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# ERP συστήματα στη λήψη στρατηγικών αποφάσεων: Μελέτη περίπτωσης

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**Dissertation Acknowledgement**

"I hereby declare that the thesis for obtaining the University of Piraeus, Business Administration - Total Quality Management: MBA-TQM master's degree, entitled "ERP systems in strategic decisions: A case study" is authored exclusively and in its entirety by me. It has neither been approved in any other graduate or undergraduate degree in Greece or abroad, nor is a part of any academic or professional work.

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## ΠΕΡΙΛΗΨΗ

Στην σημερινή αγορά οι ταχείς ρυθμοί μεταβλητότητας καθώς και το ανήσυχο οικονομικό περιβάλλον, καθιστούν περισσότερο επικίνδυνο την ασφαλή επιβίωση μιας επιχείρησης. Προς ελαχιστοποίηση του ρίσκου και της επικινδυνότητας αυτής, έχουν αναπτυχθεί ειδικά συστήματα, τα ολοκληρωμένα πληροφοριακά συστήματα διαχείρισης επιχειρησιακών πόρων (Enterprise Resource Planning –ERP- systems), τα οποία συγκεντρώνουν πλήθος τεχνολογιών προκειμένου να ενδυναμώσουν μία επιχείρηση στην καθημερινή και στρατηγική της πορεία.

 Σκοπός της παρούσας διπλωματικής εργασίας είναι να μελετηθεί η ιστορική πορεία των ERP συστημάτων, ο σκοπός υλοποίησής τους από την πλευρά της επιχείρησης καθώς επίσης και η συμβολή των συστημάτων στη διαδικασία λήψεως στρατηγικών και άλλων αποφάσεων.


**Λέξεις κλειδιά:**

ERP, strategy, decisions, Nestlé, SAP, Enterprise Resource Planning

# INTRODUCTION

## BASIC TERMS

Looking up in the dictionary one can find that a **procedure** is "a series of actions conducted in a certain order or manner"[1], obviously to accomplish an end. A number of procedures combined can result to a valuable output. This transformation of input(s) to output(s) is the **process**. The goal to each organized process is to add value to the input. Therefore, we have inputs of materials, labor and resources that through the process transform into goods and services or even inputs to another process.

**Production** is "the action of making or manufacturing from components or raw materials, or the process of being so manufactured"[2]. Factors of production are any raw material or even labor, stocks, land and capital goods (the four latter ones known as primary factors) as well as services used to produce goods and services. As a consequence a whole enterprise could be considered as a production system, since an enterprise has a goal to make goods or provide services so as to satisfy customers' needs and meet demand.

In business, there are two types of processes; **main** or operational and **supporting processes**. The first type is focusing on the processes that perform the basic transformation of an input to the desired output, the core business of an enterprise. When main processes are combined they form the primary value chain of the company. Examples of those processes usually are found in



Figure 1 Value chain based on Porter's view

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[1] Oxford Dictionary, http://oxforddictionaries.com/definition/procedure?q=procedure

[2] Oxford dictionary, http://oxforddictionaries.com/definition/production?q=production

Operations (manufacturing), in Marketing & Sales. In contrast, or supplementary to that, we have supporting processes that aid the main processes in reaching their goal and are not a part of the company's value chain. Examples of those supporting processes are found in Provision and in Human Resources (M. Porter, 1985).

Every company wants to increase its own net income which is its revenues minus costs (e.g. Wages, Salaries, Materials, Capital Costs), or, as Kay puts it (Kay J., 1993), its **added value**. The company can increase its revenues by following a specific business-level strategy, a positioning strategy. Porter (1980) has indicated four different strategies that a business can follow in order to maintain a competitive advantage (Porter, M. E., 1980): Low cost, differentiation, and focus (divided into low cost focus and differentiation focus) Porter's basic diagram was disputed and an extra addition was made by Hill (1988) as a viable option so as to include an extra strategy, which Porter was looking down on as "stuck in the middle".

Positioning strategies according to Porter are:

1. <u>Cost Leadership</u> is a positioning strategy, by which a business makes a product or offers a service at a low cost to the broadest possible market, while aiming at economies of scale which result in cost savings, partially passed to consumers.
2. <u>Cost Focus</u> is a positioning strategy, by which a business offers a product or a service at a low cost to a specific customer group.
3. <u>Product Differentiation</u> is a positioning strategy that focuses on offering a unique product to the broadest possible market. The product offering necessitates continuous innovation in light of the highly competitive market forces. (e.g. Apple's iPhone, iPad, iPod line-ups)
4. <u>Differentiation Focus</u> is a strategy that focuses on offering a unique product to a specific customer group. The customer relationship largely depends on the uniqueness of the product and the way the customer is being served. (e.g. Rolex watches; Rolls Royce cars)

A way to measure the output of a process to what it could theoretically reach in an optimal state is the **capacity**. Capacity is "the marginal ability of a productive system

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that outputs either goods or services in a well-defined time period, that is the maximum quantity of final goods or services that an enterprise can produce in a time frame"( Askounis D, 2000) [3]. The capacity can be measured in products, in units that a service may produce (e.g. successful output in a timeframe) or in critical resources (e.g. rooms in hotel). In addition, capacity utilization is the ratio of the actual output that is produced with the resources at hand (raw material, labor, machines) to the potential output, which could be produced with it, if everything was working optimally, and to full extent.

Defining the capacity that an enterprise or a business might need is usually defined at the very early phases of initial designing of a production system according to system's needs and goal/purpose, or comes as a natural evolutionary step towards expanding a production system to meet new requirements and shifting needs as new problems arise. In both cases, the most critical factor to estimate a system's capacity is **demand**; especially the demand in a given timeframe, quality, quantity, as well as delivery location.

## CAPACITY PLANNING

In a production system, a capacity planning is usually performed in order to reach specific goals according to a specific timeframe.

### FUNCTIONAL PLANNING

In a functional planning, capacity is related to the day-to-day or short term fluctuations, making the best of the availability of resources. At this level, functional

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[3] Askounis D, "Dioikisi Paragogis kai Systimaton Ypiresion"

planning aims at meeting the volatile demand that is caused due to fluctuations or even unknown factors that occur during the day and the various procedures.

## TACTICAL PLANNING OR INTERMEDIATE PLANNING

In a tactical planning, capacity is designed to meet demand in a timeframe of 1 to 2 years, which is usually fluctuated, due to seasonal fluctuations and/or unpredicted changes to customers' demand. A tactical planning is usually more difficult to be designed than that of operational planning since it requires data of different sets of time periods so as to project those data to an estimate. It requires careful and capable people to do the task, as well as a good knowledge of the current market. Capacity can be adjusted while committing resources, such as increase or decrease of stocks, overtime or even outsourcing. Forecasting and projecting tactical planning are of higher risk than that of operational planning, while being less risky that of strategic planning.

## STRATEGIC PLANNING OR LONG-TERM PLANNING

In a strategic planning, capacity is designed to meet demand in a projected timeframe of 5 to 10 years, usually as per the strategic goals of the enterprise. Given the highly volatile environment, though, such projections depend on forecasted data that are combined with a probability of failure that could lead to misjudgment. Therefore, decisions made on those data have a high risk and making strategic decisions usually means undertaking important assets and resources of the company so as to pull through. Making a wrong decision could result into higher costs, lower revenues and even going out of business. Therefore, a strategic plan is always required and it is mandatory to be reviewed once in a while so as not to falter from the path wished to be taken. Knowledge of current is not so much of a prerequisite for this planning, rather than a good market insight.

At this point, it is necessary to point out that ERP systems are the most helpful tools in order to achieve a good **strategic** planning as well as reviewing in any given time the output of a system.

## HISTORY OF ERP

Enterprise resource planning (ERP) systems are the latest part of the evolution of systems that manage the resources of an enterprise. They first appeared in the early 90s to covers the need to integrate functions across the entire enterprise.

## 1960S – ROP AND MRP

In the 1960s enterprises were targeting to increase their revenues and as a consequence they were trying to find ways to reduce the cost and manage their supplies. To achieve those goals they adopted both economic and mathematic models such as high-volume production, break-even point, marginal costs and Reorder point systems (ROP). The latter was made easy with the aid of computer software that implemented rather time-consuming equations given by mathematical models such as the EOQ, the EBQ and POQ combined with methods such as 'revised costs'.
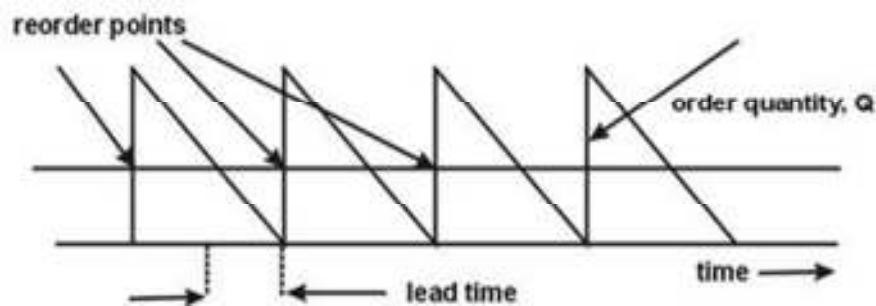


**Figure 2 EOQ basic model**
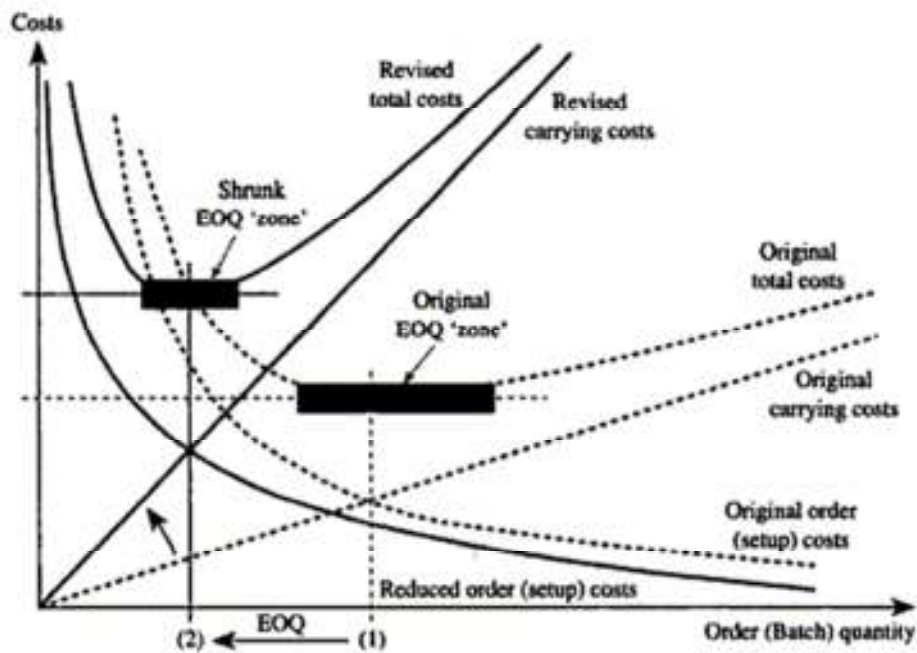
**Figure 3 EOQ Advanced model [4].**

Computers could easily follow the replenish cycle of an enterprise's inventory and suggest the best schedule by implementing a Just-In-Time (JIT) production strategy so as to minimize inventory costs as well as stockout costs while meeting the desired customer satisfaction levels (usually 95%).

*A materials requirement planning (MRP) information system is a sales forecast-based system used to schedule raw material deliveries and quantities, given assumptions of machine and labor units required to fulfill a sales forecast[5].*

MRP evolved from the earliest commercial database management package developed by Gene Thomas at IBM in the 1960s. The original structure was called BOMP ( bill-of-materials processor ), which evolved in the next generation into a more generalized tool called DBOMP (Database Organization and Maintenance Program). Material Requirements Planning is a way to control and administrate stock issues, which insures that the raw material of the final product will be available just-in-time (JIT),

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[4] Manufacturing operations and supply chain management: the lean approach, By David Taylor, David Brunt

[5] http://www.investopedia.com/terms/m/mrp.asp#axzz1p5c9SrvX

while when not needed at all, there will be in small quantities or even none at all in the repository.

Its main goal is to define effectively all the required materials in a production system, and then minimize the stock level and maximize the effectiveness/efficiency of the production system, thus increasing customer's satisfaction level. However, it is fairly accurate to say that an MRP system is a means to a better communication among the different departments that are a part of greater production plan. To be more specific, it ensures the availability of the material, proper equipment and intermediate products, it preserves to the lowest level the stock and plans the necessary actions and procedures to be taken and concluded in order to be on time in its shipping schedule and supplying procedure. An MRP system is much more useful in businesses that have high annual production volumes, as well as businesses that have a strong material-intermediate-final product dependency with timely processing procedures.

## MRP REQUIREMENTS

An MRP system is relied upon

1. the correlation and the immediate dependency of a product (intermediate or final) to its predecessor in the Bill Of Materials (BOM),

2. a main production scheduling (MPS),

3. and the inventory records

**Figure 4 A BOM diagram example**
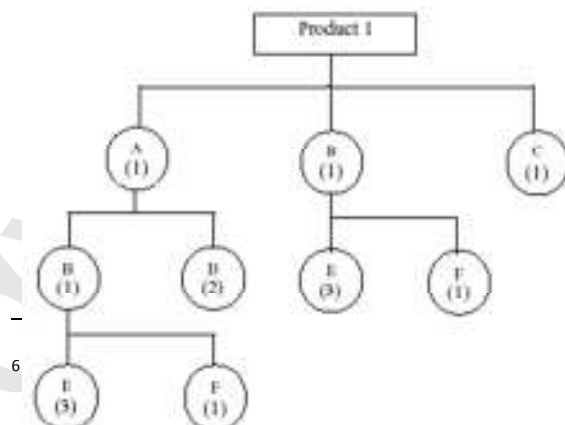


It is critical that the MPS be feasible and that the BOM file and the inventory records be accurate[6]. A BOM is a chart that shows exactly the

6  Sanders, 4th Edition © Wiley 2010

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product description, including materials, subsets and components as well as the sequence in which a product is assembled. The demand of the final products is the sum of the two factors. The first is the standard and planned orders from known customers or even strategic partners. However, there is a changing factor that is crucial; that of unexpected orders coming from customers that do not have a preordained or even preconfigured order. There are many times that the completion of those orders will bring extra cash to the company, so it is crucial for the company to be able to deliver a top notch product in a timely manner. Those unexpected orders have to be already calculated through different predictive models or other methods that the business will find more appropriate of its needs. Those two factors are the input to the Main Production Scheduling (MPS). The MPS is the criterion to which a business will define how desirable is a product as well as the period in which it will be required. It shows three basic things:

a) which final products will be produced
b) when those products will be required
c) how much of the product are required to be manufactured

Last, but never least are the inventory records. Those are the records that have all the necessary information as to the how much stock the business has to each and every single material, intermediate and final product. It also has information on scheduled shipments and deliveries, expected available quantities, supplier's name, lot size, variation in delivery time etc.

The output of the MRP system provide the business the required time schedule of the preordained or planned orders as well as changes that need to be made in previous planned orders. The system can print or output reports concerning:

a) issues that need extra handling from the management
b) how well the system is functioning and
c) future planning of stock.

The benefits that come with a well-organized MRP system are quite a few. Fewer expenses and as a result higher revenues are among them but what is really important is the fact the business could handle larger quantities, be better prepared and have a system that works flawlessly from end to end without much paperwork and human

errors. However there are some drawbacks to using MRP systems. MRP systems are primarily designed to keep a low stock level, which in times may seem like a hassle because it could mean frequent small orders, which in turn increases delivery/shipping costs or could mean a halt in production in case a supplier cannot deliver in time. Finally, it is required to maintain all the records of the warehouse up-to-date, otherwise errors are bound to happen.

## PROBLEMS WITH MRP SYSTEMS

There are several issues that are make them unfit in some enterprises.

The major problem with MRP systems is data accuracy or data integrity. In case of inaccurate inventory data, the bill of materials' data, or the master production schedule, then the outputted data will also be inaccurate.

Another major problem with MRP systems is that they rely on user input as to how long it will take a factory to make a product from its component parts. The system design also assumes that this "lead time" in manufacturing will be the same each time the item is made, now taking into consideration the quantity of the products to be manufactured, or even the simultaneous production of different items in the enterprise.

In addition, factories of the one enterprise could be scattered in different places in a country/county. An MRP is ignorant to those constraints, and does not take into account that a specific factory could have the necessary materials to begin production, but the factory that needs them is a few kilometers away.

One of the other major drawbacks of MRP is that it does not take into consideration the capacity, whether it is machine power, human or supplier constraints. This is where MRPII comes into the foreground as it can incorporate finite and infinite capacity and financial planning, as a true MRP II, is a system that also includes financials.

Manufacturing Resource Planning (MRP II) is defined by APICS (American Production and Inventory Control Society, Estd. 1957) as a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in monetary units, and has a simulation capability to answer "what-if" questions and extension of closed-loop MRP.

MRPII stands for Manufacturing Resource Planning and represents an extension of MRP. MRPII is basically a computer based planning and scheduling system, designed to improve management's control of manufacturing and its support functions. MRPII comes as an evolutionary step towards ERP systems. Its predecessor, the MRP systems, had a specific focus on the bill of materials processing and elementary scheduling functionality, as well as a basic inventory control and as such was therefore a system that could handle production lines. MRPII is an information system that integrates all **manufacturing** and related applications, including sales (not marketing), logistics, employee needs, production, engineering and decision support, material requirements planning (MRP), accounting, distribution, scheduling, design engineering, inventory management and cost control in manufacturing. In a MRPII system, fluctuations in forecast data are taken into account by including simulation of the master production schedule, thus creating a long-term control (Monk, Wagner, 2006)[7]. A more general feature of MRP2 is its extension to purchasing, to marketing and to finance (integration of all the function of the company), ERP has been the next step.

