USING ERP SOFTWARE IN TEACHING TO UNDERSTAND AND IMPROVE INDUSTRIAL LOGISTICS

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Abstract

Reality demonstrates that logistics is part of our lives. In any case, either as a manager or as a mere employee, we are all confronted with ongoing interaction with suppliers, manufacturers or consumers of goods and services. Moreover, all of us are connect at the same thing, the desire to meet our consumption needs on time in the most favorable quality / price conditions. In the context of economic development, the training of specialists in global logistics management, capable of responding to the challenges of the ever changing economic and social environment, has a very important role to play. In industrial logistics, a role becoming more and more important is a comprehensive understanding of the Supply Chain and the treatment of the logistic issues like an integrating flow of physical goods, information flow and financial flow. Thus, any software’s that are dealing with SCM (Supply Chain Management) try to assist the companies with the best information technology to achieve the global challenges in the field of production and services. As a segment of the ERP (Enterprise Resources Planning), SCM systems win a strategic role for improving efficiency and customer satisfaction in the field of production and services.

This paper highlights the importance of logistics and, on the other hand, the role of ERP software solutions and how to communicate within an automotive company. Considering the huge number of subcontractors in automotive industry an important role in a collaborative logistic strategy become strategic goal and also indispensable. From the point of view of technical education of the students enrolled in engineering faculties the knowledge of the software’s assisting the production, purchasing and distribution of the goods in this field is a must. Many universities have recognized this need and the importance of using ERP software packages as a unitary flow of goods and services from raw material suppliers to the end customer.

In this paper, the approach adopted is to develop a course that integrates the SCM, within a company using the ERP software for the supply chain simulations any time when it is possible to make an application with a software that is used in industrial environment (SAP, System 21 RP or similar). For example, is interesting to have an IDES (International Demonstration and Educational System in SCM-SAP) for simulating a business in the field of production or services. Thus, in the curricula of the “Industrial Logistics” master program we try to implement applications that are simulating the complete logistic supply chain for a certain computer-integrated production.

The course aims to understand interdependence relationships between enterprise compartments and mapping of real-world relationships and translating into Info System 21 RP and SAP software. The case studies applications from companies are simulated using the software mentioned above.

Keywords: ERP software, teaching, logistic chain, relationship between company and university.

1 INTRODUCTION

According to the definitions, Enterprise Resource Planning (ERP) systems represent a computer infrastructure of a company that circulates all the transactions generated by the daily business processes that take place in the organization. On this infrastructure, other applications are needed for a modern company such as Business Intelligence (BI), Customer Relationship Management (CRM), and Supply Chain Management (SCM). Another given definition presents ERP systems as software packages composed of several modules, such as human resources, sales, finance and production, which integrate and organize information through integrated processes, [1]. And these software packages can be personalized to meet the specific needs of a company.

Today, many companies want to acquire and implement ERP systems to improve operational performance and create competitive and strategic value. But some fail to achieve these goals due to a lack of knowledge and a better understanding of ERP and its lifecycle.
In order to achieve high performance, we believe that companies need to manage their resources as much as possible, as inefficient management will certainly increase their vulnerability to competition with other firms. In this process, it is often necessary for companies to modernize their less efficient applications or even replace them, with even more performing ones, to ensure the real-time and efficient production.

Currently, it is considered that the implementation of integrated ERP systems is able to contribute to the efficiency of a company's business. By creating such systems, the company offers the opportunity to integrate existing applications with the new applications specific to the domain in which the company operates.

In the literature, there are numerous researches focused on specific ERP issues. However, there is no consensus on defining and ERP issues. Thus, Jacobs and Bendoly, [2] emphasize that ERP should not simply be regarded as a technology artifact that helps organizations perform their tasks or as a productivity tool but should be considered as a critical technological infrastructure that improves capabilities of all other tools and processes. It is obvious that a company investing in a new ERP system is expecting an absolute and trouble-free success with the newly acquired tool. Reality is actually quite different ERP systems are a solution and not a miracle that has its own drawbacks that can be noticed especially during the implementation phase. Although ERP systems are important, statistics show that at the implementation stage, around 90% of implementations suffer from excessive cost, according to Sudzina et al (2009). This is confirmed by Standish Group 2009 in the report, which shows that 24% of ERP implementations failed, 44% were strongly challenged due to excessive cost or unresolved program, while only 32% were successful, while respecting the budget initial, [3].

