Enterprise Resource Planning: Literature Review

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Nowadays one of the significant competitive advantages in business is to faster the supply chain. This can happen with a better strategic technology planning and often incorporation of Information System (IS) to manage this process more effective and efficiently. Those IS are the roots of todays’ Enterprise Resource Planning (ERP) systems. During the 90s ERP system were the major business generators for the IT sector, while nowadays more companies are oriented towards off-the-shelf solution.

In their research Soh, Kien and Tay-Yap (2000) discuss the issues organisation face then go for off-the-shelf solutions. Common problems are misfits an ERP system has related to certain business process. These misfits resolution is trade offs between organisational change and IS customisation. They also explain that an misfit analysis must be carried out early in the process. Moreover, comprehensive understanding of the critical organizational processes and detailed knowledge of this complex software are required.

ERPs are considered complex and painful to implement mainly because they force an organisation to change its way of working as well as they are considerable expense, with long return on investment value (Al-Mashari et al., 2003). Implementing an ERP system takes from one to five years. Due to those and other factors some organisation found themselves in situation, where buying an ERP system cost them times cheaper than installing and maintaining it. Often those issues leads organisations to cancel or drop of the idea of implementing particular ERP.

This paper will discuss what ERP is, how an organisation can benefit from it and what are the critical success factors in implementing an ERP and ways to overcome them. Moreover it will talk about the most common features an ERP can offer and how to classify them. Partially the gap between theory and practise will be analyzed as well.

ERP definitions

ERP systems were named differently by different authors, some of them are enterprise systems, enterprise wide-systems, enterprise business-systems, integrated vendor software, and enterprise application systems, but however with no significantly different definitions (Al-Mashari et al., 2003). Rosemann (1999) defines ERP system as a “customizable, standard application software which includes integrated business solutions for the core processes (e.g. production planning and control, warehouse management) and the main administrative functions (e.g., accounting, human resource management) of an enterprise. Slight differently, Gable (1998),
however, defines it as a comprehensive package software solutions seek to integrate the complete range of a business processes and functions in order to present a holistic view of the business from a single information and IT architecture" (Al-Mashari et al., 2003). Today, there are various software implementations of ERP systems. They can be categorized into four tiers in terms of their high or low flexibility and functionality. The diagram below (Bititci, 2011) gives an example of ERP systems falling into the four tier categories.

Most of the ERPs support the inventory control functionality as this was the basic first step of software penetration in the production process. The second most common functionality is connected with Material Resource Planning (MRP) and modules designed to manage manufacturing operations processes. Those translate the Master Schedule (MS) into a “time-phased net requirements for the sub-assemblies, components and raw materials planning and procurement” (Al-Mashari et al., 2003). According to Gupta (2000) MRP vendors expanded their IS with capacity planning, leading to MRPII. The shortcomings of MRPII and the need to integrate these new techniques led to the development of a total integrated solution called ERP. Nowadays ERP systems are IS that merge all department’s systems into one by integrating inventory data with financial, sales, and human resources data, allowing organisations to price their products, produce financial statements, and manage effectively their resources of people, materials, and money.

ERP system implementation process is consisting of six phases: initiation, adoption, adaptation, acceptance, routinization, and infusion (Somers and Nelson, 2001) and companies have different approach and reason for implementing it. A study for Deloitte & ToucheConsulting (Computer Technology Research Corporation, 1999) categorize organisation drive for ERP implementation into two categories: technological and operational. Technological motivation is connected to the “Year 2000 (Y2K) compliance requirements, replacement of disparate system, improvement of quality and visibility of information, integration
of business processes and systems, simplification of integration of business acquisitions into the existing technology infrastructure, replacement of older, obsolete systems, and the acquirement of system that can support business growth” (Al-Mashari et al., 2003). Operational motivation aims at “improving inadequate business performance, reducing high-cost structures, improving responsiveness to customers, simplifying ineffective, complex business processes, supporting new business strategies, expanding business globally, and standardising business process throughout the enterprise” (Al-Mashari et al., 2003).

ERP systems functionality
As mentioned earlier ERP system categorize in 4 tiers depending on their complexity, features and functionality. In this section we will investigate some of the most used ERP systems. ERP systems provide role-based access to crucial data, applications, and analytical tools in the following areas (SAP, 2011):

- **Financials** – Ensure compliance and predictability of business performance – so organization can gain a deeper financial insight across the enterprise and tighten control of finances. They automate financial and management accounting and financial supply chain management.