Therefore, the more advanced system MRPII was designed and deployed mainly in the manufacturing industry. MRPII is a group of software programs designed to tie together disparate company functions to create more efficient operations in areas such

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[7] Monk, E. and Wagner, B., Concepts in Enterprise Resource Planning, 2nd Edition, 2006, Editor, Mac Mendelsohn, Canada: Thomson Course Technology

as assembly or delivery of products or services. The relation between MRP and MRPII systems is that MRP systems have evolved to become a component of MRPII systems. MRPII still uses the same elements that existed in MRP: it still uses a Master Production Schedule (MPS), it is based on BOMs (Bill Of Materials) and uses a 3-step procedure (Explosion, Netting and Offsetting) so as to implement a first schedule.

In addition, MRPII systems were better and could perform faster because processor units were hundredfold the ones that existed in the early 70s. Thus, they could perform tasks regarding inventory control and high-level capacity planning in a fragment of time. Managers could have real-time (or at least close to real-time) data in their hands and being able to make decisions easier, while watching the impact of their decisions in a simulated environment. In that area, the later designed ERP systems, are more or less the same to MRPII systems, but the newer technology aids and drives them to be even faster and capable of performing even more complex calculations.
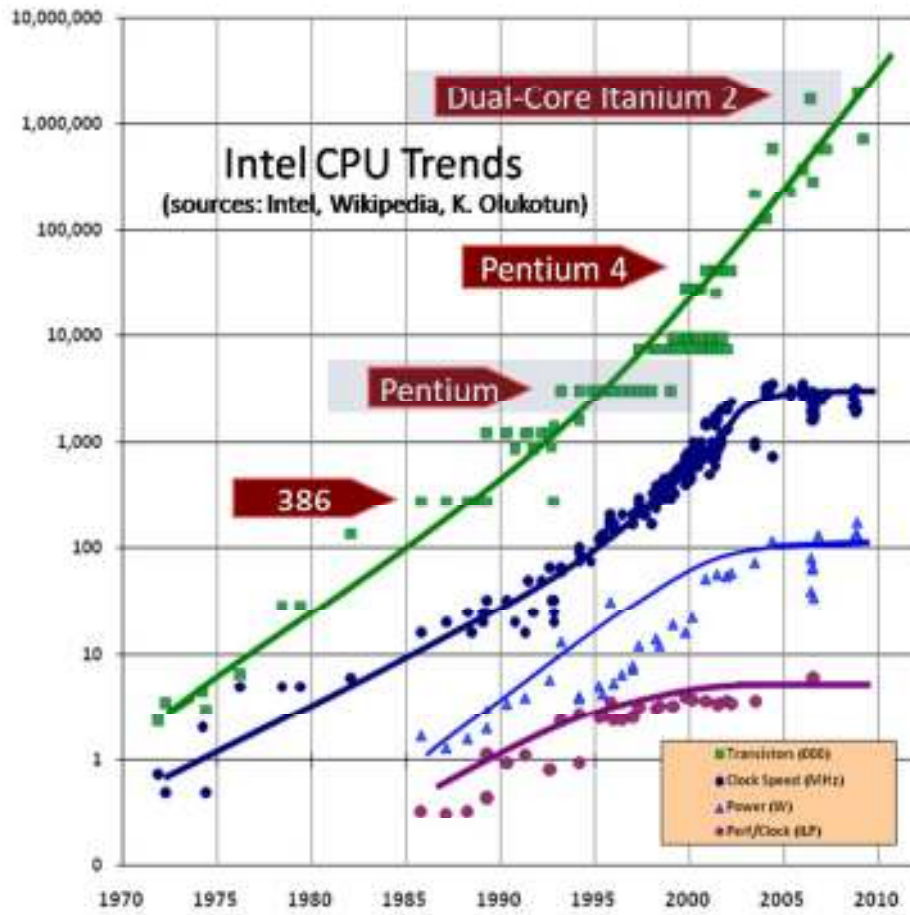
**Figure 5  CPU evolution over the years**

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MRPII VS MRP

MRP systems had several drawbacks and this is where MRPII systems come into place so as to develop those systems to surpass these obstacles that are created by those drawbacks. MRPII systems implement improvements in 5 different areas:

1. Closed loop MRP

   MRPII takes into consideration **feedback** from the shop floor (the part of a workshop or factory where production as distinct from administrative work is carried out) as for the progress of work so as to update every part of the schedule the next time the company is going to run it. This means that the

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MRPII system has a philosophy of an automatic control system. That way it can manage or reschedule on the fly critical resources if a process deviates from the desired output. This was probably the most revolutionary step towards ERP systems and a step away from MRP systems.

2. Resource Scheduling

The main reason MRPII stands for Manufacturing Resource Planning is that any sort of conversion from raw materials to finished goods in a manufacturing plant requires resources. If looked from the perspective of a process, there are monetary, human and material/machinery resources. All these resources have to be scheduled as a whole and in efficient way. Every single resource can be linked to the rest and thus create groups which will form the exact resources of each operation. This grouping can result in more efficient reporting and a precise planning by operation, which in turn can be handed over to the shop floor for a better control in every process, as each group will know where it lacks in efficiency. This way problematic groups will show up immediately and from a simple cause-and-effect diagram problems will be resolved. As a consequence, time and capacity can be adjusted and readjusted.

3. Batching Rules

The orders can be completed in different batches. MRPII takes into consideration batching rules and as such, most software packages that implement the MRPII offer a variety of batching rules. The three most important are 'Lot for Lot', 'EBQ' and 'Part Period Cover'. 'Part Period Cover' means making batches whose size cover a fixed period of demand. A policy of making a week's requirement in one batch is an example.

4. Software extension programs

A software program called "MRPII suite" implements the MRPII system. This contains the basic functionality that a manufacturing company might need

from its production line. However, basic functionality does not always meet the needs of each customer. With that in mind, an MRP suite might be adjusted to have much more functionality, if that is truly needed. Modular programs are therefore added to the basic system to incorporate the added functionality that they offer complementary to that of the basic (core) system. The most important one is Rough Cut Capacity Planning (RCCP), the first program that was designed to match the order load to the capacity available, by calculating the load per resource. This way, if a period has overloads, the extra demand can be pushed back that has spare capacity so as to achieve and balance orders can be moved. Another example is for a program that handles entering and invoicing sales orders, another into stock recording or cost accounting. A full MRP II implementation can therefore act as an integrated database for the company.

5. Data accuracy

Data accuracy in MRPII systems is of outmost importance. As the MRPII system is a sum of linked tables in a database or linked databases, this means that an error in one database or table, which could hold the data of an operation, could result in a series of errors in different tables that hold data in different operations in different departments in the company. This domino effect could affect unaware users that have little to no control to the department that is entering or using the erroneous data.

6. Realistic assumptions

MRP systems were based on a number of unrealistic assumptions; that customers, products and materials are equally important in the manufacturing process. People had designed the MRP systems to take into consideration lead times, but in reality those lead times were not always fixed. In fact, we could say that they were never fixed in best-case scenario they were normally distributed. In addition, they had not taken into consideration, that some resources are finite, and the probability of a machine or two going out of service, thus being unable to perform on schedule.

In the table below, you can find the features of an MRPII system.

**Table 1 Features of an MRPII system (Alavudeen, Venkateshwaran, 2008) [8]**

| Feature | Benefit |
|---|---|
| **Creating Production Orders from Sales Orders** | Items, which are to be manufactured, can be automatically transferred to production orders from sales orders entered by the sales department. Each item on the sales order may specify a different required date which can create separate production orders for shipments on different dates. |
| **Bill of Materials** | Create a multi-tier Bill of Materials (BOM) for a finished item or sub-assembly. A BOM can contain sub-assemblies, which have their own BOM to create an unlimited number of levels. The BOM tracks all material costs, including shrinkage, required in producing an item. |
| **Multiple BOM per Item** | System allows multiple BOM for the same item to be stored for use in different production orders or for reference purposes. |
| **Routing** | Routing (manufacturing process) can be created with unlimited number of steps (sequences). Each step (sequences) usually represents the complete unit of work in the manufacturing process such as stamping a steel sheet or soldering an electronic board or assembling the computer. For each step you can define the work center where the work will be done, set up and run labor required to perform the operation, other costs associated with the operation, set up and run machine time required for the operation. Overheads associated with the operation are calculated if the operation was meant for Labor Class and /or Machine Class. |
| **Multiple Routings per Item** | Routing can be common to multiple items. A single item can have multiple routings defined for use at different times. |
| **Production Order Types** | Different order types can be created. Estimated orders can be created to calculate estimated costs of production. Planned orders can be entered for purposes of what-if analysis and production schedule analysis. Firmed production orders record quantities, routings, and other information needed to initiate the manufacturing process |
| **Cost and Time Analysis** | During and after production, planned costs and hours can be compared to actual costs and hours for each production order or a group of orders. |

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[8] Alavudeen, A. & Venkateshwaran, N., (2008), Computer Integrated Manufacturing, Prentice-Hall, New Delhi, India

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| | |
|---|---|
| **Flexible Issue to WIP** | Items can be issued into Work-In-Process (WIP) based on all the components required for a sub-assembly or partial quantities for large production runs. |
| **Sub-assembly Production** | Sub-assemblies with an unlimited number of levels can be produced in parallel and combined to create finished items. Items can be assigned serial or lot numbers for tracking purposes during the production process. |
| **Transferring WIP to Inventory** | Finished items can be transferred to various inventory locations. Raw materials that were not used can be transferred back to inventory at any time for use in the production of other items. |
| **Integration with Inventory Warehouse Management** | Inventory warehouse management can be used to issue items to Work-In-Process of specific production orders directly from warehouse bins. |
| **Labour Time Tracking or Backflushing** | Labor time can be accounted for by entering time transactions or importing the information from data collection devices located in the plant. Where the actual time does not need to be tracked, the labor time can be calculated with automatic backflushing based on the number of items manufactured. Labor tracking can be tracked by the employees. |
| **Machine Time Tracking or Backflushing** | Machine time can be accounted for by entering time transactions or importing the information from data collection devices located in the plant. Where the actual time does not need to be tracked, the machine time can be calculated with automatic backflushing based on the number of items manufactured. Machine time can be tracked at the machine level to determine appropriate maintenance intervals and machine utilization. |
| **Other Costs** | Capture miscellaneous manufacturing costs and sub-contracting costs incurred in the manufacturing process. |
| **Overheads Calculations** | Define overhead methods for use in production bill of materials or production routing definitions. Overheads can be classified as fixed or variable depending on the analysis required and on which G/L accounts are charged. An overhead method can specify fixed, variable, or both. Overheads can be based on cost or quantity of items. |
| **WIP Location Tracking** | Once items are moved from inventory into Work-In-Process, their exact location in the production area or if items are sent to an outside contractor is known. Each movement can be tracked by location, time and the person who moved the items. |
| **Work Centers** | The manufacturing area can be divided into logical work centers, which can be used in the routing process. Each work center can define standard production routing steps, which can then be used when creating new routings, or modifying existing routings. |
| **Comprehensive** | A collection of 20+ reports can be used to extract information quickly, |

| Reporting | modify existing reports or create new reports quickly. |
|---|---|
| **Unlimited Transaction History** | All transactions entered in the system are available for review at any time, performance of the system is not affected by the number of transactions. |
| **No month End or Year End Closing Process** | Transactions can be entered for any period in any year, which has not been locked. Periods can be locked or unlocked at any time. |

To understand the functionality of an MRPII and the closed loops, the flowchart below can show this functionality compared to a MRP system.

**Manufacturing Resource Planning**

| | | |
|---|---|---|
| Business Planning | Objectives | |
| Sales Planning | Demands | Monthly |
| Production Planning | Demands | |
| Resources OK? | No | |
| Master Scheduling | Products | |
| Materials Planning | Material | Weekly |
| Capacity Planning | Capacity | |
| Planning OK? | No | |
| Purchasing | Parts | |
| Shop Floor Control | Hours | Daily |
| Performance Measurement | Accountability | |
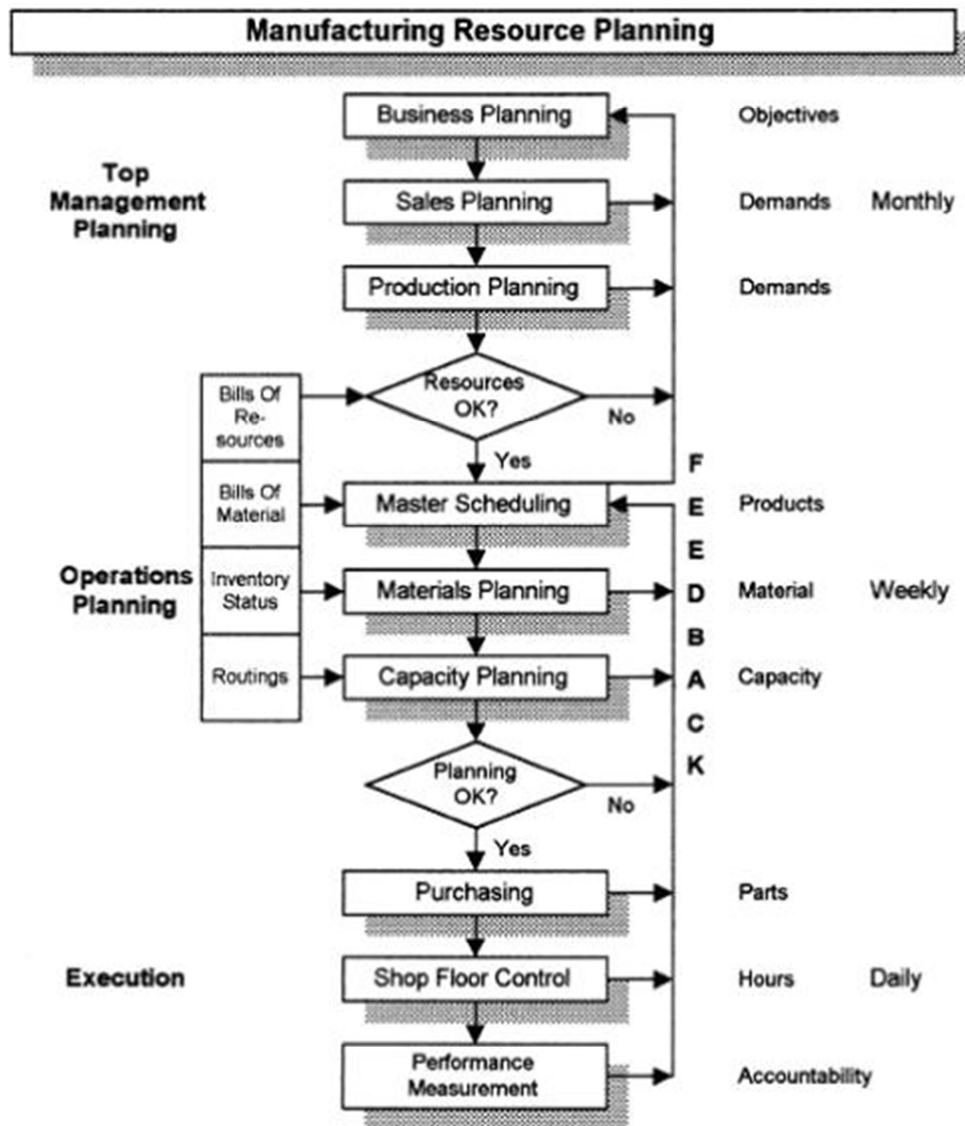
**Figure 6 Closed loop MRPII (Burman 1995)[9]**

An MRPII system is not a proprietary system so it has many forms. This is better understood if its modularity is taken into consideration. The base system is basically a stripped down version that every manufacturing is using, while each customer has its own software that has various modules added to that stripped down version. The MRP II system integrates these modules together so that they use common data and freely exchange information, in a model of how a manufacturing enterprise should and can

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[9] Burman, Richard, (1995), Manufacturing Management: Principles and Systems, McGraw-Hill Book Company, England

operate. The MRP II approach is therefore very different from the "point solution" approach, where individual systems are deployed to help a company plan, control or manage a specific activity. MRP II is by definition fully integrated or at least fully interfaced. The table shows what are the key features in a MRPII system

| Characteristic basic modules | together with ancillary & related systems such as: | MRP II systems can provide: |
|---|---|---|
| • Master Production Scheduling (MPS) <br> • Item Master Data (Technical Data) <br> • Bill of Materials (BOM) (Technical Data) <br> • Production Resources Data (Manufacturing Technical Data) <br> • Inventories & Orders (Inventory Control) <br> • Purchasing Management <br> • Material Requirements Planning (MRP) <br> • Shop Floor Control (SFC) <br> • Capacity planning or Capacity Requirements Planning (CRP) <br> • Standard Costing (Cost Control) <br> • Cost Reporting / Management (Cost Control) <br> • Distribution Resource Planning (DRP) | <u>Ancillary:</u> <br> • Business Planning <br> • Lot Traceability <br> • Contract Management <br> • Tool Management <br> • Engineering Change Control <br> • Configuration Management <br> • **Shop Floor Data Collection** <br> • Sales Analysis and Forecasting <br> • **Finite Capacity Scheduling (FCS)** <br><br> <u>Related:</u> <br> • General Ledger <br> • Accounts Payable (Purchase Ledger) <br> • Accounts Receivable (Sales Ledger) <br> • Sales Order Management <br> • Distribution Requirements Planning (DRP) <br> • [Automated] Warehouse Management <br> • Project Management <br> • Technical Records <br> • Estimating <br> • Computer-aided design/Computer-aided manufacturing (CAD/CAM) | • Better control of inventories <br> • Improved scheduling <br> • Productive relationships with suppliers <br><br> For Design / Engineering: <br> • Improved design control <br> • Better quality and quality control <br><br> <u>For Financial and Costing:</u> <br> • Reduced working capital for inventory <br> • Improved cash flow through quicker deliveries <br> • Accurate inventory records <br> • Timely and valid cost and profitability information |

| | • CAPP | |
|---|---|---|

ERP systems stand for Enterprise (-wide) Resource Planning systems. ERP systems evolved from MRP and MRP II systems towards the end of the 1980s. ERP is first mentioned in 1993 Gartner Group of Stamford, Connecticut [3]. ERP systems appeared with the power of enterprise-wide inter-functional coordination and integration. ERP technology has moved from mainframe-based batched operations to the client-server architecture and Internet-enabled real-time operations. As noted before, ERP systems are the evolution of MRP and MRPII systems. According to the American Production and Inventory Control Society (APICS, 1998) dictionary, ERP is "An accounting oriented Information System for identifying and planning the enterprise wide resources to take and/or ship account for customer orders". In another part it is stated, "An ERP System is a set of processes that defines the optimum methods for operating a specific business to achieve maximum productivity and profitability"[i]. The reason of each ERP system's deployment is to support, analyze and enhance the business processes, because it is in those processes that lie the company's **<u>strategic</u>** opportunities.