Alexis Leon in his book "ERP Demystified," [4] points out that the main causes of ERP implementation failures come from the poor assessment of the importance of the human factor. Some examples of these causes include:
- Lack of adequate ERP education and training
- A bad match between ERP and users
- Employees resistant to change
- Lack of commitment from top leadership
- Poor tracking after implementation

But, like any software product, implementing an ERP system has advantages and disadvantages. The main advantages of implementing an ERP system in the organization are [5]:
- Access to secure information - the ERP solution stores all information about enterprise activities in a common database, providing accurate and secure information and improved reports;
- Avoid data and operations redundancy - eliminates the need for multiple data entries as all ERP modules access the central database information;
- Reducing delivery times - minimizing reporting delays;
- Cost reduction - "Time is money" and ERP solution saves time resources by providing better control over all organizational decisions;
- Improved maintenance - the relationship between the ERP system provider and the enterprise adopting the solution does not end with the acquisition and implementation of the system in the organization;
- Expansion - ERP solutions can be integrated with other important applications, such as Customer Relationship Management (CRM) or Supply Chain Management (SCM);
- Electronic commerce and e-business - ERP solutions can offer options for internet trading.

But, also disadvantages such as:
- Extremely high costs. The cost of adopting an ERP solution in the organization varies from thousands to millions of euros, which makes them a risky investment.
- Time consuming. Adopting an ERP solution brings major changes in an organization, being a highly complex process that can even lead to the company's need to change its organizational culture;
• Module compliance. In choosing an ERP solution, organizations must take into account their strategic objectives and business processes;
• Complexity. An ERP system incorporates many modules. It seems that there are few companies that exploit all the functions of the adopted ERP solution; the 80/20 principle is also applicable to ERP systems, ie 80% of organizations adopting an ERP solution use only 20% of its functions, and only 20% of firms adopting the same solution exploit 80% of the functions.

2 EVOLUTION OF ERP SYSTEMS

The starting point for the evolution of the current applications for the enterprise is the 1960s, and then, over the course of four decades, following closely developments in hardware and software, the evolution continued to ERP systems, [6]. The 1960s are characterized by the fact that most businesses have centralized applications through their own forces, which means that their design, development and implementation has been done in-house. Most applications focused on inventory control and automation of management, but it also attempted to create applications for automatic wage calculation and for general accounting. As programming languages used in that period we mention COBOL, ALGOL and FORTRAN.

In the '70s, Material Requirements Planning (MRP) systems are outlined. In the literature [2], [7], these applications are considered as a set of techniques that use inventory, stock data and production schedule to calculate material requirements, launch supply and ensure it throughout the manufacturing process. Viewed through time and evolution from simple inventory control applications, MRP applications have been the metamorphosis of inventory control system under the influence of the computer and its applications.

With the maturation of MRP systems, the 1980s marked the move to MRP II or Manufacturing Resource Planning, which is conceived around the idea of optimizing manufacturing processes by synchronizing material requirements with production requirements. At that time, MRP II was the solution for efficient planning of all enterprise resources and ensure the operational planning of needs that support production processes, financial planning, and "what if?" Scenarios, and we can say that MRP II is not just a planning and tracking tool for production, being a much more complex system that has evolved towards something even more comprehensive, namely Enterprise Resource Planning. In [5], [6], [7], it appears that at that time another name has been proposed that has worked for a while: BRP (Business Resource Planning), a name that emphasizes that it is more than just a production-only system. So, the late 1980s and 1990s were marked by the emergence of ERP systems, becoming the standard by replacing existing MRPII systems with large companies and, in particular, multinationals [8], [9]. With the MRP II technological foundation, ERP systems integrate all economic processes: production, distribution, accounting, finance, personnel, inventory, service and maintenance, logistics and project management, ensuring information consistency, accessibility and visibility throughout organization.

The 2000s are characterized by applications such as APS (Advanced Planning and Scheduling), e-business solutions for Customer Relationship Management (CRM) or Supply Chain Management (SCM). New concepts such as BPI (Business Process Integration), Enterprise Application Integration (EAI), ENS (Enterprise Nervous System) have also emerged during this period, [6]. To graphically illustrate the evolution of ERP systems over the last four decades, we present the following figure 1.

![Figure 1. Evolution of ERP Systems](image-url)
Regarding the significant impact of ERP systems in a company, Chen et al. [10]. He states, a company's success depends increasingly on the information it receives in a timely manner.

This trend towards ERP systems in large and medium-sized organizations has a significant impact on the career of graduate faculty and master. ERP systems essentially alter the fundamental business processes, which means that the system that supports these processes as well as the design and development of these systems have also changed. However, most curricula do not provide significant coverage of ERP concepts [11], [12], graduates do not really know these systems and their impact on industry. In the recent past, several ULBS master programs have made significant changes in the curricula by introducing a discipline related to enterprise resource planning. Thus, the paper highlights the importance of these ERP systems and the way of implementation within the Master of Industrial Logistics program of the Faculty of Engineering.