- **Human Capital Management** – Optimize human resource processes with a complete, integrated, and global human capital management solution. Organisations can maximize the potential of workforce, while supporting innovation, growth, and flexibility. They can automate talent management, core HR processes, and workforce deployment – enabling increased efficiency and better compliance with changing global and local regulations.

- **Operations** – Manage end-to-end procurement and logistics business processes for complete business cycles including Bill of Materials, Order Management, Rough Cut Capacity Planning, Material Requirements, Planning, Capacity Requirements Planning, Purchasing, Inventory Management, Shop Floor Control, Forecasting, Demand Management, Master Production Scheduling, Product Costing

- **Corporate Services** – Helps organizations manage their most cost-intensive corporate functions by supporting and streamlining administrative processes in the areas of real estate; enterprise assets; project portfolios; corporate travel; environment, health, and safety compliance; quality; and global trade services.


ERP Advantages and Disadvantages
ERP makes companies more agile and flexible, allowing them to share information. All these
affect their ability to react in a better way to competition and market. A study for Deloitte & ToucheConsulting (Computer Technology Research Corporation, 1999) classify the benefits from ERP implementation as **tangible and intangible**. The **tangible** ones are inventory reduction, reduction of personnel, increased productivity, improvements in order management, more rapid closing of financial cycles, reduction in IT and procurement costs, improvement of cash flow management, increase of revenue and profits, reduction in transportation and logistics costs, reduction in the need for system maintenance, and improvement in on-time delivery performance. **Intangibles** refer to the increased visibility of corporate data, new or improved business processes, improved responsiveness to customers, unanticipated reduction in cost, tighter integration between systems, standardization of computing platforms, increased flexibility, global sharing of information, improved business performance, and improved visibility into SCM process (Al-Mashari et al., 2003). According to Gupta (2000) the main benefits of ERP implementation are reduction of inventory and improving communication with suppliers and customers. Some other advantages mentioned in his study are:

- Y2K compliance;
- ease of use;
- integration of all functions already established;
- suppliers and customers can be online communications;
- customization is an option;
- improved decision making due to availability of timely and appropriate information;
- improved process times;
- feasibility of administering praefacto control on the operations;
- Internet interface is an option;
- reduces planning inaccuracies.

On the other hand, Al-Mashari et al. (2003) argue that one of the biggest advantages of an ERP implementation is the re-engineering of the whole organisation processes to comply with the ERP and as a result change the business culture.

Posten and Grabski (2001) summarise the reasons why an organisation wants to implement ERP system:

- Reduced asset bases and costs, enhanced decision support, more accurate and timely information, reduced financial cycles, and increased procurement leverage;
- Increased customer satisfaction through integration and consistency;
- Conversion to Year 20002 compliant software;
- Response to pressure from trading partners who have already converted their systems;
- Globally integrated information access across the enterprise and supply chain;
- Enabling e-business; or
- Flexibility to change quickly and configure the business in response to a changing marketplace while making tacit process knowledge explicit.

Next to the numerous advantages an ERP implementation offer to an organisation, there are considerable disadvantages, which management should look after. Gupta (2000) is summarizing them below:

- organizational resistance to change may be high;
- changeover may take a long time causing cost overruns;
data errors will be carried throughout the system;
maintenance is costly and time consuming.

**Critical Success Factors in ERP**
The success of ERP implementation has variety of factors, that are considered to be critical and many researches are trying to list them. Al-Mashari et al. (2003) suggests that “clear vision and business director is fundamental for the success of ERP system implementation”.

According to Gupta (2000), the key to successful implementation of ERP is as follows:

- commitment from top management;
- form a task force with personnel from all functional areas to foster ties between project management and business units;
- take an assessment of hardware requirements;
- step-by-step introduction rather than all at once;
- start early planning on user training and support;
- streamline decision making so that implementation work can move quickly;
- be patient because ERP implementation takes time.