The capabilities of ERP systems expanded up those of MRP; in addition to manufacturing, this new system handled logistics, distribution, inventory, shipping, invoice, and accounting. Soon, ERP software became even more comprehensive, serving the operations of a number of other business activities, including: sales and marketing; production management and quality assurance; and human resource management. The ERP system consists of modules. Just like MRPII, each enterprise can add to the basic system (some call it the backbone ERP system) the modules it desires to implement. So there are basic modules that compose an ERP system. Each module can be installed on its own or with a combination of other modules, some of which are finance, logistic, manufacturing, order fulfillment, human resources, and supplier management. However, unlike MRPII, the ERP is not constrained to implementing basic functions for core business functions, but it has **expanded to** sophisticated systems with numerous add-ons for **analytical and e-business applications**.

Nowadays, ERP systems are used to plan and decide the strategic moves in a corporation. Highly efficient and capable hardware systems/servers are installed in those corporations to analyze the information provided from ERP systems or previous-generation systems so as to make appropriate decisions. Mathematics provides the base for this kind of analysis, since elaborate algorithms demand advanced calculations and many types of heuristics.

To understand ERPs' change in the integration systems, a reference to the basic differences between MRP, MRPII and ERP is necessary. MRP is simply about ensuring the materials are available to manufacture a specific part in a specific volume. MRP II takes care of all other aspects of a job including ordering, tracking inventory and ensuring capacity. However, an ERP system is an integrated information system that serves **all** departments within an enterprise. ERP software provides an integral coordination of the activities, which are carried out at every department of the enterprise.

Analysis in the ERP systems can happen in two main categories:

| Planning level | - Procurement & content cataloging applications |
| | - Transportation Planning & content systems |
| | - Demand planning and revenue management |
| | - APS, SCM, CRM and SFA |
| Operational level | - Inventory Management Systems |
| | - Manufacturing Execution System |
| | - Transportation Execution |
| | - Warehouse Management System |

Technically, ERP extends MRPII and links it with the company's information resources such as: capital, human resource, information system, financial management, accounting/logistics, sales, etc.

The information system is a resource that a company may or may not have. However, from ERP and onwards it is impossible not to have an information system because ERP can be approached as an information system. The information system has much information that can be retrieved at one's will. The term is generic but it shows that information on a company can hide or reveal significant resources that previously

were not accessible or even thought of, mainly due to the fact that it was not easy to see the bigger picture or have reports at the necessary time.

## ADVANCED PLANNING AND SCHEDULING (APS)

Advanced planning and scheduling (APS) system is a system that its purpose was to find the best way to organize and plan the manufacturing enterprise so as to cut losses or as a TQM manager would say, to cut the fat both in the processes and in between. Such lean functionality ranges from strategic (network optimization) and tactical (supply planning) to operational (line scheduling).

> "Advanced planning systems utilize complex mathematical algorithms to forecast demand, to plan and to schedule production within specified constraints, and to derive optimal sourcing and product-mix solutions. "(Kenn Steger-Jensen, Hans-Henrik Hvolby, 2002)[10]

APS systems main task is to run algorithms, so as to find the optimal solutions to planning problems that have various constraints, such as materials, labor, financial resources, capacity resources etc.

Companies can –at least in theory- maximize their effectiveness, while being able to offer competitive product variation, to cope with shorter product life cycles, to minimize their costs and maximize their efficiency. The main difference between ERP systems and APS systems is that APS systems allow the manager to manipulate the supply chain in real time. MRP systems and ERP systems do deal with multiple constraints simply by providing a planner with exception reports. However, APS systems take all of the factors into consideration (materials, labor, machines, storage, logistics) and suggest scenarios from which the user can choose whether or not go forward with.

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[10] Kenn Steger-Jensen, Hans-Henrik Hvolby (2002), Constraint Based Planning in Advanced Planning and Scheduling Systems, The 8th International Conference on Concurrent Enterprising. Rome, Italy

The software can provide vital information in planning the supply chain, while having various constraints over resources, real-time feedback and processing as well as integration. This is the main reason that, after the Y2K (the millennium bug in computers) and the Euro integration into ERP systems, APS systems will be the main focus of the ERP community. Optimizing the supply chain even further will help enterprises gain competitive advantage and therefore might lead to strategic decision making. That is why big ERP providers and vendors want to buy APS providers, so as to integrate their software to their own ERP systems, either as modules or fully integrated to the backbone and stripped down system.

## E.R.P. AND THE INTERNET

Transforming knowledge that comes from information deeply stored in any enterprise's processes, while using intelligent procedures to draw that information in order to make strategic decisions, is the key factor to any implementation of an ERP system that can and probably will lead to success. However, that information is usually stored in processes that do not communicate and such communication is often difficult to be achieved in a short period of time, e.g. each department in an enterprise is located in different floors, building or even states. This is where the net comes in to the picture; to create a bigger picture.

ERP systems have matured over the past decade and are not the same as the ones that were designed in the early 90s. ERP vendors are trying to enable processes that confer a competitive edge (e.g. pricing, promotions, bundling of products and services) that do not work well out in the open over the Internet. SAP, PeopleSoft, Oracle, Microsoft, RosettaNet, Neon and Ariba are trying to this day to reconfigure their products to the modern world, where internet is not just a tool to find information, but a tool that connects modules, enterprises and people. Large companies, whose basic transaction processing is not a core competency, are moving to outsourcing the difficult task to undertake of installing and maintaining ERP systems.

Any technology has 5 milestones before reaching to its critical mass point and subsequently to where mass marketing begins. Those milestones are: **the initial hype, the learning, experimenting and investing milestone, the new wave of technology and equipment milestone, the infrastructure consolidation and then the critical mass point**. The Internet and the e-business conceptions are disruptive technologies that rose to critical mass from their initial hype in a very short period of time; thus the term disruptive. While the ERP systems –an adaptive technology as it emerges from technologies that preexisted- needed a period of 30 to 40 years to affect enterprises the way it does today, the Internet only needed 4 years to reach a critical mass (Grant Norris, James R. Hurley, Kenneth M, Hartley, John R. Dunleavy, John D. Balls (2000).[11]

E-businesses started emerging and claiming share of the market, while traditional enterprises tried to follow. Their tardiness led to falling behind and losing significant market share. Nowadays, being a company that has B2B transactions without an ERP handling operations via the Internet is bound to fail. This rapid growth of e-business reflects the compelling advantages that it offers over conventional brick-and-mortar stores, including greater flexibility, enhanced market outreach, lower cost structures, faster transactions, broader product lines, greater convenience, and customization.

ERP systems was an adaptive technology that merged finance, procurement, and manufacturing planning while integrating them together in a seamless manner, drawing from that integration critical information to make strategic decisions. E-business on the other hand was the next step for the ERP systems, one that came very early in the ERP design phase, so it later became a vital and crucial part of that system. E-business was the model, soon to become part of the backbone of an ERP system, that aimed on extending ERP's focus area to handle relations beside an enterprise's four walls and live up to the expectations of the outside world. E-business applications manage supplier data, customer data and all associated transactions, while insuring that agreement on standard ways of communicating in a mutually accepted way for different business events over the Internet.

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[11] Grant Norris, James R. Hurley, Kenneth M, Hartley, John R. Dunleavy, John D. Balls (2000), E-Business and ERP, Transforming the Enterprise, , John Wiley & Sons, Inc

To understand the difference between a basic ERP system and the e-business module, we have to see their main difference. An ERP system carries out certain business information tasks that lie inside the enterprise, inside its four walls. An ERP system coordinates that information, and possibly even streamlines it to each department so as to have an up-to-date system that has all the necessary information in one place. Its goal is to provide the best way to organize efficiently and effectively all the process inside the company. The e-business module is the portal to the outside world, the module that handles the connection between an enterprise and its customers or suppliers. That can be simplistically speaking, a web page or a web GUI (graphical user interface) that handles those transactions, or any other sort of middleware. So, e-business has a primary focus on external, cross-platform and cross-enterprise efficiency and effectiveness and on product promotion. However one can argue that e-business is not just a GUI but a whole philosophy that indicates that the customers want highly personalized websites, while retaining their ratio of higher quality to lower costs both in the product in the service that comes afterwards.

Customers now can compare prices side-by-side in a single product category as well as the costs of the transaction and that of any added service (e.g. warranty issues). This power of information that the customers now have is pushing the enterprises to go further, to search for new ways to bring down costs, to offer more than their competitors do and to maximize their profits. Enterprises are now trying to integrate Customer-Relation Management (known as ERPII) to their suites. They are trying to change their value chain to provide more value while on the same production line. New technology and especially e-business provides companies with data warehouses that store and analyze their customers' buying habits and find patterns so as to provide them with personalized info, recommendations on their products and special offerings. Therefore, they build a great relationship and ensure little by little their loyalty.

The Internet is a cheap way to find information and close deals to more places more easily. The ERP system demands for that information. Then the ERP can interact with that information provided from the web technologies and find the best fitting product, while calculating the best route to get to a desired outcome. This is a perfect match!

There is not a single path to develop an ERP system. Each enterprise has its own goals, which are mandated by its own strategic decisions. Therefore, an ERP system had to adapt to those strategies and possibly even facilitate the decision making for future strategic decisions. However, the ERP is constrained in its four walls. This is where the e-business model comes into action, as it is the model the shows the outside world.

The e-business model along with the ERP systems can show a great potential as each model shows strategic paths to follow, each in its own field. An ERP system deals with all the internal processes of an enterprise and wants to provide information to the outside world (whether it is customers or suppliers or both). The e-business model is primarily focused on finding a way in the enterprise's information as an outside entity. The meeting point of those models is leading to their convergence and thus can lead to the best strategy to pursuit.

In this era, the one cannot live without the other. At least, an e-business cannot substitute an ERP system, because even if everything came down to a transactional interface that is perpetuated from one step or department to another ("web-based order-entry form end that customers will use will hand off the transaction to an application that generates material orders to the front end that suppliers use, and the one that logistics providers use, and so on"), still there comes a point when financial and human resources' data have to be processed, processes that the ERP systems are keen on.

Information exchanged between companies could benefit all parties. Such information includes but is not limited to demand forecasts, product designs and changes, order status, capacity availability. The benefit of exchanging those information over the Internet is the major contribution to quick and fast transactions leading to even faster delivery times. This time saving benefit is passed on to the final customer who sees an order being delivered well ahead of time and is pleased with the result.

This pleasure offers the grounds for even further improvement. Therefore, e-business transactions are becoming the norm nowadays as fast communication schemes lead to customer satisfaction. E-business is the leading technology that enterprises focus on as they can reach more customers, faster, better, efficiently, effectively and most importantly, individually. That individual approach is handled by combining both

ERP systems and the Internet. Even if a company decides not to implement an ERP, the problem will start arising once it will connect to its customers and suppliers. Both want reliable data, accurate information and timely deliveries to do business with.

**e-business and ERP systems are complementing each other**. This is the reason why leading enterprises send their own people to work on their partner's ERP systems so as to work as close as possible and to minimize the costs and burden that ERP misconfiguration could cause to interconnected parties. Usually, enterprises with well-maintained and organized ERP systems are the ones that act like chiefs in their ERP network supplier-customer teams. That happens because a company that has few to no integrity data problems can become a solid backbone to the extending intranet of the connected enterprises, and thus behave more reliably as a Web-based coordinator. This is later discussed in Strategic Alliances.

## ERP, E-BUSINESS AND E-SUPPLY CHAIN

As it has been mentioned before, the Internet was a main differentiator when it came to redefining an enterprise. Via the Internet, businesses could share information once enclosed in the four walls of the enterprise, forming alliances, synergies and partnerships much more easily and quickly in the interest of the customer. From the start of the new millennium, extended enterprises supplanted individual companies as the entities that competed against each other. ERP systems had to address issues of agility, low latency to market and low cost and high degrees of synchronization with their suppliers to deliver the products on time or even before it, without jeopardizing quality. At the core of each enterprise lies the value chain, whose integration meant visibility, access and timeliness. Within the industry value chain, the group of companies that carry out each step in creating and delivering product is called the supply chain. The more integrated with suppliers a company is, the better it can address customers' needs.

Electronic Supply-chain management (e-SCM) is the use of Internet along with the use of ERP systems across enterprises in order to accumulate, consolidate business processes, so as to improve speed agility, real-time control, and customer satisfaction.

## E-SUPPLY CHAIN COMPONENTS

The e-supply-chain consists of six components, Supply Chain Replenishment, E-procurement, Collaborative planning, Collaborative product development, E-logistics and Supply webs.

**Supply chain replenishment** includes aligning customer real-time demand, to company's processes and consequently to their partners' strategic alignment. Companies use this to remove any bullwhip effect, as stocking points are practically eliminated, and supplies and replenishment are determined by real-time data and information both in the company and in the suppliers' end. This helps to minimize costs, as it minimizes inventories, reduces distribution steps as well as increase the speed at which the replenishment takes place. This scenario is greatly appreciated in companies that have an extended value chain such as those discussed later in "extended value chains".

**E-procurement** is the combination of web technologies to facilitate procurement processes, including requisitioning, sourcing, contracting, ordering and payment. It accumulates catalogs, contracts, purchase orders and shipping notices so as to purchase both direct or indirect materials, while reducing redesign issues, processing costs, ensuring purchase price leverage, contract compliance and increasing visibility, delivery satisfaction and quality.

**Collaborative planning** is perhaps the combination of the aforementioned components, as it requires both sellers and buyers to share both the demand and a plan of supply to support this demand. Both parties have real-time access to point-of-sale or order information. Changes in the forecasted demand as well as changes to schedules, orders or product changes, trigger immediately adjustments to all parties'

schedules. All parties synchronize their product flows and their production plans, while reducing inventories and increasing customer responsiveness.

**Collaborative product development** ensures the web communication between product development techniques across companies, by tightly integrating and streamlining communication channels and design standards. While a product is developed, secure channels over the web ensure confidentiality between the companies that design the product and those that engineer it, test it, and those who undertake the service responsibilities. Once a product design is finished, search engines try to find corresponding standards and technologies to meet the product's design needs.

**E-logistics** is the use of web to support warehouse and transportation management processes. It enables inventory tracking, shipment tracking and other tracing information inside and outside the company.

Finally, **supply webs** is the culmination of the above, as they are portals that serve industry sectors by integrating the supply-chains of various buyers and seller and congregating all transactions, information, products and funds of the companies.

## E-SCM INTEGRATION

According to Forrester Research, there are three stages of supply-chain integration: integration, extension and exploitation. The integration stage happens when a company wants to integrate all its own systems, whether legacy or disparate ERP systems, into one that will be able to handle quickly supply and demand needs and their fluctuations. In the next stage, the one called extension, enterprises start working together in order to complete bidirectional, real-time data with their strategic or operational partners (i.e. logistics providers). This stage is often the most controversial, as if a company doesn't have a well-running ERP then it is bound to face organizational obstacles such as process redesigning, which more often then not

incurs high costs and personnel denial to implement those changes. Finally, the exploitation stage is all about agility and switching to the right and less costly supplier or buyer.

Needless to point out that ERP systems provide the needed edge to enterprises that have integrated their processes in one. More and more enterprises nowadays have moved to the exploitation phase and ERP systems have all the necessary modules and interfaces, to interact through e-business technologies with other enterprises in the way we have described in the extended value chains section.

Once a GUI or a web page is deployed to the server, where anyone can find product and/or service information and secure channels to make transactions are well established and tested, then enterprises want to forge strategic alliances, by integrating information with their suppliers first and then with their customers. First this is done by enabling customers demand to be shared across the supply chain and, in an instant, pass that information on the suppliers. Consequently, every change can be updated instantly, reducing bullwhip effects, increased costs, misinterpretations and false deliveries.

A number of events take place when companies integrate ERP and e-SCM. Businesses force inadvertently their suppliers to join their extended enterprise. Those who do not comply with electronic transactions and ERP bonding are cast out of the enterprises' network that does electronic trading (known as e-trade). Then, those who do enter the network of e-trading companies, already maintain an ERP and enjoying its strengths and benefits to the company, can work at an even faster pace, with streamlined orders making work easier, much more organized and the company wealthier as the earnings will rise due to the increased number of orders.

Since the mid-90s companies have understood and sought the need for a more personalized communication between customers and suppliers. While the need for a fast, reliable, and personalized communication to each and every supplier was addressed by making fully operational and well-organized e-business processes and procedures via the web, customers' issues were not properly addressed. Even to this day, customer relationship management is in its infancy and it is making its very first steps trying to understand how to best fit a company's resources to buyers' attitude and by extension to their behavior.

Customer Relationship Management could be viewed as the endeavor an enterprise is making in order to achieve customer loyalty through successful marketing and communication that addresses his/her needs. This endeavor has proportionally become bigger and bigger in order to include every single contact point a company may have with its customers, whether they are consumers or businesses. It has been shown that it costs 6-8 times more to sell to a new customer than an existing one.