The mission of the Industrial Logistics Masters program is to develop a strong postgraduate core of logistics chain management (SCM) based on the use of ERP software packages as a unitary flow of goods and services from raw material suppliers to the final customer. It also aims to develop the knowledge and use capabilities of leading enterprise resource planning software for graduates of the first cycle of undergraduate studies of various types, given that ULBS is part of the SAP University Alliance. Through the global approach to the logistics chain, graduates of this master's program will be able to better understand the complete process of a production or service enterprise.

The main objective of the enterprise resource planning discipline is the students' understanding of ERP concepts, principles and methods, as well as the understanding of interdependence relationships between enterprise compartments. Affiliation of the Faculty of Engineering at SAP University Alliance and beneficiary of SAP academic licenses, a software used by most companies that have opened subsidiaries in the Sibiu area such as: Continental Automotive, Marquardt, Kromberg & Schubert, SNR, Churing, Siemens, Brandl and others who are clients or SAP partners.

Case studies from this master program are largely based on the use of the My SAP ERP-R/3 software through the agreement with the UCC (Technical Competence Center) of the Technical University of Munich and the Infor ERP System 21 software used by Takata companies. Thus, understanding basic concepts about ERP systems is today a necessity for any college or master's degree in engineering, economics or computer science.

3 USE OF INFORMATION TECHNOLOGY TO IMPROVE INDUSTRIAL LOGISTICS. CASE STUDIES.

To emphasize the importance of knowledge of ERP software, below are two software products used at „Industrial Logistics“ master program. The case studies to be presented have main role is to enable students to understand the complexities of an unprecedented of an ERP software, and especially a SAP systems [13]. And, those who know the computer science, but without having had contact with SAP or other similar systems will hardly guess is as complex ERP in general and SAP in particular. In order to understand the benefits of using ERP software and to gain competency, students get a small case to solve each application by defining a production plan, checking the stock, making and placing a new order and planning the production of real products made in the companies in Sibiu. These exercises require students to create a vendor, a client or a sales order, or establish a production plan for a simple product.

3.1 SAP R/3

SAP systems are based on a three-level client / server architecture. It is the classic architecture model in which the data layer is separated from the application level that is separate from the interface layer. The user interface is an application called SAP Front End (Figure 2) that is used to connect to the SAP server, [13], [14].
Through this application, the user has access to the SAP platform and can use all the applications available on the server. The SAP Front End application runs on the customer side of the user. As I said earlier, the SAP system commonly used for training is loaded with imaginary company data called IDES Holding AG, [14]. Without this data, students and other categories of readers cannot execute transactions. In order to be able to work in SAP, the student must first know some basic elements about the structure of IDES, as the organizational principles of a functioning company can be understood.

The case study presented below relates to the planning and control of production, SAP PP of a "Speed sensor". The work steps are as follows:

- Each participant will have its own main and traded data. All the main data records end in ##.
- Goods received for required components
- Create production order
- Confirm the production order
- Automatic display of goods movement
- Check warehouse stock.

3.1.1 Creating a Production Order

A production order lists all production requests, make sure that a specific quantity of materials or services is manufactured or prepared for particular information. It determines the work center and the resources used to produce a material. A production order can be a production order (different manufacturing) or a process command (manufacturing process).

In the SAP Easy Access menu, select Logistics → Production → Production Control → Order → Create → With Material (transaction CO01).
Enter the ULBS-SENZOR-11, the production factory [1000], and select the command type [PP01] Standard Production Order (int number) and then ENTER to confirm the recordings. On the Production order Create: Header screen, enter a total quantity of 1 piece. As main information for PP01 type orders are calculated using reverse-planning, enter the last working day of the current month as final information and then ENTER to confirm, and the system will calculate the main information.

3.1.2 Confirming a Production Order

To speed up the production process, make and confirm the order, without moving the components required to storage. For this, select Logistics → Production → Production Control → Confirmation → Enter → For Order (transaction CO15), where in Order field enter production order number (Figure 4).

![Figure 4. Confirmation of production order](image)

3.1.3 Automatically display material movement

In the SAP Easy Access menu, select Logistics → Materials Management → Inventory Management → Material Document → Display (MB03 transaction). The material field should display the document number of the created confirmation material, as shown in Figure 5.

![Figure 5. Document number](image)

At the end of the document, the system displays the type of movement and a sign. This sign indicates whether the move of goods is an entry (+) or an exit (-). The system was now automatically supplied with production components and posted the sensor to the warehouse.