Umbre et al. (2003) summarizes the most prominent CSFs below:

- clear understanding of strategic goals
- commitment by top management
- excellent project management
- organizational change management
- a great implementation team
- data accuracy
- extensive education and training
- focused performance measures
- multi-site issues

Mabert et al. (2003) are summarizing CSFs from three case studies based on different organization implementing ERP systems. They found similarities between those organisations which implementation was successful. These are listed below:

- Senior executives were very involved throughout the project, from the outset to completion, and also established clear priorities.
- A cross-functional ERP Steering Committee with executive leadership was established to oversee the project. The Steering Committee was empowered to make key decisions, both during the planning and implementing stages.
- The implementation team spent extra time up front to define in great detail exactly how the implementation would be carried out.
- These companies laid out clear guidelines on performance measurements.
- Modifications to the ERP system code were kept to a minimum.
- Organizational change and training strategies were developed in advance and were continually updated during the implementation.
- Key technology issues, such as data integrity and technology infrastructure, were addressed early.
- Only minor re-engineering efforts were carried out up front.
The implementation plan and subsequent progress was communicated regularly to employees, suppliers and customers.

Willcocks and Sykes (2000) look at the CSFs from an IT point of view and defined 8 enabling factors:

- Senior-level sponsorship, championship, support and participation;
- Business themes, new business model and reengineering drives technology choice;
- “Dolphin” multifunctional teams, time box philosophy, regular business benefits;
- CIO as strategic business partner;
- Nine core IT capabilities retained/being developed in-house;
- In-house and insourcing of technical expertise preferred;
- Supplier partnering—strong relationships and part of team; and
- ERP perceived as business investment in R&D and business innovation rather than primarily as a cost efficiency issue.

Somers and Nelson (2001) summarize a comprehensive list of 22 CSFs during ERP implementation. The list is based on factors that may affect the ERP implementation process and the probability of conversion success have been identified in the IT implementation, IT failures, and business process reengineering. Among the more important factors are:

1. top management support and involvement,
2. the need for a project champion,
3. user training,
4. technological competence,
5. process delineation,
6. project planning,
7. change management,
8. and project management.

Bradford and Fronin (2003) test those eight CSFs and they proven their significance for the success implementation.

In addition to those, the rest of 22 CSFs are:

1. Management of expectations
2. Vendor/customer partnerships
3. Use of vendors’ development tools
4. Careful selection of the appropriate package
5. Steering committee
6. Use of consultants
7. Minimal customization
8. Data analysis and conversion
9. Defining the architecture
10. Dedicated resources
11. Clear goals and objectives
12. Interdepartmental communication
13. Interdepartmental cooperation
14. Ongoing vendor support

**ERP in theory and practice**
Poston and Grabski (2001) examined financial impact of ERP implementations. The results indicate no significant change in costs as a percentage of revenue until the fourth year. Moreover, a significant decrease in costs only for cost of goods sold as a percentage of sales was shown. On the other hand, there were no significant decreases associated with selling, general, and administrative costs scaled by revenues. However, there was a significant decrease in the number of employees as a percentage of revenue all 3 years after ERP implementation. These findings based on practice contradict with the theory behind ERP and creates a paradox suggesting additional complexities surround ERP technology.

Hunton, Lippincott and Reck (2003) researched organisation performance of ERP adopters and non-adopters. Results indicate that return on assets (ROA), return on investment (ROI), and asset turnover (ATO) were significantly better after the third year for adopters, as compared to nonadopters. Their results were consistent with Poston and Grabski (2001), who reported no pre- to post-adopter improvement in financial performance for ERP firms. However remarkable differences arise between the two studies in financial performance. Non-adopters financial performance decreased over time while it held steady for adopters.

The theory suggests that ERP system implementation has better impact on larger organisations (Bradford and Frorin, 2003), however, Hunton, Lippincott and Reck (2003) proven in practice that “for relatively large ERP-adopting firms, there will be a significant negative association between firm health and performance”.

Conclusion
In this paper we discussed what ERPs are and how an organisation can benefit from implementing one. A chapter was dedicated to the most common functionality of ERPs nowadays and their classification. The main advantages and disadvantages from different authors were summarized and an insight view of the implementation of ERP was mentioned together with comprehensive list of Critical Success Factors (CSFs).

In conclusion, IS, and ERP in particular, implementations are projects with high risk, which require appropriate management. Organizations planning to implement ERP must learn how to identify the critical issues that affect the implementation process and know when in the process to address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided.

Future research can be done of analyzing the gap between ERP theory and their actual practical use and implementation.

References
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