As previously implied, eSCM software can create wealth by reducing operational costs in the value and distribution chain. The benefits deriving from the restructures, while reshaping the ERP to fit the suppliers' communication with the company, can be shared with customers so as to improve the overall experience, thus increasing loyalty. Reducing cycle times in manufacturing of the products as well as order tracking information are among few of the simple things a company can do to please and increase in size its clientele. Loyalty not only decreases costs of win-again customers but it also adds to enhanced revenue as people are less reserved to buy more products from a certain company, providing more buying info and creating a solid information database/warehouse that can lead a company to better understand its market shares.

From the industrial evolution till today, companies were treating customers as a mass; a mass that wanted their products so they developed simple algorithms to explain that

mass behavior and their reaction to it. However, as time and technology has evolved, this worldview is now obsolete. A customer must find the service or the product meet and most importantly exceed his/her expectations, otherwise the company may find itself one day without customers as they will have moved on to companies that offer more while ensuring the same quantifiable measures that matter to the customer (e.g. price, benefits etc.). Using ERP systems (to be exact ERP with CRM systems or simply ERPII systems), companies can understand customer buying patterns, preferences as well as retain information as to how their customers want to interact with the company by drawing that information from their previous purchases.

Companies shift their interest from integrating their processes, as they have already done that, and try to gain more perspective on their customers' needs. In this world, the motto in order for a company to succeed is not "profits, profits, profits" but meeting customers' needs. ERP systems have already helped in streamlining processes across the enterprise, e-business has helped those ERP systems to reach out to the world of suppliers and customers, and customer relationship management software aims to refine and redefine those relationships to gain better and greater coupling between parties.

Integrating sales, product configuration & design, planning and IT in a harmonic entity that the enterprise can draw vital information from and plan its resources accordingly is something that ERP systems were designed to do in the first place. E-business enables the transition from mass marketing to personal customer relationship, while still selling the same products. CRM and ERPs can drive the change in certain products much faster as the feedback from customers is accelerated at a rapid pace. Customers now encounter a unique in their transactions with the company, whether it may be through different business units, regional offices or operational organizations within the company. The customers can have an integrated, seamless and multichannel customer service.

However, CRM is not just an IT module to ERP systems. It is a collaboration between people, processes, equipment and careful warehouse design. The CRM module mainly focuses on marketing, sales and customer service. The more careful the implementation the better the results it brings. The idea of CRM is not new. What is new is the technology offered from the mid-90s to today. Relational databases, fast

servers and even the new trend of **social media** has radically changed the way a company can serve by better understanding its customers.

## LOYALTY AND TRUST

When referring to loyalty, we mean the probability a customer might buy again a product or the built trust that a customer has for a company resulting to buying one of its brands or the repeated purchase of a product that is justified by a favorable attitude towards a company and/or its brands. According to Srini S. Srinivasan Rolph Andersona, Kishore Ponnavolub (Srini S. Srinivasan, Rolph Andersona, Kishore Ponnavolub, 2002)[12], there are basically 8 factors that ensure higher retention or loyalty rates: (1) customization, (2) contact interactivity, (3) cultivation, (4) care, (5) community, (6) choice, (7) convenience, and (8) character.

**Customization** can happen in two levels. First of all, ERP systems can hold data of their customers' interactions with their e-business front-ends and adjust their face, front-end or sellers to respond accordingly. It is the first layer of customization: Present yourself in a way that the customer finds it pleasant to interact with you. This is why Amazon.com and eBay can change their front page based on your previous searches and purchases. Although holding data on purchases does not help a lot, unless they are repeated and related, history of viewed items helps companies better adjust their offerings based on customers' current wishes.

The second layer of customization is regarding the nature of the service or product that the company is offering. The ERP systems can store information on how the customer wants specific products (e.g. contact lenses with specific properties and

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[12] Srini S. Srinivasan, Rolph Andersona, Kishore Ponnavolub (2002), Customer loyalty in e-commerce: an exploration of its antecedents and consequences, Drexel University, Philadelphia, PA 19104, USA, McKinsey & Company, USA..

characteristics). Customization also creates the perception of increased choice by enabling a quick focus on what the customer really wants.

**Contact interactivity** is a crucial factor to customer loyalty. When a customer wants to learn more information on a specific product, any delay on behalf of the company may result in poor performance and consequently in customer loss. In addition, interactivity may increase customer loyalty if done properly, as the company through its representative can offer to the customer new products or products and services that serve him best. E-business interactivity adds to this advantage, as a customer can view reviews and be proposed in an instant of possible alternatives. ERP systems can be configured in such a way that there will be no need for human interaction and interactivity. They can process data in a fragment a second and can make complex correlations that could be more beneficial for the company offering a product than previous marketing endeavors.

**Cultivation** is the extent to which a company informs its customers of new products, new offerings or relevant products and services. A company can use its records and its ERP system can send out special offers to valued customers or new offerings can trigger notification to respective users, users that are more likely to be interested in them than others. For example, Amazon.com sends periodically e-mail to its customers so as to inform them on savings. This way, the customers have a feeling that the company is taking special care of them. It also minimizes the probability the customer to search even further to other sellers and at some point he/she remembers that he/she has seen the product or the serviced offered by the company, thus fortifying brand loyalty.

**Care** is the behavior that a company shows in respect to customers' pre and post-purchase activities and/or amenities and facilities. In particular, it is critical because it shows that the company shows the appropriate attention to its customers regarding details and even more identifying any occurring problems. This acknowledgement is comforting from the customer's side and prevents his justifiable motion to let the whole world know (i.e. social media). This is ERP systems' probably greatest challenge as they do not understand human reactions and their Artificial Intelligence is still far from adequate.

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A virtual **community** is basically an entity that relies on interconnected people that can share information in an instant over products and services provided by the company. This is easily facilitated nowadays through e-business/ERP's modules that can create forum-like communities. Those people can connect in those communities and through comment links, buying circles, and chat rooms sponsored by the company can increase –unknowingly– the word-of-mouth effect. In addition, it may increase loyalty, as people in those communities want to feel special and they come up with special IDs or nicknames that contribute to a greater bonding.

The **choices** compared with a conventional retailer are far greater, when using an ERP system, since an e-retailer can avoid keep away from operational costs of running a conventional brick and mortar store. The retailer can use larger storage rooms, while increasing his available product lines. In addition, ERP systems can combine information and support alliances with partners in order to provide far greater product variety to his or her customers. The more choices a customer has, especially if the e-retailer can aggregate, provide support and meet his or her needs then he is bound to succeed as a one-stop shop.

As far as **convenience** is concerned, ERP systems can facilitate the customer; make it more easy for him to navigate in the company's site, while being intuitive and customized. The ERP systems are able to support those attributes since they can hold information on exactly a customer has done and interacted with the company. E-business modules can render a company's information helpful, while indexing it in an appropriate way so it can be accessible in a fragment of moment; as speed, little input from the customer and efficient transactions are crucial for the customer and he/she leaves the company's website with a good impression. Absent information or difficult to find are things that almost always add up to a user's ultimately leaving reasons the company to find someone better, perhaps even never coming back.

Finally, memorable logos and mottos as well as the way the company chooses to build its website, from colors, texts, and cascaded styles to animations –or lack thereof-, are attributes that add to the **character** of the company. Is it serious, fun, creative, bold etc? The company must position itself carefully when building a website, as it is its way to advertise itself to the public in a more direct way than ever before. ERP systems are not important for this part, but their e-business modules must be able to

support enhancements in an easy way. For example, use of Adobe®'s Flash® is declining for the past years and HTML5 with CSS3 is on the rise. Shouldn't a business be able to transform its website accordingly and in a timely manner? Perhaps in the future, this transition will enable the company to maintain a specific character to the customer (i.e. innovative) Character is the equivalent to person-to-person interaction of the brick-and-mortar stores. A website must have invested in it in order to be familiar to any customer visiting it.

## KEY CRM TECHNOLOGIES

Marketing people, unable to understand IT infrastructure, as they are IT illiterate, no longer need to comprehend how ERP systems work, as ERP systems can be the transparent tool to build a strong report system that delivers tangible and measurable data, centered on customers, who are sources of income and value creation. Mass marketing is a thing of the past, and one-to-one marketing can create larger impact on customers' loyalty. CRM modules are both inexpensive (as long as the company has deployed and maintains successfully an ERP system) and powerful in every imaginable way. The four main areas where the marketing has now put its efforts in understanding and serving better its customers, therefore engaging in a profitable relationship, are **technology enabled selling, call centers, e-business and data warehousing/mining.**

## TECHNOLOGY ENABLED SELLING (TES)

Technology enabled selling is basically the notion that the use of technology is not just for the sake of just using technology; it is to facilitate the day-to-day operations. The ever-changing land in sales pushes for further understanding and development in the area of TES. In the consumer markets, customers already expect a set of

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provisions to consider a service or product as a quality product/service. In the business-to-business world though, things are getting more perplexed and relationships have increased in both complexity and diversity.

TES usually means that the company must change the way it operates, how to best implement it as well as sales-force resistance. TES is usually the idea that technology can help in sales in different ways. However not everyone in the company is fond of changes. This is the reason that TES usually restrains its power in administrative and cost savings rather than extend its full potential to the sales department.

The changes that are required are not just about the technology that is to be used. It has to be incorporated to the set of processes that the company is operating with. Sometimes that means changes in existing processes or making new ones that integrate customer information and transaction data, while aligning with the company's strategies and goals. In order for TES to work, a deep integration of disparate systems may be necessary. High telecommunication links are a must and interfaces must be designed in a such way so as to ensure data accuracy and consistency.

TES –if implemented correctly- usually results in shorter payback period times, clearer and aligned strategic goals across the company departments and enhanced marketing portfolio (information and intelligence). The sales department can better understand their customers, provide fast responses to their needs and to issues that may arise. As a consequence, they foster a relationship where loyalty is flourish and retention rates are increased.

## CALL CENTERS

Call centers are currently one of the most used key technologies in CRM. Probably this has something to do with the fact that call centers bridge the gap that exists between fully automated service delivery and person-to-person service delivery.

Regular call centers can provide service to customers, business partners and employees upon request. They are increasingly the main point of contact for everyone. Their functions are as follow:

1. Resolving issues or in case of inability to resolve them, forward them to a higher level of service provision
2. Provide information on products and services
3. Match successfully products and/or services based on customers' needs and then recommending them to their customers
4. Take calls and keep track on customers' requests and issues
5. Create reports and fish diagrams to find possible reasons that cause systematically issues to the customers.

Since the call centers are the main point of contact for every customer, partner or employee, they need to be designed and deployed in such a way so as to ensure the best service provision. The best call centers want to be able to provide as much service as the customer will allow them to

In the last few years there are numerous successful cases of call centers. Dell Computers has a tool-free number across Europe and the US and ensures that the over 1$ in sales through its website are given the necessary after sales attention. Caller-ID is used so that each telephone can be rerouted to the representative in the call center has the customer's language as his/her native one. Customers and partners can communicate in their native language and therefore feel at ease with the company.

Call centers usually use a three-tiered environment. First there is the **technological screening**. At this tier, the system, either automatically by letting the customer press a corresponding number or via a person that does the first sorting out, screens the case and routes it to the corresponding or best fitting department. Secondly, a **service representative** takes care of the customer and tries to find solution to the problems

that have risen. Last, in case that a problem is beyond the representative's knowledge, the issue is routed to a **case manager or a specialist**.

This way the issues are resolved in a timely and consistent way, while maintaining a high quality service where self-service is facilitated, resource utilization is optimized and the expertise level is provided only when it is needed.

What qualifies a call center as a top-notch is the sum of specific measurable indicators and at levels specifically certain *information attributes*, such as:

    i.    Accuracy,
   ii.    Confidentiality,
  iii.    Accessibility and
  iv.    Reliability

In the first tier the call center must ensure the *technological attributes*:

    a.  Intelligence,
    b.  Efficiency,
    c.  Controllability and a
    d.  Human interface

While in the next two tiers, the call center must ensure the personal attributes:

    a.  Helpfulness,
    b.  Knowledge,
    c.  Responsibility and
    d.  Comprehensiveness

Call centers have incorporated in their ERPII systems forms of feedback request from their customers. The aforementioned forms keep track of specific attributes of a call representative. It is not unknown for those forms to implement a standard SERVQUAL or SERVPERF questionnaire to find out where they are lacking in.

It is known that Paypal has incorporated a similar form of feedback from its customers when they communicate with a representative, via phone, email or a video chat. Whenever a case is closed, an email requests the users to submit their thoughts on the representative. This way, an ERP system can hold information on employee

job performance and report if a group of employees have strong or weak attributes so as to perform or schedule additional training for appropriate reallocation.

## E-NABLED CALL CENTERS

Those call centers are a subcategory of the previous call centers, different from them in the way that they don't support or provide after-sales service. They are focused on providing specific information to customers. Nowadays customers have to navigate through an elaborate maze of choices in order to get the information they need or even worse go through an ill prepared voice recognition system to find out their order status.

E-nabled call centers are built around the touch points of customer information. ERP systems can provide information on previous transactions and based on CRM global trends, the centers can provide helpful information to the customers that they could never think they wanted, exceeding customer's expectations, complementing his/her interest and improving his/her buying experience.

## E-BUSINESS

## I.P. (INTERNET PROTOCOL) TELEPHONY

Although IP telephony could and probably is more thought as a category of call centers, I find it more appropriate to link it to the e-business part, since it starts from the e-business part of a company, its website.

It was mentioned before that the best call centers want to be able to provide as much service as the customer will allow them to. With that in mind, they could link audio, video and data, all into one place.

When a user visits a website, the company can provide a hyperlink to open his/her favorite Voice-Over-IP software and call the representative to find more information based on the page he/she was on. This based upon request and product/service facilitates both the customer as well as the company to skip the first tier previously mentioned, as it there is no need to which product the customer might be needing information. In addition, VoIP software have the ability to save the transaction, the conversation as well as provide both parties the ends in order to communicate and exchange more freely archives and messages.

IP video chat (e.g. Skype®) can enable users have a face-to-face experience with the representative, although usually not preferred as companies find it easier to find representatives that can help their customers without paying attention to appearances.

Last, they can interact via Remote Desktop. The user grants the representative rights to control remotely the computer of the user and then watch as his problem is being addressed. This way, in case a similar problem occurs, the user will have seen how to handle those problems since he/she has seen the way to do it. Think of it as a remote training course.

Through all these methods, the user can have a user ID and therefore his help may be more speedy based on his/her previous encounters. He could also be offered special upgrades or new products. This Computer-telephone integration (CTI) technology is already available to the high-end CRM software suites such as those of Ericsson and eFusion.

## FIELD SERVICE

While the third tier of a call center is a specialist or a case manager, it is however sometimes inevitable to resolve any case remotely. In these cases, issues are addressed from special or qualified representatives that are sent on the customer's site. These field representatives are usually up-to-date with the previously taken steps to resolve any issues remotely and are aware of the issues that have risen. They are well-informed on both the customer's needs as well as the product's specifications,

manuals and design documents included. Those representatives can check remotely on the customer's queries and calls as well as update the current status of a pending issue.

While one can argue whether field service actually belongs to the e-business part of a company, it is informed that everything starts from the e-business part of a company and it is then referred to the field service when needed. E-business plays a crucial part in the field service and it has nowadays reshaped the field service so as to incorporate its procedures to its own. Field service on the other hand uses the procedures of the e-business to update information on the fly, therefore being able to do business faster and more efficiently.

## DATA WAREHOUSING AND DATA MINING

Companies can hold through their ERP systems large chunks of data. Although it is in some areas very helpful to hold such data, in other areas it can be useless. However, ERP systems give the extra opportunity to extract vital information from those otherwise useless data. ERP systems can not only hold many data (an advantage that is given by the evolution of their backbone RDMS- relation database management systems) but can combine information from those databases and report trends, targets, comparisons and possible integrity reports.

A data warehouse is a data structure (usually a database) that holds, indexes, aggregates, partitions and updates data on the data. A simple example would be the sum of the production that was manufactured in a day. A data warehouse can store that information in an extra data structure or even in a database. Those updates can occur hourly, daily, or even yearly. ERP systems can perform those tasks whenever they are programmed to, and therefore can facilitate in extracting such information on demand. A data warehouse is more of a data repository that offers knowledge on various topics; knowledge that can be extracted from the already taken data.

These reports are particularly useful for the managers of every level. Users-managers can learn about the company's performance, learn of possible shortcomings and act

upon them fast, while being certain of their accuracy. ERP systems through their data mining give power to the managers and can be the crucial part in providing them with a critical advantage; an advantage that could be a strategic one as well.

As for the CRM part, companies and especially their marketing departments extract information on the customers from the data. Those data can be shipping details, buying details, buying trends as well as preferences. For example, when supermarkets are closed and there are basically no transactions between customers and the supermarket, their ERP systems start scanning profiles of the customers and try to mix and match their age and gender with buying habits. The results can be used either individually either on a mass/group scale. This enables the supermarket, while providing its marketing and service provision department with specific reports, to make offers to certain age groups or even gender groups. It can also offer savings on special occasions or even some days of the week so as to balance its workload. These reports, for example, have lead multiplexes in the greater area of Attica to offer half-price savings on weekdays (Monday, Tuesday, Wednesday) that they had little income. The options are practically limitless.

Data warehouses and data mining enhance service provision as well. They are the basic function of today's decision and policy-making managers in the company. Of course, the idea was well known before even the ERP systems. As mentioned before data warehouses usually are a special-purposed database of pre-processed operational data. By organizing those data from multiple databases simultaneously, they provide the go-to repository of known facts and related data that are used as a basis to the decisions made in a strategic and an operational way.

The word mining comes from the fact that those systems parse historic data in order to find trends and opportunities, discover discrepancies and possible deviations from optimal behavior or even identify threats. As such, data warehouses can provide better services to the customers as well as maintain a high level of quality. They aid in exceeding customer expectations (since the customer is taken by surprise and welcomes any information and product that can make his life easier). Data warehousing systems usually have a three-fold merit.