3.2 Infor ERP System 21

The resource planning system called "Infor System 21 RP" is a software developed by Infor Global Solutions, and the IBM System platform, [15]. Infor System 21 RP is an extremely flexible and scalable enterprise resource management solution that allows customers to quickly adapt to market changes, respond to customer needs in time, have a full picture of available capabilities, and reduce costs by optimizing resource use.
The main modules of Infor System 21 RP are:

- **Planning** - responds to changing customer expectations - in terms of both profit, production, manufacturing period, or compliance objectives.

- **Production** - a highly flexible and functional component, covering a wide range of production typologies, from in-stock manufacturing to custom-made.

- **Financial** - multi-site, multi-currency component, allows reporting in various accounting systems, reconciliation of balance sheets, profit and loss accounts, and cash flow values across different entities. It provides a very flexible solid financial and accounting base for defining data from general accounting, customer and vendor management. It is in line with the Romanian financial and accounting legislation.

- **Supply** - provides centralized and decentralized management capabilities for orders, contracts and needs, bidding, supplier's credibility assessment, procurement planning, return and custody management, as well as statistics and supply history.

- **Warehouse Management** - Facilitates inventory planning and traceability by tracking batches and series of articles using bar codes and modern RFID technologies.

This software is used for production planning in the Takata company and the case study illustrated is real. In the factory in Sibiu, the production of “airbags” is strictly based on firm orders, the company's policy avoiding production based on forecasting; in this way, the factory produces exactly the number of airbags the internal customer orders. To initiate production planning, it is necessary for one of Takata's internal customers to register and validate a product request.

After the launch of the product request, the customer will send a copy of the electronic order to Takata Sibiu, as shown in Figure 7. Product demand is recorded directly into the ERP software database used so that it is accessible at any time from any TAKATA workstation.
After receiving and processing the order, the Logistics personnel will complete the next-day production plan for the PAB04 line, including the 1260 parts ordered by the customer. Based on the orders received and the quantities requested by the customers, the Logistics department staff produces day and weekly production plans for each production line, but also for the entire factory. In order to achieve the quantities of products ordered, the availability of production capacities for the next 16 weeks is also checked.

Several factors are taken into account for the verification of production capacities, the most important of which are: hourly production capacity, number of available operators on the line, days off (free legal days, medical leave, rest leave) and number shifts in the production line (in this case the maximum number of shifts is 3).

![Figure 8. Checking of production capacities](image)

After performing production capability checks, the results are centralized and can be interpreted using graphs. (Figure 9).

![Figure 9. Graph on check of production capacities](image)

After organizing and planning the production and all the necessary resources, the logistics department performs the centralized sales plan (fig.10), including the order identified with code 57185 for airbags that must arrive at the customer's warehouse to specify deadline.

![Figure 10. Centralized Sales Plan](image)
The examples above show how the use of ERP software improves the flow of information between different departments of a company - for example, creating and tracking materials in a warehouse, purchase, accounting, and sales. These case studies conducted in an intuitive way allow students to make other examples during the individual study. By using these softwares, students can develop applicative competences, such as development of simulation capacities of products and processes and the adapting in real environment of operations planning and scheduling.

4 CONCLUSIONS

We can say that, it is important to note that ERP systems can offer opportunities to improve a curriculum for faculties. Within the masters Industrial Logistics program, although master's students are engineering, economical or letters graduates, they are attracted to this ERP course. This paper focuses on the experience of teaching staff teaching this master program to convey the core concepts for students by using an ERP system in the curriculum.

In the nearly 10 years since these ERP systems were taught, there have been many learning experiences from both teachers and students. Upon completion of the Master, students can develop a deeper and wider understanding of how an enterprise operates, business processes and administrative activities of an ERP system. A major benefit of an ERP initiative in this decade is the ability to attract key recruiters on campus. Higher education institutions play an important role in shaping the future graduate, especially in their cognitive and academic development. Therefore, the masters of Industrial Logistics seeks the best tools for constantly improving the knowledge and development of students. This paper makes an important contribution by providing details and experiences with using an ERP software and in special SAP software.

The main problem faced by students during the implementation of applications is access to information that is mitigated by the use of ERP software. The students appreciated that they learned practical things but said that the software products used are complex and can not assimilate all the modules considering that they can use these products only at the Faculty of Engineering.

In response to the wishes of the students, it is hoped that in the next academic year they will use the free platform as they are freely available, and students could use this tool outside of home courses as well. Finally, students can really see the problems that appear in the information flow and appreciate the value of ERP solutions.

REFERENCES


