This led to high stocks, proliferation of different planning processes, a relatively high level head count, communication problems, etc. The company was far away from the desired situation of "having the right inventory and effective and efficient production." The project lasted 14 months. The selected software belongs to CSAP R/E 4.6; the relational database is the SQL Server and the functional system Windows NT. Figure 3 illustrates a production management view of "how the situation was before" and "where it has decided to go."

D. Reasons for Abolishing the Old ERP Solution

As a first step, the company went into an internal audit, trying to identify the reasons and answer questions, such as:

Why a new ERP was needed in place of the old one?

What was its essential scope for the company?

What would it bring to the company?

As the deployment of an ERP is definitely expensive in terms of effort, time and money.

The reasons for implementing new software are well known and beyond the scope of this article. However, the following three specific company oriented points are worth mentioning:

The current application had become obsolete (text environment), difficult to maintain and above all it was a pool of application rather than integrated software.

The need for on-line information, the necessity of a common working platform within the group together with the elimination of multiple entries for the same operation entity.

The pressure from the third party companies to implement an ERP solution, which could be interfaced with their system for EDI transmission.

E. Reasons for Selecting the New ERP Solution

The next step the company had to do was the justification of the project, that is: How did it know if the specific ERP system fulfilled its strategic goals? In other words, how did it know that SAP was the right ERP tool for the company?

It is beyond the purpose of this article to describe the benefits of installing an SAP solution. What is important is to outline the reasons for the specific selection, which include amongst others:

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Its proven record of success in similar companies

Its Chemical & Pharmaceutical (specific) modules (solutions) which come as an enhancement to the standard system; most appropriate for the specific company where process manufacturing, quality management, process costing and plant-specific business processes were viewed as important software components

It handles dangerous goods

It has an excellent interface to MSOffice applications and other reporting tools, so it can be linked with the company's sales and marketing tools

It is widely parametric

It is the most mature system compared with any other ERP used in Greece

The local support for the implementation phase and further support is at a high level

It is quite attractive as value for money

The supplier's financial strength and its reputation for quality.

F. Selection and Implementation Phases

The project was divided into three main phases, namely: selection, implementation and post-implementation.

G. Selection of ERP

The first phase started in early 2001, by collecting Request For Information (RFI) from the major software suppliers in Greece. After a first screening, from the company's cross-functional selection team, based on product and vendor capabilities, by June 2001, four potential suppliers were selected (two international and two Greek) which were invited to present their product to the company's management. The presentation was based on the company's needs and gave a general feeling of the functionality of the systems. Moreover, they were asked to provide their Request For Offer (RFO) based on a detailed specification sheet by functional module and business area, provided by the company. Furthermore, a group of managers visited companies where the bidders had deployed similar products, in order to discuss the various problems during implementation and daily working practice. The selection team examined the detailed RFQs and also compared prices, finally selecting the SAP solution as the best value for money.

The last part of the selection phase involved the choice of the consultant that would assist the implementation of the system, following a process similar to that of ERP-selection.

H. Implementation of ERP

The implementation was divided into four stages:

I. Blueprint phase: Analysis of all business modules and functions, where the key users of each module together with the responsible consultant, analyse and document all working scenarios in detail and finally outline the proposed parameterisation and functionality of the system to be delivered. The problems that occurred in this phase were:

> The key users were usually referred to the common daily practice and forgot to refer exceptions that occurred once or twice per year, thus preventing the full parameterisation of the system.
>
> Key users were lacking basic knowledge of software engineering practices, necessary to understand and "translate" the proposed system functionality (as was presented by the consultant).
>
> The consultant did not have a wide industrial background, so during the discussions of production and planning modules, there was a lack of understanding of the specifications.
>
> Key users did not have the complete picture of the company's functionality, so they eventually forgot to check if their proposed parameters affected other process areas. This was quite critical not only for the common daily practice but for statistical groupings, too.

II. *Development phase*: At this stage the documented blueprints were translated into software implementation and each scenario was tested to stand alone between the key user and the consultant. The problem in this phase was again the crosschecking in interoperation of different business areas.

III. *Integration test*: This phase involved loading of sample data in order to check the interoperability of the functions and the working scenarios in detail. The major problem of this phase was the time span allocated, as it was not possible to prepare a complete set of data, as demanded by SAP functionality. In order for an integration test to be successful and thoroughly checked, there must be at least a two month period where users should be dedicated to checking the system compared to their working needs. This phase is crucial because it reveals anything forgotten during the blueprint phase and allows modifications to be made before the "live system."

IV. *Data migration and live startup*: The ultimate phase comprises raw data preparation, check and validation, uploading and final verification. This is

the most difficult part especially when a company has thousands of materials, customers and vendors. Data preparation has to start in the early phase of implementation in order to consider the new structural data that have to be added to those existing in the old system, since SAP implementation gives the opportunity to classify any data under various hierarchies and groupings. That means that the more you want, the more you have to prepare and check, before the system goes alive and the supplier goes offsite.