First, they improve customer marketing and raise the satisfaction percentage. They therefore increase the retention ratio of their customers. Secondly, they help in

understanding and forecasting the company's financial position. Lastly, they streamline business operations.

ERP systems withhold all the information that a company wants to incorporate in them. It is the ultimate tool for effective allocation of a business's resources. Its accuracy, integrity as well as the fact that it relies in DBMS systems and thus its transactions are ACID (atomicity, consistency, isolation, durability), means that the senior managers can draw data from it in a quick and effective manner, so as to reach to complex strategic decisions in a short period of time.

Since it integrates finance modules, it can assess resource planning in a matter of minutes and then report on it so that a manager will be able to deploy its resources quickly. For example, a company can owe money to a supplier. The supplier could also be a customer and owing the company money himself. The company can assess its economic standpoint and pay or demand from the supplier/customer the difference from his account. Another example could be of the supply chain management. The ERP system can integrate all the different and cut-off parts of a company's value chain, and therefore decide upon it the best lead times, the overall cycle time and the necessary inventory levels as well as the reorder point. This last example is not exclusive to an ERP system but was offered long before it came along from its ancestor the MRPII system. However, it still provides the same and better integration in order to provide a holistic view of a company's supply chain and therefore locating the points where the company could cut spending. The ERP system, now offers better marketing options as it can handle promotions, pricing, commissions and offers.

Last but never least, an ERP system can administer all the knowledge that its database of information has. This database, as mentioned before, is called a data warehouse since it holds data from different departments and can perform and provide, when configured appropriately, elaborate and difficult to perform by a human being analysis and reports. This is the main and strong privilege of running an ERP system since it not only stores data as a transactional machine or a storage device but also can extract precious information from those data.

It should now be clear that ERP systems hold the power of ultrafast computers to report on new activities, new offers and new possible opportunities in a fragment of time that was once required in the past. ERP systems provide the necessary reports, once configured properly, to show data that would be otherwise hidden in the different departments or even sites of the same enterprise. Therefore, ERP systems enable the recipient of those reports to make decisions based on solid data that come right from the enterprise's main or supporting processes. The fact that those reports can be usually retrieved in a time frame of a day or even less, gives the ability to the board of Directors to make decisions in a fast and agile way. In addition, this speed really implies a certain level of flexibility that can give the enterprise the edge that it wants to gain a greater market share.

## MODULES

A basic ERP system is usually comprised of 5 modules: Finance, Logistics, Sales & Marketing, Human resources and manufacturing.

### FINANCE

As enterprises grow by acquiring other enterprises (via horizontal or vertical acquisitions or both), they have various business units, which work independently from each other. Those units usually even have conflicting or legacy systems that it would require months or even years to transform them in a single system. Problems such data accuracy, isolation, data consistency and transactional durability arise when trying to interact with different systems in a single enterprise.

One of the most easy to understand problems in today's enterprises that have not switched to a unified ERP system across the enterprise's functions and business units, is that the finance departments in different locations have to deal with currency and tax/legislation issues. If, for example, a company tries to have the same legacy system in different locations it would render making decisions a very difficult task. A manager cannot make decisions because a decision he might make for a specific location could be impossible to implement or even illegal. In addition to that, a legacy system would have to be altered to meet the requirements of the country's legislation. This change in the legacy systems is so big that it usually renders the unified aspect of having one system a moot point. There is no more a single system that handles different locations and their financial issues; there are multiple. And trying to make them communicate without intervention and possible error is usually impossible or a very difficult task.

The solution to that problem is the ERP system's capability to react as a middleware to different systems. The current ERP systems have sub-modules that can convert information from one system to another in a seamless way, providing consistent, accurate and basically real-time data. ERP systems can translate data from one legacy system to another on the fly. That last part is crucial element to providing senior managers with information that they can rely on and make decisions.

However, as legacy systems grow older and maintenance costs are increasing, the true power of the ERP systems does not lie in the ERP's ability to behave as middleware. To make that clear imagine the situation when there is a data request in the ERP system and it has to communicate with the legacy system. The legacy could be doing as fast as it can and still not be enough for the ERP to deliver the data fast. The bottleneck in delivering data fast is the legacy system. There also lies a possibility, a threat to the enterprise's well-being, that the legacy system might lose its ability to store and deliver accurate data.

The true potential of an ERP implementation shines when it shows that it can incorporate all the data from a legacy system to its own database. The past few years ERP vendors have acquired other companies to be able to do that as seamlessly and as unobtrusively as possible. They can transfer data from older systems and therefore

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being able to process data faster, accurately while increasing the possibilities of handling that data in a more structured and efficient way.

For those reasons, the finance module benefits from the ERP systems enabling their Directors or Chiefs to make strategic decisions. Imagine an enterprise that has business units all around the world. In this global economy, enterprises want to react in the best way with their environment. While a business unit may be thriving in performance, another one may be performing less well. As the financial departments of the enterprise are interlinked and can show global and specific information, the unified ERP system can predict or forecast potential losses in the years that follow in the whole department or as down as one department in a certain business unit.

This enables the Board of Directors to make strategic decisions and either plan to bring the business unit or the entire department back to profit through strategic moves, such as buyouts or cutting losses in unnecessary functions and activities or even to sell the entire department. That was the case in 2004's IBM's selling its PC group to China-based Lenovo in a deal valued at $1.75 billion, while taking a minority stake in the company. The joint venture made Lenovo the third-largest PC maker in the world, and the deal still gave IBM a hand in the PC business.

Another fine example of ERPs' ability to help Directors is that of ERP's concurrency. As ERP systems interlink databases from disparate business units and are based on real-time data and transactions, a single change in it can set off a series of reactions in every module. A manager can watch the financial effects of his decisions and alter them accordingly. So, an ERP is a perfect tool for senior managers as it helps making strategic decisions, while measuring finance indexes, costs and performance.

## 1. FREE CASH FLOW

This is a metric that often shows the financial soundness of the enterprise as well as how its operations can create additional cash for further development of the enterprise in the market. With it the enterprise can expand into new markets or leave markets

that it has losses. The metric is actually the net cash available after deducting the investments and working capital increases from the enterprise's operating cash flow.

The ERP system unifies the financial departments from the different locations the enterprise may be operating. This common pool data is easier to retrieve data such as the free cash flow of the entire enterprise or a single department in a single location. The Board has a clear view of the entire cash flow the enterprise may have and might proceed to making short-term decisions, such as initiating dividend, or making more strategic ones. In those strategic decisions, an enterprise utilizes this very serious metric when they are about to make substantial capital expenditures, such as buying out another company or a part of it, open new factories or expand their operations in new locations.

Usually such strategic decisions affect the entire enterprise or even corporation, and that is why the ERP system offers a great aid in that domain. The ERP system has an inherent ability to search and retrieve results as wide or narrow and as general or deep as the user specifies it. So it is this inherent capability that enables the Board to make fitting decisions in any scope of the enterprise. The previous example of IBM selling it PC division to Lenovo is a perfect example of a wide and general approach that they used their ERP system to make that strategic decision. Another example that shows the perfect combination of the ERP's system inherent capability to find the free cash flow and enable a company to acquire another is that of Apple's acquisition in April 27, 2010 of the Siri company, the virtual voice assistant that every iPhone has since version 4S and onwards. Apple's free cash flow had reached the amount of $4.206 Billion at that point which led to a possibly great acquisition, one that even till this day Apple takes pride in.

## 2. ECONOMIC VALUE-ADDED

This metric is an evaluation of each department on how much they are really adding to the enterprise, what is their real contribution to the overall company as well as the value of the final product or the service provided. With it the Directors can reach to conclusions about how productive an employee, a department in a single location, or a

department as a whole in the enterprise is. This way they can make accurate decisions to expand businesses that increase the enterprise's economic value while keeping an eye on those that are slowing degrading and prevent them from destroying its added value even further. It is actually calculated as net income minus the operating capital cost.

In this metric we can understand the ERP's ability to go not general and enterprise wide as with the free cash flow, but deep and narrow/specific. The ERP system holds every single data from every (narrow/specific) location, and it holds so much information, that it can reach the depth (deep) of each and every single employee's performance. Although one can argue whether this depth and specification really is all about strategic decisions, it can lead to strategic moves as well. For example, this metric is utilized when enterprises set economic value-added goals in a time frame of 5-10 years, so as to effectively assess their departments' value contributions and improve the resource allocation process.

The ERP system can report on performance indicators that imply economic value added on a number of occasions. It is clear that how an enterprise defines that performance indicator is up to the team that evaluates departments and people. However ERP systems offer that possibility and even alert the respective teams' leaders when their goals have not been reached. Those thresholds can be monitored at specific time intervals in an unobtrusive manner. The leaders can see if they have reached, for example, their daily, monthly or yearly quota.

## 3. ASSET MANAGEMENT

This is a metric that values the efficient management of the assets that the company is holding at the time of the report as well as the liabilities it might present in the foreseeable future that are making the company ready to turnover strategically. It is also a metric that shows the enhanced management of its working capital and cash conversion cycle. What the ERP system can do in a matter of minutes is to gather important information as to the cash (i.e. free cash flow mentioned earlier), the receivables that the company will demand from others in the future, whether near or

distant, the inventory that it keeps that could lead into profit once they sell and the fixed equipment or even buildings that in case of liquidity could turn into cash. It can also determine the liabilities that the enterprise has in general or a specific department. Those liabilities could include the payables that the enterprise is bound to give to its affiliates and suppliers and the accruals of its staff for working in the enterprise.

This is probably the most important metric that a company has in order to decide its current performance and whether or not it fails to compete with other companies in the same market. With proper benchmarks it can distinguish its position in the field and make the necessary actions in order to keep the same course in its route to success or acknowledge that it has deviated from it. Asset management is definitely a strategic metric as it requires both time and a great deal of money to acquire new assets and especially fixed equipment and buildings are the most expensive and time-demanding decisions an enterprise has to make. Using the PESTLE (Political, Economic, Social, Technical, Legal and Ethical) model the enterprise can understand the external environment it surrounds it. An efficient asset management can then lead the enterprise to profits even if the circumstances in the external environment are dire.

The ERP systems can hold that kind of information in a specific database for each business unit the enterprise might have, or none at all. Some assets are easy to find such as receivables, payables and mostly the current price of the buildings of the enterprise, while others such as the accurate estimation of equipment inventory (the problem here would be the degree of integration in a production line) can be a starting point for a systematic and creative accounting fraud.

## 4. CAPITAL STRUCTURE

This metric is crucial for the enterprises to understand their financial health and therefore can make sound decisions on how to operate in the long run. Capital structure is the way that an enterprise has decided to operate by defining the ratio of the money needed from investors or banks to that it currently is willing to invest itself

from its cash flows to specific endeavor, e.g. an acquisition, an expansion or even a sellout.

Let's say that an enterprise has a clear mission to thrive in the market all by itself, that it views itself as a clear leader and that it understands consumers' taste. Let's just also assume that it has a clear advantage in that area and that it has also a lot of cash. First of all, the ERP system can tell its Board of Directors how much money it possesses, whether in liquid form or in assets. Then the Board of Directors can decide the level of leverage they want in their operations from investors or how much they want to capitalize the next product "success". By defining the leverage that the company has, it can cash in much more money than by splitting the profits. However, by lowering the leverage it also increases the risk that the next endeavor could be a huge loss that could bring the company's growth to a halt. Therefore, defining the optimal capital structure is crucial for a company and its growth.

The above scenario illustrates that the optimal capital structure can lead to a more precise evaluation of the enterprise ability to borrow money, in the short and in the long run, and most importantly the risk of a possible financial distress. Enterprises usually use the information from their capital structure and then benchmark it to that of the other enterprises in the market, so as to see if their cost of capital is over their adversaries'.

Capital structure is also known as financing decisions, because the enterprise must find the equilibrium to the resources of its financing of new or same old operations.

## 5. PROFITABILITY RATIOS

It is often told that enterprises' goal and true aim is to make profit. In fact, the profit maximization is what has been keeping the West and the capitalistic world turning round. Profit is accomplished by meeting the people's and other companies' (and eventually people) needs. Profit is the reason that it enables an enterprise to Research and Develop, to try and shape its profile in the market and then to assure its place in the future market as it will have the necessary money to invest.

Profitability ratios are the way to measure the efficiency in the enterprise's operations, how well it uses its resources. The more efficient the company, the greater is its profitability. They are also a way to estimate and determine an enterpise's

> "ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time. For most of these ratios, having a higher value relative to a competitor's ratio or the same ratio from a previous period is indicative that the company is doing well."[13]

In fact, profitability ratios are not a single metric, but a series of metrics that show the profits in a department. Some of them are the profit margin, the return on assets, return on equity as well as return on investment. All these metrics are usually used in combination with past data, and perhaps the same metrics are observed through a timeline so as to define trends. From those trends the enterprise can deduct its fiscal health and of course identify any sort of deviation from its mission statement and its goals.

As with everything mentioned before, profitability ratios can be deducted for specific departments as well as for the entire company in a specific timeframe. The ERP systems hold systematic data about the departments and it is very easy to schedule hourly, daily, monthly or yearly reports based on those data. Since, those data require a lot of time to be defined, there are various techniques so as to save while creating the reports. Usually, those reports are prepared during the night time for each location, where there is little to no fiscal activity. In addition, if a metric has been calculated the previous timeframe, there is no need to recalculate it. ERP systems can hold data on the data. For example, they can save these reports in a separate database, so as to retrieve information much faster, without requiring minutes or hours for the calculations. ERP systems can hold these data and additionally can hold metadata on the data.

It is clear that these data are most important for Directors to make decisions based on solid and valid information. Those metrics, when read by the appropriate candidate, can reveal several strengths of the company as well as notify it for its fiscal

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[13] http://www.investopedia.com/terms/p/profitabilityratios.asp#axzz24MPUXETZ

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weaknesses. Usually, the Directors use those tools to make short-term decisions and not so much strategic ones. However, there are companies that are global and wile knowing their strengths and weaknesses and having evaluated possible threats and opportunities, use those profitability ratios as tools to adjust their strategies, reevaluate them or even form strategies.

As with capital structure, profitability ratios can be used to determine an enterprise's standing point in the market. It has been proven to be very useful to be able to compare an enterprise's profitability against that of its major adversaries in the market segment that it is operating. Such a comparison reveals whether the enterprise is operating more or less efficiently than its competitors. In addition, the identification of trends in an enterprise's profitability ratios over time discloses whether its performance is improving, declining or remains stagnant.

Below, there are shown some profit ratios that the enterprises use on a daily or monthly basis that their ERP systems can calculate fast and accurately and also help in finding weak spots in the enterprise.

## 1. GROSS PROFIT MARGIN

The gross profit margin is calculated as the percentage of sales available to cover general and administrative expenses and other operating costs.

$$Gross\ Profit\ Margin = \frac{Sales\ Revenue\ -\ Cost\ of\ Goods\ Sold}{Sales\ Revenue}$$

## 2. NET PROFIT MARGIN

Net profit margin is calculated as the percentage of profit earned on sales. As mentioned earlier, this is an important ratio as it is crucial for enterprises to be able to make net profit so as to make sure that they will be able to operate in the long run.

$$Net\ Profit\ Margin = \frac{Net\ Income}{Sales\ Revenue}$$

### 3. RETURN ON ASSETS

This ratio measures the profit earned on the employment of assets. Net income is the profit after preferred dividends (those set by contract) have been paid. Total assets include both current and non-current assets.

$$Return\ on\ Total\ Assets = \frac{Net\ Income\ available\ to\ Common\ Stockholders}{Total\ Assets}$$

### 4. RETURN ON STOCKHOLDERS' EQUITY

This ratio measures the percentage of profit earned on common stockholders' investment in the company. In theory, a company attempting to maximize the wealth of its stockholders should be trying to maximize this ratio.

$$Return\ on\ Stockholders'Equity$$
$$= \frac{Net\ Income\ available\ to\ Common\ Stockholders}{Total\ AssetsStockholders'Equity}$$

## 6. MORE FINANCIAL STRATEGIC METRICS

ERP systems make fiscal decisions easier to be made through various other tools and metrics that enterprises deploy and measure the data that they collect. Below one can find some of them that are used occasionally and depend on whether the enterprise really wants them or not.

### GROWTH INDICES

With growth indices the Director of an enterprise can determine both the market share growth and its own enterprise's growth. Presumably he/she will have defined an acceptable growth rate and will have set bounds to what his expenditures (cash flows etc.) can be for the aforementioned growth. He/She must have calculated the necessary return on investment and decided it is acceptable. Strategic decisions for

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reaching goals of growth are usually a reason for the extensive use of the aforementioned metrics.
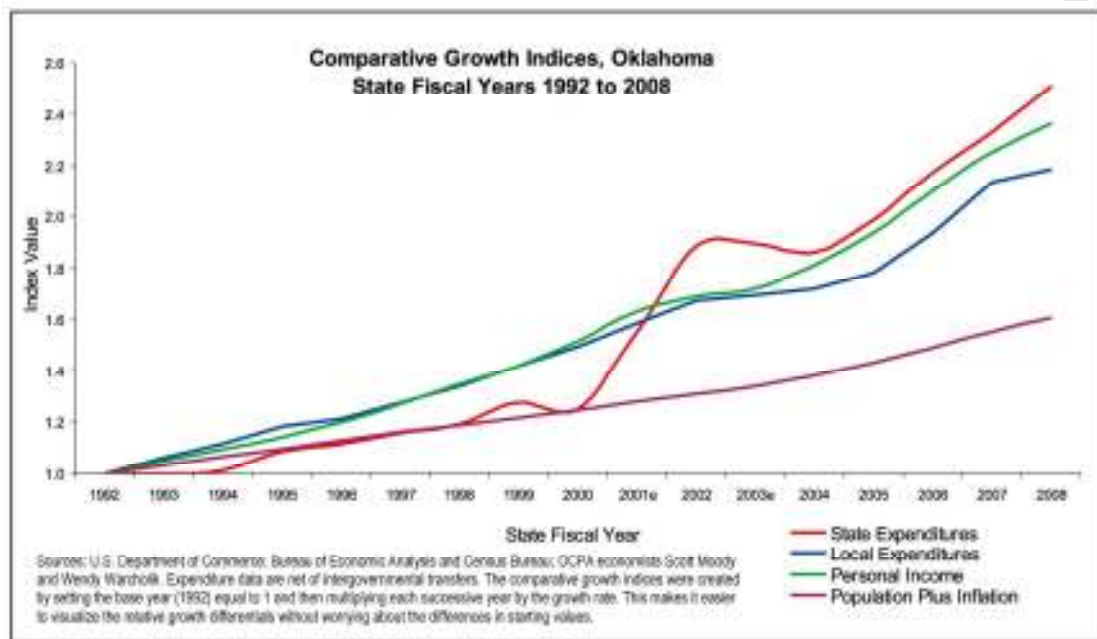


**Figure 7 An example of a growth graph**

## RISK ASSESSMENT AND MANAGEMENT

Although ERP systems are not entirely helpful in this area, they can provide information for existing and already found and monitored weaknesses and spot certain risks regarding corporate governance and regulatory compliance, their possibility to occur and perhaps even the economic impact that their occurrence might have in the enterprise. The irony lies in the fact that deploying an ERP is a huge risk an enterprise might undertake.

## TAX OPTIMIZATION

One thing not often mentioned is that the ERPs help global enterprises to mitigate risks and optimize their taxes by taking advantage of the various laws around the globe. To make it more clear, multisite enterprises that operate in different countries or counties can take advantage of tax irregularities that exist in each country. Therefore, various acquisitions can be more lucrative if the corporation decides for

one of its subsidiaries to take it over; whether that subsidiary operates in the same region or in Cayman Islands…

The most important thing for that to work is to have an up-to-date ERP system, relying on data that the law department will keep up-to-date. This is one of the few times that the ERP touches a field that is mainly secondary; that of the legal department.

## LOGISTICS

As mentioned from F.Wanke and W.Zinn,

"Logistics managers are involved in three strategic level decisions:

> (1)    Make to order vs make to stock.
> (2)    Push vs pull inventory deployment logic.
> (3)    Inventory centralization vs decentralization" (Wanke, Zinn, 2004)[14]

In addition to that, logistics managers must take into consideration different factors when forming a logistics strategy. For example, a logistics manager must review periodically (usually every 5 years) if the transportation strategies help service levels. He/She must acknowledge the fact that its enterprise might be too big to have an internal department specifically for the logistics. It is more difficult to keep up to the current transactional speed and especially if an enterprise is constantly growing. To that point there could be the thought of outsourcing the logistics function to a separate company that has more knowledge and specializes in it. Another thought would be

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[14] Wanke, Peter F. and Zinn, Walter. (2004), Strategic Logistics Decision Making, International. Journal of Physical Distribution & Logistics Management 34.6 http://www.forumlogistica.net/site/new/wanke.pdf

about the integrity of the data. Logistics managers want their <u>data</u> to be as precise and as <u>accurate</u> as possible. Finally, logistics managers must always think if their goals and strategies are <u>aligned</u> to that of the entire enterprise.

So where exactly do the ERP systems fit it in making strategic decisions in logistics?

ERP systems have the inherent ability to store everything they are told to. ERP systems can find the optimal level of performance in the distribution ecosystem, so as to provide equilibrium between quality and cost management so as to meet customers' desires and needs. They can run special algorithms and report on distribution resource planning, warehousing, inventory planning and control, value added services, distribution via dedicated & shared networks, track and trace and freight management, to name just a few functions that the logistics department has to pull through.

## KEY PERFORMANCE INDICATORS

As an ERP system integrates all the functions in an enterprise, it stores information of past KPIs (key performance indicators) while running forecasting algorithms. Those key performance indicators are watched automatically by ERP systems and reports come out for out of bounds behaviors. Some of the key performance indicators could be the following[15]:

a. Customer order-to-delivery time (days)
b. Supplier delivery dock-to-stock cycle time (hours)
c. Customer order pick-to-ship cycle time (hours)
d. Order fill rate
e. Total logistics costs as a percentage of sales

ERP systems can monitor those indicators and provide day-to-day reports on how the company is on track to success in strategic decisions and goals. Strategically they can assure for the highly discussed 95% satisfaction level of the customer.

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[15] http://www.ahfa.us/uploads/documents/Performance.pdf

## CHARTS

Perhaps the most important attribute an ERP system can offer to the logistics team is that of charts. ERP systems systems push the entire enterprise to share the same code for each supplier, the same code for products they stock, they process, they handle. This integration, although it might bring headache at first, it then proves to be a crucial factor to find which of the once separate entities, are in fact the one and same.

Let's think that a supplier of the enterprise has an economic activity in the Balkans and let's also suppose that an enterprise has business units in different locations in the Balkans, none of which has an integrated system such as an ERP. You may realize that the supplier can bargain different prices for those different business units. Look at it in reverse. The business units cannot achieve a good bargain price, if they are not together. There is a possibility that, while it may be a strategic partner for one country, it may be just a minor supplier in another one. In addition to those, bad relationships from one business unit may have implications to the neighboring units. If an enterprise has an ERP system, it can bring out the importance of one supplier in a geographic area, it can accumulate their business units' needs to bargain for better prices or even handle deeper integration with him/her.

This is of most importance for the logistics team. Charts are not only used for suppliers. ERP systems can gather information on products as well. Imagine that a product performs well in a certain country while in its neighbor country it may be stocking. These charts and that information can be used so as to deliver products quicker to the country in higher need while taking advantage of the fact the stock will not go bad (i.e. food).

Strategic decisions can result from that. If the ERP system finds that are frequent to a neighbor country and that labor costs are the same, perhaps it will transfer the production line so as to save in distribution costs. On the contrary, an ERP system can report on labor costs combined with distribution costs and demand. That way, logistics managers can make substantial decisions on the shape of the enterprise in the years to come.

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## SALES & MARKETING

Perhaps one of the most important uses of ERP systems is to take their advantage of interconnectivity and calculate in an instant, costs and revenue and foresee sales volumes based on a demand and supply model. Planning and creating an effective sales strategy is a tedious task, one that can take days or even months. The enterprise must decide in which market segment a product best fits, and then promote it accordingly.

ERP systems are keen on providing information based on those inquiries. There are numerous examples in literature of enterprises having problems with order acquisitions, operations as well as distribution and accounting systems. Enterprises that do not have ERP systems usually face issues that demand time to resolve. Such issues could be the inaccuracy of supplied information to the sales team, increasing lead times that are reducing the customers' satisfaction level, incostistency in credit systems therefore leading to collection issues, problems with service and last but not least quality control issues.

## PROCESSES AND APPLICATIONS

To better understand sales and marketing, it is necessary to define the sales and marketing processes. At the operational level, there are simple daily activities such as telemarketing, direct mail and prospecting, while there are also contact management processes such as keeping databases and lists up-to-date. At the support level, there exist several processes in the sales order processing system as well as Point Of Sales systems.

ERP systems allow the Sales team to make strategic decisions much faster and as accurately as possible. ERP systems are designed to allocate resources to achieve

maximum revenues. These decisions can occur in a timeframe of 1 month to a timeframe of 4-5 years if there are ways to make strategic alliances with point of sales that can offer certain discounts.

A definite example is what Apple® did when it launched the iPhone. This cooperation lasted almost 4 years before Apple finally deciding to create two versions of its iPhone, one for AT&T and one for Verizon. Although some might argue that this is as a strategic move, for the business of electronics it is eons. This strategy was beneficiary to both AT&T and Apple in the US. Apple strategically cooperated with AT&T and achieved high market penetration, had a clear way to distribute its phone trough the distribution network of AT&T and achieved subsidized prices. AT&T on the other hand was the only representative for the US market, having high gains for those years simply by selling the iPhone and accepting new consumers in its network. It is known that every year approximately, AT&T found itself with new 2.5 million new users due to its iPhone exclusivity, the deal represented at least $700 million a year in operating profits — profits that AT&T started losing once Verizon sold the iPhone too.[16]

ERP systems can provide information on analysis of revenues against market benchmarks, information that can lead to decisions to improve or discard certain buyers or abolish certain marketing strategies. What the ERP systems can also do, is to find and list the most and least profitable products or services an enterprise might be offering, while sorting them out by territory and salesperson. ERP systems allow for quicker analysis, are able to identify trends in sales activity, can analyze salesperson performance, identify strong and weak products and can signal potential shortfalls or excesses in stock levels.

ERP systems are able to maintain a strategy in the sales department as they allow information in forecasting trends and determine customers' needs in different market segments. ERP systems can detect such shifts based on the company's sales history, customer demands (this is perhaps where the CRM module could come handy), demographic trends and, if possible, based on competitor information.

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[16] http://bits.blogs.nytimes.com/2009/04/22/why-att-wants-to-keep-the-iphone-away-from-verizon/

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This is crucial to form strategies for the next 5-10 years. As consumers shift from one behavior to another, an ERP system must be able to spot those differences and the enterprise must shift to that direction as well. For example, there might a shift from Personal Computers and especially laptops to smartphones or even tablets. Microsoft had tried in the past to create such products but people did not want them. However, since 2010, people have started rethinking of tablet PCs (probably due to the great ecosystem Apple had created with iTunes and apps from iPhone) Microsoft reexamined its basic software product, that of Microsoft® Windows™, and in a few months' time it will be delivering its newest Operating system to support both PCs as well as tablets! This strategic move has finally come to fruition and it remains to be seen whether Windows 8™ will be a success or an experiment like Windows Vista™ that was a huge drain of resources and a massive fiscal disappointment.

Marketing in an enterprise can use the ERP systems to enhance their advertising and decide about product pricing based on pricing models. As ERP systems have data on different products a company might produce, a new product might be close to a previous product and therefore ERP system can provide information on those products and the sales team can make decisions for the pricing. ERP systems can also draw information Consumer price index (CPI), the expected consumer disposable income, the production volumes, costs of raw materials and labor costs to decide even further on pricing.

It has been already mentioned that ERP systems are different from legacy systems. They allow the elaborate integration of marketing support systems and ERPII systems provide integrated Customer Relationship Management and as such can help in making decisions. The purpose of those modules is multiple:

1. Identify sales prospects. A company could invest a lot of money and time into sales prospects and could form a new strategic move. Therefore it is very crucial to have tools that can aid into examining and evaluating whether it is possible and even profitable to embark into something new.
2. Process orders.
3. Manage inventory. A company can decide to cut back from warehousing expenditures and costs, or even create new sites for extended inventory if it seems that it will earn more cash.

4. Arrange deliveries.
5. Handle billing.
6. Process payments.

The benefits arising from having ERP modules in the sales and marketing modules are the ones that have been mentioned as a result of deploying ERP systems in multisite enterprises. First of all, the Sales team has standard codes and documents, therefore enabling it to share common best practices on different aspects of daily operations. In addition, they share a common database and have access to common data. Finally, these modules provide a standard way to make audits easier (audit trails") and allow data integration and data migration in case the enterprise decides to move to more efficient databases and structural changes in the ERP system.

Below, we can see the Sales and Marketing module as well as related modules and what they do exactly in an ERP system.

**TABLE 4-3** The Sales and Marketing Module and Related Modules

| Subsystem | What It Does |
|---|---|
| Pre-sales | Tracks customer contacts; provides the customer with a price quote |
| Sales order processing | Uses the price quote to record items to be purchased; determines the sales price; records order quantities; configures quantity discounts; checks customer credit |
| Inventory sourcing | Checks the inventory database to see if items can be delivered on time; updates the production planning database to avoid any shortfalls |
| Delivery | Releases documents to the warehouse: items are picked; orders are packed and shipped |
| Billing* | Uses sales order data to create an invoice; updates accounting records: increases (debits) accounts receivable |
| Payment* | Accepts payment; decreases the customer's accounts receivable balance with the amount of payment |

*Handled by the Accounting module.

**Table 2 Mary Summer, Enterprise Resource Planning, 1st Edition, Prentice Hall, 2005**

## CRM

ERPII systems have incorporated CRM modules that help the Sales and Marketing department to make decisions regarding their customers' behaviors. CRM systems and their incorporation in the ERPII systems are designed so they can present a great front-end interface to both the customer and to the employees of the company that handles the customers. They provide to the enterprise a set of tools that is both easy to understand the customers and provide information on their buying behavior.

CRM is actually developed from sales force automation software. Nowadays, CRM software heavily relies in the Sales and Marketing ER module for operational-level data. From there, a company can see market opportunities or segments in the market that it has yet to fill with products. For example, let's say that a telecommunications enterprise has different products for different ages. CRM module can report on penetration shortages in specific age groups. Therefore, the sales department can initiate programs to find the reasons the specific age group does not prefer its network and adjust newer programs specially designed to attract them.

Another example would be to find from the CRM program the reasons that their customers might be leaving the network. CRM software can analyze data and patterns and find when a person is about to switch network and proceed to make special offers so as to keep him interested. The possibilities are quite a few. The enterprise can sustain its clientele and find ways to make it even larger, thus augmenting its market share. CRM software provides the Managers with sales activity, correlation between sales and territory management, databases of behavioral trends, provides product-specific configuration support and knowledge and information in resource management.

What is more important is that with that information, managers are able to generate information and discover new things about their marketing strategies and operations.

## COMPETITIVE ADVANTAGE – AN EXAMPLE

The sales and marketing module in ERP systems is usually the main tool that an enterprise has so as to create and maintain a competitive advantage. There is a perfect example of how Amazon.com has created and maintained over the years its own competitive advantage. Amazon.com is an American multinational electronic commerce company with headquarters in Seattle, Washington, United States. It is the world's largest online retailer. The company also produces consumer electronics— notably the Amazon.com Kindle e-book reader and the Kindle Fire Tablet computer —and is a major provider of cloud computing services. The company has retail websites for various countries while shipping to other countries as well some of its products.

Amazon.com has seen through its ERP system that its customers require a full range of services. They want their service to be consistent and their experience to be as seamless as possible. This is greatly achieved by its e-business website. The company provides live information for every customer the procedure of his/her purchase order. The enterprise has an e-commerce expertise and knows how to organize its products and show them on the webpage so as to provide to the customer an easy and pleasant stay to Amazon.com's website.

In addition to being able to watch the status of his/her order, Amazon.com provides him/her with personal propositions through e-mail every now and then, while offering the possibility to let their friends know of various offers. This is greatly achieved by Amazon.com being one of the best data mining companies. Amazon.com can keep in its CRM what the customer might be looking, how long he/she has stayed in the website and for what products, as well as keep a record of his/her wish list. All that information enables Amazon.com to create a clear view on each and every single one of its customers and try to serve them one by one, individually. Amazon.com has therefore a gigantic pool of data in its servers that can analyze and find yearly trends, correlate age groups with specific products, even analyze whether its clientele would be happy if Amazon.com itself would design and produce a product, i.e. Kindle Fire.

Another example of Amazon.com can do with its large database of customers is to see where the majority of people in certain geographic area buy stuff from Amazon.com and what kind of stuff they buy. With that in mind, it can create distribution centers in strategic places so as to lower the costs. That decision is of great importance as an enterprise cannot change easily its distribution centers, as it is a decision that requires both money and time.

All of the above and other services that complement the CRM module such as 1-click ordering and a-z guarantee program, have established Amazon.com as an enterprise that values customer service and combines it with an easy to use web site. Those attributes, based mainly in its CRM software, are what have made Amazon.com to be the top company for the last consecutive years in its field (Internet Retail companies) maintaining an amazing American Customer Satisfaction Index of 86/100. The distinctive advantage is still protected by patents covering 1-click ordering by that is out of the scope of this section.

# Scores By Company

Amazon

| | Base-line | 95 | 96 | 97 | 98 | 99 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | Previous Year % Change | First Year % Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Amazon | | | | | | | 84 | 84 | 88 | 88 | 84 | 87 | 87 | 88 | 86 | 86 | 87 | # | | -1.1 | 2.4 |
| Newegg | | | | | | | NM | NM | NM | NM | NM | NM | NM | 87 | 88 | 86 | 84 | 85 | | 1.2 | -2.3 |
| Overstock | | | | | | | NM | NM | NM | NM | NM | NM | NM | 80 | 82 | 82 | 83 | 83 | | 0.0 | 3.8 |
| Internet Retail | | | | | | | 78 | 77 | 83 | 84 | 80 | 81 | 83 | 83 | 82 | 83 | 80 | 81 | | 1.3 | 3.8 |
| eBay | | | | | | | 80 | 82 | 82 | 84 | 80 | 81 | 80 | 81 | 78 | 79 | 81 | 81 | | 0.0 | 1.3 |
| All Others | | | | | | | 77 | 75 | 82 | 83 | 79 | 80 | 82 | 82 | 82 | 83 | 79 | 80 | | 2.6 | 3.0 |
| Netflix | | | | | | | NM | NM | NM | NM | NM | NM | NM | 84 | 85 | 87 | 88 | 74 | | -14.0 | -11.9 |
| Buy.com | | | | | | | 78 | 78 | 80 | 80 | 80 | 80 | 81 | NM | NM | NM | NM | NM | | NA | NA |
| barnesandnoble.com | | | | | | | 77 | 82 | 87 | 86 | 87 | 87 | 88 | NM | NM | NM | NM | NM | | NA | NA |
| 1-800-FLOWERS.COM | | | | | | | 69 | 76 | 79 | 75 | 79 | 77 | 77 | NM | NM | NM | NM | NM | | NA | NA |
| uBid.com | | | | | | | 67 | 69 | 70 | 73 | 73 | 73 | 74 | NM | NM | NM | NM | NM | | NA | NA |
| Egghead.com | | | | | | | 73 | † | | | | | | | | | | | | NA | NA |

Score tables print best in landscape.