Live operation: No major problems were observed, apart from the fact that the degree of familiarisation of the end users with the new system was not at a good level, due to the short time spent on training, something well balanced by the great effort made by these users later during the operational process. As a matter of reference, the company operated normally with minimal problems, after seven days from the time the system went live.

J. Post-Implementation of ERP

With the system in place, the next scheduled step is to audit (check) it against its qualitative and quantitative selection objectives. A process which has been organised to take place after one year from the full start up, with further audits taking place every year thereafter.

Conclusions

For any company that produces and supplies products or services, the process of producing and delivering on time is critical. Nearly all of them today use some sort of Information Technology infrastructure as a supporting tool, which can either stand alone, be integrated to other third party software, developed in-house or be a fully integrated system. In either case, what is needed is a flexible and multifunctional integrated solution able to manage, control, account for, and report all sales-, supply chain- and production-activities of the company. It also needs to be integrated not only internally but externally too, to link systems together along the entire chain. ERP software is such a lever. It must be seen as a foundation for a company to avail itself of the new technological opportunities and not just as a back-office solution. The successful deployment of an ERP solution is an integral part of the success of the company. The selection and implementation phases are painful; but may be necessarily so, if it is to achieve successful results, in the end.

This article dealt with some of the major activities involved in the implementation of an ERP system for a production and commercial company in Greece. The overall aim was to provide an insight from a variety of angles into the selection and implementation phases that were followed. Of course, it was not possible to adequately cover all implementation actions, however, useful insight was given.

The benefits achieved, so far, provide a cost justification and confirmation of the will to invest in a new ERP system and amongst others, include:

A. Inventory reductions

There are ongoing savings of the inventory carrying costs as a result of proper:

a. netting: by netting demand against inventory to determine market net requirements

b. purchasing: the company buys what is needed through correct Bill of Materials [BOM], using parametrical Optimum Quantity algorithms

c. BOM: all changes in the BOM are encountered, thus preventing obsolete inventories

d. Planning: production orders are processed faster, resulting in better control for the work-in-process inventories

e. Manufacturing: it produced what is demanded from time phased plans

f. Delivering: deliveries match the actual quantities on the right dates.

B. Labour cost reductions

The reductions in labour costs are the results of improved manufacturing practices which has resulted in:

a. fewer-shortages, -disruptions and –interruptions, less-rework, -overtime and –rush jobs.

b. Better visibility of required work, so that capacity is properly scheduled to meet demands

c. More free time for production personnel who are now used better and more constructively.

C. Improved customer service

The great degree of integration results in much better coordination amongst forecasting (sales), production planning and logistics/inventory planning. This, in turn, has led to better customer service and to fewer lost sales; while sales people are now concentrating on selling products rather than apologising for company deficiencies.

Moreover, by providing shipment schedules, reacting to changes in demand and tracking the progress of orders [Bendoly and Jacobs, 2004], a higher customer satisfaction level has been achieved and there are more repeat orders.

D. Improved visibility

As the system provides a basis for linking operations, it allows for real-time visibility. For example, production planners can now view what and where

the orders are, thus allowing them to schedule against the forecast. This visibility has triggered co-operation and co-ordination between operations and allowed for a better understanding by operational managers of the effects their decision have.

E. Others

1. Flexibility and better access to information, less prone to errors
2. Elimination of most of the manual (paper) work
3. Applying the "one set of data" principle, and
4. Integrating a holistic corporate attitude.

Finally, a number of lessons learnt from the present study suggest:

Selection of the right people to be the key-users, who, in turn, will be the liaison between the company and the consultant(s). These people should have an integrated perception of the business functions together with a detailed knowledge of their module. Software literacy is also helpful, especially when it comes to data preparation.

Treat consultant(s) as employees and do not let them manage the company. The company should manage them.

Detailed description of the working scenarios, including even the rarest cases.

Agreement on the statistical data needed by each function in order to prepare grouping structures and coding.

Awareness of both management and employees that extra working effort should be made for a long period of time, on top of the daily operations.

Data preparation should start as soon as the organisational structure of the ERP has been established.

Business organisational chart and present operation practices should be re-evaluated and modified against the workflow and interoperability of the system [Schniederjans and Kim, 2003].

The more effort that a user puts in the early stages of implementation, the easier its daily routine will be when the system goes live.

An understanding that the selection and implementation process of a project of such magnitude should not be treated as just another company-project.

A radical shifting from functional to process approach.

Careful handling of the migration process as it should run in parallel to the running of a profitable business.

A change in management attitude to support people during their emotional reactions, together with promotional success practice.

An awareness and understanding of these benefits and lessons learnt will increase the success of future ERP implementations and should be carefully considered in planning for ERP; always bearing in mind that whilst the potential benefits are high, so is the cost of failure.

Endnote

1. Effectiveness is the degree to which customer requirements are met; while efficiency is a measure of how economically the resources of the organisation are used to provide a given level of customer satisfaction [Neely, 1991].

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