Legend
NA  Not available
#  Company merger
†  Company defunct
NM  Not measured
^  Industry aggregated

**Figure 8 ACSI score for Amazon.com in the past years**[17]

In general, CRM solutions offer a great way to maintain a competitive advantage while ensuring consumers and customers' satisfaction levels to a high degree. The implementation of the CRM software will be one of the deciding factors that can make a company great in the general public's mind.

To sum it up, the Sales and Marketing module takes advantage of the large database or mine of data that is the ERP and as that information is stored in a database, simple queries can provide instantly the best-case scenario for a single market segment, so as to provide special discounts, pricing, rebates, tax cuts. The best part is that it can hold information and calculate all of the above for various segments, materials, customers, sales channels, as well as for a group's entire set of products and services, therefore providing complex discounts that change dynamically according to the offering's profitability.

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http://www.theacsi.org/index.php?option=com_content&view=article&id=149&catid=&Itemid=214&c=Amazon.com

Most ERP systems have incorporated a Human Resources module. This module enables the Human Resources department crew to find, maintain and update information on the staff of the enterprise. The info that is usually maintained by the ERP system is usually diverse.

First the ERP has demographic information such as the employee's full name and address, birth date, age, gender and ethnicity. That way, enterprises can keep up with statutory regulations regarding discrimination accusations based on gender and ethnicity. Next, ERP systems have an emergency contact information field as well as their name, their relation to the employee and their age so that if something bad happens, the company can notify the right people. This is also maintained so that certain benefits can be accomplished. Proof of that is that if a Google employee dies, the beloved one and their children get to get paid 50% of the salary for the next 10 years, while aiding the children with a 1000$ paycheck per month until they reach the age of 19 (or 23 if they are full-time students) (Casserly, 2012))[18].

The more important part comes in a next field. It is that of the employee's current position, department and supervisor as well as his/her studies and progress in the company. Apart from the reasons to train a possible employee into a new technology, this info can be accumulated to compare employee's department turnover. This a important to evaluate whether a manager is right for a department as sometimes employees are afraid to tell the right about a manager so as to keep their job. Salary and pay grade are also an important part of the Human resources module. This info can be provided as historical information where one could see the progression an employee has made for the past years as well as who is its highest performer.

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[18] Meghan Casserly, "Here's What Happens To Google Employees When They Die", FORBESWOMAN (blog), Forbes, 8/08/2012, http://www.forbes.com/sites/meghancasserly/2012/08/08/heres-what-happens-to-google-employees-when-they-die/

Training is also a big part of the ERP's HR module as this way the enterprise can invest on a group of its employees to learn new technologies and be more skillful. These skills, while costing money, have the great feature that the enterprise can expect a larger increase in its productivity and are more valuable to the employer. Payroll is also maintained by this module so as to make sure who gets paid, for how many hours and what for.

Another big feature of the HR's module is that it keeps track of the benefits of the administration area. The benefits information is used to determine the exact benefits an employee is eligible for a specific year as well as the ones he had the previous ones. While this information may not be seem important foro the enterprise itself, it is often necessary or even obligatory to pass these to insurance carriers and benefit providers. As this field is crucial, e.g. the US law demands for the enterprise to provide the staff it lays off with a COBRA letter that gives the employee the option to stay on his/her current benefits program for a specific period of time.

Last but not least, recruiting is also one the main jobs that an enterprise must be sure it is made right. It is very important for an enterprise to choose the right candidates for the openings. The economy today is not going well, and therefore everybody wants to just have a job. Once an opening is posted, the employer is swamped with hundreds applicants' CVs, people from carious backgrounds and usually unsuitable for the opening. The HR module is able to clear up and do the hard work of rejecting most of the unsuitable people.  It can also manage interviews with those who seem most qualified, as well as get feedback from  the  employees who recruit them (White L., 2011)[19].

Human resource management is an essential of the success for any enterprise in the world. ERP systems facilitate the department's processes by making it easier to organize data and access it with ease. HR modules are divided by certain submodules:

1. **Personnel management**
2. **Organizational management**

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[19] Lynda K White, "An Introduction to the ERP Human Resources Module",  Software Shortlist.com, August 30, 2011, http://www.softwareshortlist.com/erp/articles/erp-applications/an-introduction-to-the-erp-human-resources-module/, accessed July 2012.

3. **Payroll Accounting**
4. **Time management**
5. **Personnel development**

## PERSONNEL MANAGEMENT

Personnel management is the part of the HR department and includes systems (whether in ERP systems or as stand-alone systems) that contain Human Resources' master data and enable personnel administration while providing info about them, help in the recruitment process, the travel management and handle things such as benefits and salary.

### I.     PERSONNEL ADMINISTARTION

As ERP modules handle all the information in an enterprise and not by specific department, different department in an enterprise can have access to that information at the same time. This brings down the hassle of maintaining two or multiple identical entries (known as duplicates), reducing the possibility of mistakes down to a minimum because each field is always up-to-date as it is updated to all subsystems at once.

### II.     EMPLOYEE MASTER DATA

This unique database that everyone draws information from can hold all the information about an employee and save time by providing the required set of tools so as to be tailored to the enterprises' needs. That means that the HR module can be configured to hold any set of data, combining fields, fields with both numbers and letters, with special characters, fields that are required and therefore cannot be null, blobs, scanned images or documents for storage, binary large objects. In addition, HR

information stores and analyzes that info to provide reports on employee data and enterprises' charts.

### III.  RECRUITMENT MANAGEMENT

This submodule aids the HR department in hiring people. It is crucial for an enterprise to be composed of the right person for a job. Reducing the cost of recruiting and hiring new employees is a challenge for the HR department, who is responsible for matching not only the right people in the right job but, at the same time, at the right time, and with the right skills and education. These functions are completed successfully only through effective automation of the entire recruitment process. The recruitment component is designed to help meet every facet of this challenge like managing open positions/requisitions, applicant screening, selection and hiring, correspondence, reporting and cost analysis.

Strategically this is most important submodule of HR module. The enterprise invests both a lot of money to recruit a person and valuable time to train him/her. The most conservative estimates of turnover show costs in the range of 2 to 3 times annual salary. Brad Smart, author of "Topgrading - How Leading Companies win by Hiring, Coaching and Keeping the best People", suggests the multiplier is more like 27 times annual salary if the mistake involves an "A" player. By that estimation, an $80,000 miss-hire could cost the enterprise 2 millions! (Smart, 1999) [20] A company can create a lot of value if its employees are happy and can create a big difference in its market position in the long run, if its employees are engaged to it.

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[20] Smart, Bradford D. Ph.D. Topgrading. Paramus: Prentice Hall Press, 1999.

## IV.    TRAVEL MANAGEMENT

This submodule aids the HR department in processing the travel expenses plus taxes in a clean and easy way in several currencies. HR Travel management allows the department to plan and calculate a business trip from endpoint to endpoint - from the initial travel request to posting in financial accounting and controlling. The submodule has taken into account any subsequent corrections and all retroactive accounting requirements, credit card transactions and reimbursement.

## V.    SALARY ADMINISTRATION

This submodule helps in maintaining the salaries of the personnel, the dates that the enterprise has paid its staff as well as keeps records of salary changes. It is also very useful when bonuses are calculated.

## ORGANIZATIONAL MANAGEMENT

This submodule is not a strategy making module, but it can help visualize in a graphical way, how the enterprise's environment is changing, including moves, additions, changes in employee positions and generally all the organizational structural shifting.

## PAYROLL ACCOUNTING

Yet another non-strategy making module, however it is used primarily to keep track of the payroll activities that the enterprise might have. This is a global module, that

includes all the employees of the enterprise, from the intern to the CEO and from Australia to half around the world in Portugal.

## TIME MANAGEMENT

The HR module enables the enterprise, should it want, to make different patterns for consorting with regulatory requirements and determine overtime and shift planning. If a company makes a strategic acquisition, it can plan its staff excess or its deficit and take into account different aspects of leaves of absence (sick leaves, paid vacation etc.)

## PERSONNEL DEVELOPMENT

This is the most crucial part from a strategic point of view. It has been mentioned before that the HR module helps the HR department to ensure that the people the enterprise is, has been and will be hiring are the perfect match for the proposed openings. What has not been stressed enough is that the personnel development is a strategic function of the company, one that ensures its growth, longevity and sustainability in the constantly changing market.

By investing time in developing and training an employee, the enterprise invests in its prosperity and its long term wealth. It also ensures that its goals and those of the employee are aligned and matched. Of course this requires a clear vision and mission for the enterprise as well as strategic planning.

In the following paragraphs we show what the personnel development might strategically mean for the enterprise.

## I. TRAINING AND EVENT MANAGEMENT

A good HR system usually schedules seminars, training courses and business events according to the possible or future needs of the enterprise. There are numerous benefits in organizing training courses for the employees. First and foremost, employees acquire new skills, skills that the enterprise will require at some point, skills that it will enable the enterprise to aim higher in its performance, through its employees' increased performance. In addition to that, the working climate will improve as the employees will be well-educated on their job and therefore will be able to do their jobs without hassle or even friction between them. The employee morale will increase and this will trigger a series of events that will lead to even more increased performance. It is even possible that the staff quality will ameliorate, and that will result in becoming (the enterprise) a great working place attracting better people and more well-educated. It is possible, so as to increase morale, at the end of the training to have a certain certification goal or even a written congratulatory form.

This all requires vision and mission control. Of course before that it is crucial for the enterprise to check its internal state as well as the environment in which it operates. That way it can formulate better the needed training that its employees require. The ERP can help in defining whether its employees have the desired knowledge or they are in fact needed to learn more.

## II. SUCCESSION PLANNING

This is another crucial factor in an enterprise's success. For an enterprise to be able to cope with the market's volatility, the enterprise's HR department with the cooperation of the Managers must be sure of promoting capable persons to jobs that fit them best. This is greatly achieved by maintaining historic data on a person's track inside the enterprise, as well as keep updated his/her personal file. Therefore, when in need, the enterprise with the aid of the ERP system can decide on which person can fulfill the opening best.

Succession planning requires both time and money. It is important for a company to keep its edge and this is greatly accomplished by its people. Of course, its employees should not be stagnant in the job, but must evolve along with the enterprise. They

must be trained to follow market's trends and the enterprise must enable them to think even further through special events. Policies throughout the company can foster creativity and therefore ensure the enterprise's future.

To sum up, the term "human resources" is sometimes considered as the sum of people working in a company. When referring to human resources it is probably appropriate to imply the cost that it takes for a company to recruit and train employees as well as the cost that a company has to let them go. It is essential to understand that people are an essential resource to a company without which it is difficult to thrive. Great leaders as well as happy employees tend to increase a company's capital. ERP systems hold information on personnel, can handle the required training the personnel needs, foresee the demand in contracted personnel and store its living expenses and reimbursable travel. It differentiates personnel according to their level in the hierarchy of each company and each Business unit. It is able to centralize or decentralize the payroll function by Business Unit, state, country or by legal entity.

As it stores a person's qualifications it can match a company's current and future needs or program training so as to organize succession planning and enhance career planning; it can maximize time management to best and optimal level and run cost optimizations to certain projects that are run by staff.

## MANUFACTURING

Although this is not clearly a strategy decision making module but more of a mid-term decision making module at best, it is imperative to mention a few words. Since ERP systems watch closely the financial data, it is almost impossible to do that without a proper linking to manufacturing. Each ERP has a definitive way to encode manufacturing parts to its system, a clear registry of its products, its customers and

suppliers, as well as a way to calculate product lead times and availability so as to manage costs, materials and distribution.

With an ERP an enterprise can foresee demand based on past sales (e.g. if a product is seasonal) and schedule its production accordingly while ensuring storage facilities and costs. As everything runs real-time, a manager can see the results of what-if scenarios and make decisions on time based on the results that the ERP system will provide him.

As time goes by, ERP systems have been able to provide a clear way of bringing the costs down to a minimum while ensuring higher profits. However, in a highly volatile market, in order for the competitors to survive in a market segment, they had to implement ERP systems themselves so as to remain competitive. In a free market such as the one the West is currently in, enterprises lowered their costs, therefore enabling them to lower their prices for the customers. However, an enterprise can only do so much to reorganize its organizational structure and its processes. The ERP achieved that internal reorganizing, but it needed something more.

The fact that the customers demand lower costs, and that the competitors can offer it, now leads an enterprise to redesign its alliances with strategic partners. Companies now can profit (or lose money) from aligning their processes to those of their suppliers. This strategic alliance can use **weak** integrations using third party portals, **side-by-side** or **strong**.

## THIRD-PARTY PORTALS

The weakest of the three is that of using **third parties** to aggregate the necessary information and provide a whole product from start to end. Those third parties are marketplaces or portals where one can find the necessary information and configure to his/her liking the final product, made entirely by his choice. Those third parties can process his desire in an auction-style procedure, a fixed-price procedure or a bargain procedure. The customer is responsible to configure and form the final product from his choices that he has made in those marketplaces. Below it is shown the connection between ERP systems and their strategic cooperation while using third party solutions.
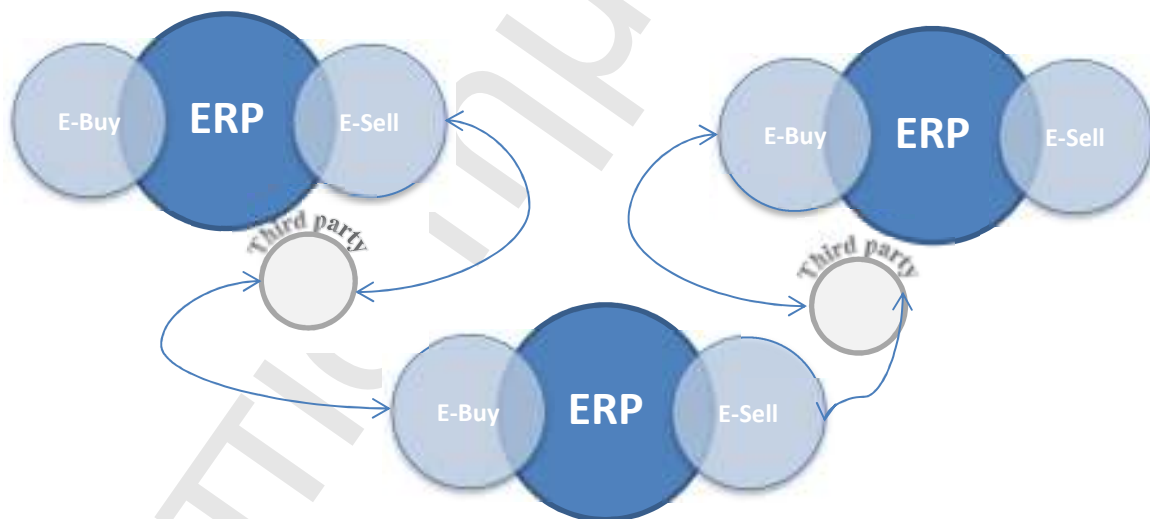
Extended value chain with Third-party Portals

The next model is that the web-interface of an ERP is connected directly to the web-interface of o supplier and that of its customer. This is a bit harder to implement, as it requires different middleware to transform the data that enters an ERP into data that it can understand and process, while ensuring that the data that it sends to its customer can be processed in a commonly agreed upon language and form. In this way, there have been formed different open standards that ensure the much-desired **interoperability**, such as that of the XML (extensible markup language) that can store data and provide an easy way for the systems to communicate and exchange data or even SOAP (originally defined as Simple Object Access Protocol), which is a protocol specification for exchanging structured information in the implementation of Web Services in computer networks, much like the XML as it relies on it.
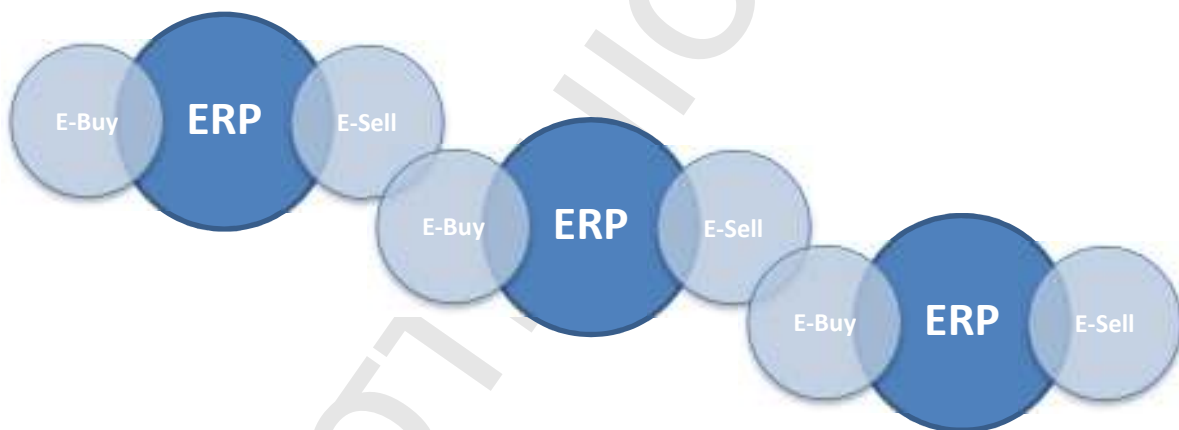


Extended value chain with Buy-Side Front End

connecting to Sell-side front End

## ERP-2-ERP CONNECTIONS

Last but not least is the model of strong or deep strategic alliance ERP integration. In this case each ERP is directly connected to another. This can be achieved either using

unique protocols (therefore increasing both security and -unfortunately- complexity) between two different ERPs, the same way as Electronic data interchange (EDI) does, or use open standards through the Internet.
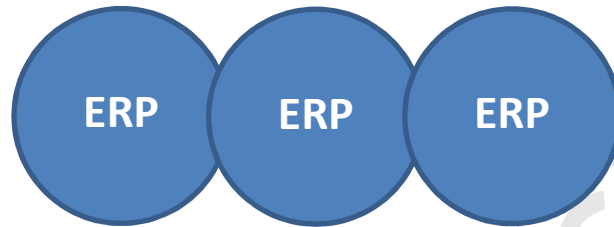


Extended value chain with ERP-2-ERP connections

The Web transforms the way enterprises do business as it enables them to form new strategic alliances based on transforming a value chain into an integrated value network. The enterprises can integrate with other enterprises that they had previously interacted, and form new strategies based on quality, delivery times, location, pricing and economies of scale. Perhaps it can decide on outsourcing part of its productions or perhaps it will be able to insource some its already outsourced functions.

In this thesis, I had the pleasure to talk to people from Nestlé and be able to discuss about their implementation of their ERP system. Their ERP system is a deployment of the commercially known SAP system and the headquarters of the enterprise are in Switzerland.

## A FEW WORDS ABOUT NESTLÉ

Nestlé is the world's leading nutrition, health and wellness company. "Good Food, Good Life" is one of their mottos so as to ensure quality every day, everywhere and to enhance lives, throughout life, with good food and beverages.

One of their policies is to lead well and it should lead through a good behavior. They want to be trusted and to be the best they recognize that trust is earned over a long period of time by consistently delivering on their promises. Nestlé "believes that it is only possible to create long-term sustainable value for their shareholders if their behavior, strategies and operations also create value for the communities where we operate, for our business partners and of course, for our consumers. [They] call this 'creating shared value'".

Nestlé can trace its origins back to 1866, when the first European condensed milk factory was opened in Cham, Switzerland, by the Anglo-Swiss Condensed Milk Company. One year later, Henri Nestlé, a trained pharmacist, launched one of the world's first prepared infant cereals 'Farine lactée' in Vevey, Switzerland.

The two companies merged in 1905 to become the Nestlé we know today, with headquarters still based in the Swiss town of Vevey. They employ around 330 000 people in over 150 countries and have 461 factories or operations in 83 countries. Nestlé sales for 2011 were almost CHF 83.7 bn (~70 bn €).

The Nestlé Corporate Business Principles are at the basis of the company's culture, developed over 140 years, which reflects the ideas of fairness, honesty and long-term thinking. The ten principles they hold are as follow:

1. Nutrition, Health and Wellness
2. Quality Assurance and product safety
3. Consumer communication
4. Human rights in business activities
5. Leadership and personal responsibility
6. Safety and health at work
7. Supplier and customer relations
8. Agricultural and rural development
9. Environmental Sustainability
10. Water

## NESTLÉ SAP IMPLEMENTATION

### HISTORY

First of all, in 2000 the headquarters in Switzerland decided to implement an ERP system for the entire enterprise; an enterprise that operates in different regions with multiple sites in each region, and every country having its own micro implementations of what would later be ERP modules. Those micro implementations of an ERP system where dispersed, diverse and differentiated but they had a common interface to communicate with one another. One of the first moves was to decide which ERP solution they would deploy; and they chose the commercial solution of SAP. In parallel, they examined how it would cooperate with preexisting software that was already functioning around the globe.

To this point, **it must be pointed that implementing a SAP solution is by itself a strategic move**. Each project in Nestlé could last from 9 months to 2-3 years, while the program itself lasted about 8 years. Therefore, it requires a great deal of money and time and once started it is very difficult to go back to the place the enterprise has started, unless it is abandoned in the very early stages. In Nestlé this program (and not just a project) was named GLOBE.

As pointed out by Alex Pattison, an employee of Price Waterhouse Coopers who helped in the intitative of the GLOBE program[21],

> "GLOBE is a business re-engineering program being carried out by Nestlé. Its primary goals are to implement a series of Business Excellence initiatives, re-align data standards and data management on a global level and to standardise working practices through the implementation of SAP. The implementation of mySAP.com includes Workplace, SAP R/3, BW, APO, CRM, EBP and Knowledge Warehouse. It is currently the largest SAP project and will result in the role out of mySAP.com to Nestlé's 150,000 employees.
>
> The project was split into four workstreams: Business Excellence, Data Standards/Data Management, Information Technology and Global Template".

According to Mr. José Lopez, Executive VP, Operations & GLOBE[22], by 2010, 91 Nestlé Markets/Businesses are operating with GLOBE processes, data and systems

- 96% sales coverage
- 169,000 users
- 806 Manufacturing Sites
- 1109 Distribution Centers
- 594 Sales Offices

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[21] http://www.alexpattison.net/work/projects/Nestléglobe.html

[22]

http://www.Nestlé.com/Common/NestléDocuments/Documents/Library/Presentations/Investors_Ev ents/Investor_seminar_2011/NIS2011-05-GLOBE-NCE-JLopez.pdf

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Nestlé uses the ERP system within its 4 walls and uses EDI to communicate with its retailers.

## REASONS TO IMPLEMENT THE ERP

First of all, the reason to implement the ERP system, Nestlé decided that it would **facilitate its functions** throughout commercial, financial, manufacturing, quality and distribution functions. It is also important that SAP exists in every corner of the planet and therefore can provide its services in multisite enterprises.

To implement the GLOBE program, Nestlé decided to gather about 2000 people from its sites and bring them together and discuss. In 2000 the design phase started and it lasted up to 2002. These transactional categories are as follow:

1) Technical & Production (T&P)
   a) Manufacturing
   b) Quality
   c) Asset & Maintenance
2) Finance & Control (FiCo)
   a) Accounting & Operations
   b) Business Intelligence
   c) Product Costing
3) Generating Demand Sales & Marketing
4) HR
5) Supply Chain
   a) Customer Service
   b) Materials Handling
   c) P2P (procure 2 pay – purchasing)
   d) Demand & Supply planning
   e) Direct Delivery

But why would Nestlé require from its Managers to have those categories? One of the benefits of implementing an ERP system was to adopt throughout the enterprise the **best practices** for each and every single transactional category. Since implementing an ERP system is like making a fresh start, why not do it right the first time? Structural changes are bound to happen while transitioning to an ERP system. Therefore, best practices can be pushed to every department.

Implementing the ERP system in the design phase, through its best practices, Nestlé wanted to achieve **business excellence**, to be the best in its field continuously in an ever changing and volatile environment. Nestlé wanted to be the one of the top providers in its area , along with P&G, Kraft, Coca-Cola, Unilever, Johnson and Johnson etc. Nestlé wanted to be the top enterprise and provide the best quality products, in the best prices while keeping its promises to the public. Being the best would enable Nestlé to hold a great market share globally, while ensuring its sustainability and be able to compete with the other enterprises.

Business coordination and strategy-policy making is decided in the FiCo department. Although it is thought to be just for financing, FiCo is today the department that is handling all the strategic moves of the enterprise. For that to take the appropriate decisions, the aforementioned categories facilitate in making those decisions easier while ensuring that the enterprise has enough room to breathe and operate functionally.

Best practices and business excellence were not the only reason that the enterprise wanted to implement the program. Direct Delivery department takes care of the multiple and difficult transactions in multiple sites. For example, Nestlé has every scenario possible imagined to supply its customers with its products. In Latin America, Nestlé has to supply pushing trays and reach every neighborhood within their reach. In Europe, Nestlé usually supplies supermarkets and stockists and at the same time it makes sure to supply kiosks!

Figure 9 Nestlé is one of the top enterprises providing consumer products

Nestlé had to implement the ERP system and cover every end-to-end scenario, applicable in different sites of the world, with a single ERP system. While this was a difficult task to achieve, it had the opportunity to gather all those data and be able to organize and arrange them in such way that it would be both less time-consuming and easier to make quick decisions. This is a strategic point in its operations, because Nestlé can now gather all the data in a matter of minutes.

Another benefit is that Nestlé developed **end-to-end processes**. This was a major change and a strategic point on how the enterprise views and handles all of its processes. Before the ERP, each function of the enterprise, (logistics, manufacturing, finance etc.) was different operational units inside the company. With the ERP and end-to-end processes these departments are a part of process. For example, "order to cash" starts from Generating Demands, then the Order, Order completion, Materials handling (warehouses and stocks), Order control, Finance control, up to the point that the customer pays the enterprise. This cycle starts from one department and ends in another department. The functions/departments are not segments of an enterprise anymore but are part of a chain that put through a process.

While the first pillar/objectives in the GLOBE program were **Business Excellence and best practices**, there were two more pillars that needed to be achieved with the program. The second was **standardization and data management** and the third was **infrastructure standardization**.
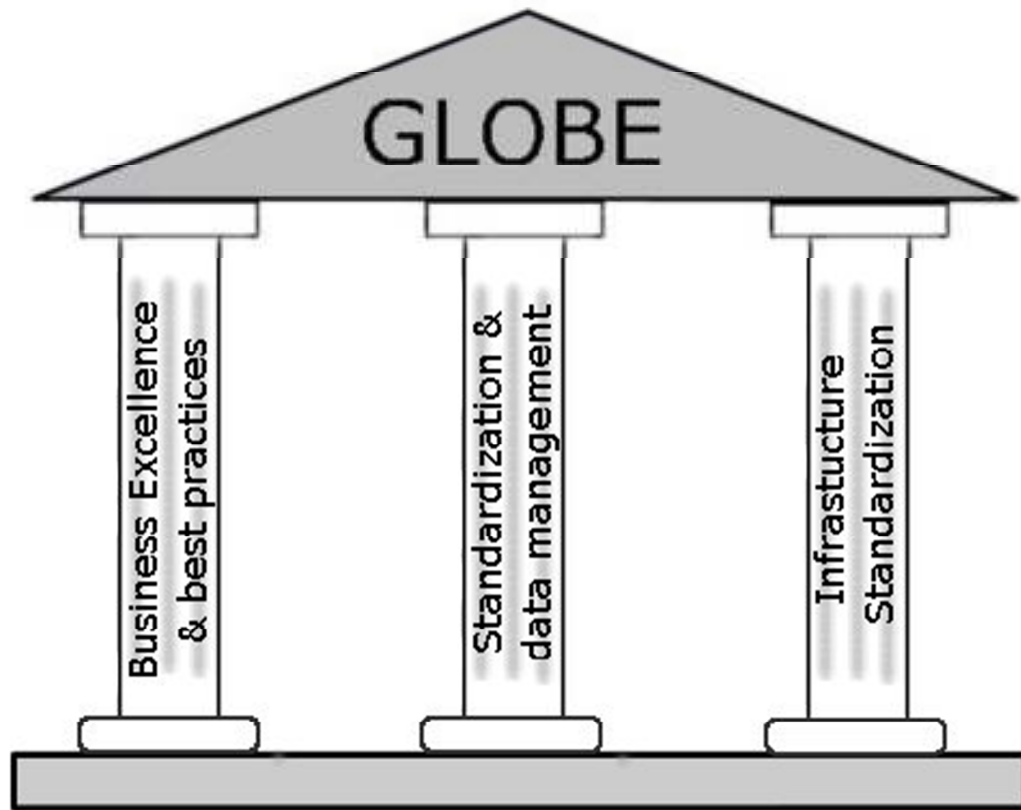
Data management and standardization means a harmonization of the data, **uniqueness and correctness as well as avoidance of duplicate entries, which lead to advanced efficiency**. For example, in case there is a supplier or a customer that has active transactions with different sites of Nestlé (e.g. Italy and Greece), he will have a unique identification number globally. Therefore a single id facilitates in watching how many contracts the company has with a single contractor. Every time his data would change, every site would be notified on the fly since it would access the same database entry. The standardization takes care of how the data are organized, how many fields are required, why and which ones could be truncated or altered so that every site could understand a single attribute instantly. For uniqueness to be achieved the English language was adopted throughout the ERP system and there few exceptions that different modules are in both the local and the English language. Reconciliation, consolidation and explanation of the data are understood throughout the enterprise.

Last pillar is the **infrastructure standardization**. The enterprise wanted a harmonized environment and therefore they chose a single hardware platform that the

ERP implementation could be deployed and function properly. For example, the end users work in HP workstations.

One of the benefits is that with the ERP system is that it can make **organizational changes while not disrupting the functions of the enterprise**. In 2010, GLOBE achieved a "first-of-its-kind" worldwide major upgrade with zero business disruption. This will enable Nestlé, during the next 5-7 years, to fully leverage the GLOBE Solution using the latest technologies.

On the <u>downside</u>, especially in the first year, the change in ERP was a difficult task to go through. Employees thought that the ERP was too **demanding** and **fixed** and this is probably due to the fact they were not used to handle it.

## PROS

In Nestlé, the SAP system has provided the company with numerous advantages that beforehand did not exist.

1. Short time of technical support process. Modules share information and therefore the employees can deal with more Qualitative characteristics.
2. Readily accessible data at a central level. Every user can take reports; there is no need for a specific user to be in charge of reports.
3. Simultaneous access to data. Everyone (or at least those with required access) can see at any point the same updated data (profit margin, capacity, demand, suppliers, costing and manufacturing) and make accurate decisions.
4. Instead of silos, disparate departments, there is an end-to-end process which enables better understanding and processing of the order. This process integration and alignment facilitates in viewing the order as the fundamental aspect of the enterprise.
5. With the ERP system, even the Business Unit of Greece can watch the BU as a whole or drill as much as the employee wants. The level of detail depends on how much information he requires from the system (goal to each product,

supplier, employee performance and Business Unit's performance, while comparing functions between units around the globe and tracing gaps).

6. Electronic Data Interchange (EDI), that is the structured transmission of data between organizations is facilitated, and Customer Relationship Processes (CRP) are both facilitated by the ERP system and are handled in a manner that the enterprise can build on its efficiency for the supply chain.

7. Daily reports and creation of more indicators to better understand your customers and the reasons why you fail to perform better, i.e. Case Failure rate and refusals.

8. Better traceability and ability to react in short period of time

9. Better finding and tracing the Remaining life of a product and matching the requirements of the customer for the product with it.

10. Creation of new and better communication channels among users and teams. Previously it used to be difficult to communicate and even more difficult to have access at the same time on several data. Now with the ERP, everything is done in matter of seconds.

## CONS

No matter how it seems, transitioning to an ERP system is not always the best solution. Sometimes, implementing the ERP you might come across the dilemma of choosing what is more important to you. There are some negative effects following the adaptation and implementation of an ERP system and Nestlé had one of these moments. The enterprise decided that the advantages outweigh the disadvantages and learnt to live with them.

For example, one of the basic issues that have risen in Nestlé, is the fact that while they required 10 minutes approximately to create a new entry for a new supplier or a new customer, nowadays those functions are handled globally by their central offices in India and Germany, leading to increased times of approximately 1-5 days! This ERP implementation loses the agility and suppleness that their previous system

offered. Of course, this is done so as to avoid by every means necessary errors and to double check data validity.

Another big issue was that it required a considerable amount of time so as to initially feed the system with the appropriate data. The user must initially check for the credibility and accuracy of the data, in case the data that the system provides are not correct.

One little issue that was quickly addressed was that of increased in submitting the forms that composed the order. From writing down the order information to selecting from drop down menus the appropriate info, there was an increase in time. However, this issue was quickly addressed by giving tablet/handheld devices to the delivery persons so when they came back to the office, their devices updated automatically the system on the fly.

Last but not least, in practice it seems that the ERP solution, as a general and perhaps future proof solution, requires much more fields to complete in comparison with previous legacy systems. What has also got worse is perhaps the complexity of the system. And it is not the initial learning time that I am referring to. It is the fact that there is added interdependence. For example, in case something needs to be changed, there may be times that the owner is just one, and the other departments must consult with him in order to change it, the one in charge and probably the one with enough knowledge what the change might trigger. Corrections of master data require much more effort. This process, while error resilient is also very time-consuming.

## STRATEGIC DECISIONS

The benefit from data uniqueness is that information that was one hidden, and sometimes it was, now comes to the light. For example, Nestlé had a supplier in the Balkans. However, a Business Unit could not understand the importance of that supplier for the company as a whole. It had only a basic idea from its own local

system. With the ERP, the single unique id that the supplier had could mean in better understanding the importance of that supplier in the supply chain of the enterprise. It could also mean unified data and therefore bargain better prices.

In addition to that, the same thing could happen for a product that Nestlé was manufacturing. The headquarters could now have a global view in matter of minutes. Therefore, Nestlé was now able to from strategic alliances and agreements with suppliers that were active and operating in a certain geographic area. These were easy to be found since the ERP system could form a pie chart (or a Pareto chart) to show the basic suppliers or the products that enterprise has the most gain in producing.

On the other end of the ERP system (that of the sales end), Nestlé could find its basic customers. With them, it could achieve greater integration and perhaps even make special offers to promote its products.

The ERP system in Nestlé behaves as a business warehouse, ready to find and report information on demand and within minutes. Previously, extraction alone would require time. Now the ERP system gives the opportunity to extract those data and then you can adjust it by using simple tools like Microsoft® Excel.

To this point I must note the Business Unit of Nestlé in Greece does not make strategic decisions. The decisions it usually makes are mid-term ones at best. For example, they could decide whether or not to close a silo or warehouse or create a new one, but this is as far it will go. It makes 2-3 year plans at most. The strategic moves are usually made in the headquarters in Switzerland.

However, I've been told that they use data from their past in order to watch whether they have achieved their goals, strategic goals set by the headquarters. They watch closely on matters of market share, real growth, profit etc. The headquarters form their strategy based on :

I. Internal data:
   a. Past data
   b. Real everyday data (i.e. profit margin, volumes)
II. External data:
   a. Business environment
   b. Market research

c. Industry data

They can also assume from their data for the whole industry. They can watch on their performance and make assumptions about the industry while knowing their own market share (i.e. the market is booming or is shrinking).The headquarters can make decisions on strategic requirements, based on data from the ERP system, such as financial objectives (whether the capacity, resources and investments are enough), commercial objectives, (growth, market share, profits) or even functional objectives (internal: case fill rates, new product introduction, external: media investment or maintain market share).

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