INFORMATION TECHNOLOGY AND ENTERPRISE RESOURCE PLANNING TOWARDS BUSINESS PROCESS RENOVATION

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Abstract:

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The main goal of the paper is to stress the impact of information technology (IT) and enterprise resource planning (ERP) systems in business process renovation and discuss some aspects of business processes and information modeling. Business process renovation is presented as the key element of the new business orientation and the highest level of strategy for managing change that commonly cannot be handled by continuous improvement and reengineering methods or organizational restructuring. In this transformation process we recognize ERP systems as the core functionality that facilitates the flow of information among different business activities of an enterprise, and also enabling information sharing across organizational units on different locations.

Povzetek:

Osnovni cilj prispevka je opozoriti na vplivnost informacijske tehnologije in celovitih rešitev na možnosti prenove poslovanja ter pri tem izpostaviti vidike in povezave med poslovnim (procesnim) in informacijskim modeliranjem. Prenova poslovnih procesov je predstavljena kot ključna dejavnost v smeri novih poslovnih usmeritev organizacije in je najpomembnejša strateška usmeritev upravljanja s spremembami, ki je ni moč izvesti z obstoječimi metodami korenite prenove in stalnih izboljšav ali pa z znanimi metodami sprememinjanja organizacij. Celovite rešitve vidimo v tem procesu kot ključne dejavnike, ki zagotavljajo informatizacijo poslovnih procesov oziroma informacijske povezave posameznih aktivnosti, kot tudi nudenje informacijskih virov organizacije njenim enotam na različnih lokacijah.

1. INTRODUCTION

In order to survive in highly competitive business environments, companies have to continuously change their business processes. New conditions in the marketplace have given a special stimulus to modelling business processes over the past ten years: product expansion, competitive sales conditions, development of global, world distribution networks, better informed customers, and orientation of the businesses toward their customers and satisfying their individual needs. In the light of this, re-engineering of business processes has often been employed, and information technology is a frequently utilized approach used to improve business processes.

The paper stresses the necessity for organisational restructuring in the context of global information connectivity. Business Process Reengineering (BPR) is an organizational method demanding radical redesign of business processes in order to achieve more efficiency, better quality and more competitive production (Hammer and Champy, 1993). It means analyzing and altering the business processes of the organization as a whole.

A business process includes activities and tasks that cross functional and/or organizational boundaries. Information technology (IT) is the most important factor in enabling new redesigned processes. Modern information technology is oriented towards business processes and communications between persons using these processes, and is therefore called process and information technology (Ould, 1995). In that way BPR can be described as organizational process redesigning, with the direct influence of IT. Despite the fact that many academics and practitioners agree on this idea, BPR and information systems modelling are still performed separately. The goal of this paper is to examine this domain and propose the framework for business process modelling and IT integration.

The main goal of the paper was to explore the relationship between IT, ERP and business process renovation. The evaluation of BPR is described in Chapter 2. A brief overview of ERP systems is presented in Chapter 3. The framework for business process renovation and ERP systems modelling is provided in Chapter 4. Finally, conclusions outline the main findings of this research in Chapter 5.

2. BPR EVOLUTION

BPR has become one of the most popular topics in organizational management, creating new ways of doing business (Tumay, 1995). Many leading organizations have conducted BPR in order to improve productivity and gain competitive advantage. However, regardless of the number of companies involved in re-engineering, the rate of success of re-engineering projects is less than 50% (Hammer and Champy, 1993). Some of the frequently mentioned problems related to BPR include the inability to accurately predict the outcome of radical change, the difficulty in capturing existing processes in a structured way, the lack of creativity in process redesign, the level of costs incurred in implementing the new process, and the inability to recognize the dynamic nature of the processes.

On the other hand, CPI integrates methods such as industrial engineering, systems analysis and design, socio-technical design and total quality management (Davenport, 1993; Galliers, 1998). Continuous improvement refers to programs and initiatives that emphasize incremental improvement in work processes and outputs over an open-ended period of time (Davenport and Beers, 1995). Several researchers suggest that using CPI techniques dramatically increases competitive advantage. Furthermore, it is particularly suggested that TQM be integrated with BPR (Al-Mashari and Zairi, 1999).

Business Renovation (BR) integrates the radical strategic method of BPR and more progressive methods of Continuous Process Improvement (CPI) with adequate IT (Kovacic et al., 2001). Process renovation is a reengineering strategy that critically examines current business practices and procedures, re-thinks them through and then redesigns the mission-critical products, processes and services (Prassad, 1999). The analysis of published BPR cases suggested that Hammer's well-known definition of BPR is too limited since it focuses on processes and ignores other important aspects of institutions such as organizational structure, people, communication and IT (Grant, 2002).

In the 90s, BPR focused on internal benefits such as cost reduction, the downsizing of a company and operational efficiency, which are more tactical than strategically focused. Nowadays, e-business renovation strategies focus on the processes between business partners and the applications supporting these processes. These strategies are designed to address different types of processes with the emphasis on different aspects (Phipps, 2000), (Kalakota and Robinson, 2001): customer relationship management, supply chain management, selling-chain management, and enterprise resource planning.

By strictly pursuing a process perspective, businesses are restructured across functional and hierarchical boundaries. To accommodate these changes, organizations may need to be restructured around these new business processes (Grover and Malortha, 1997). BPR driven by e-business could not be based only on radical redesign of intra-organisational processes, but should be extended to the entire business network (internal and external). An enhancement geared to include also inter-organisational processes is called Business Network Redesign (Alt et al, 2000). Business Network Redesign (BNR) is driven by global information connectivity and e-commerce. It identifies the inter-organisational processes to redesign and extend the strengths of BPR to the networking among business partners. An online partnership must extend far beyond presenting promotional and pre-sales activities on companies' Web sites. It has to drill deep into a company's processes in order to create totally different business models. Therefore, most companies need to re-evaluate and Web-enable core processes to strengthen customer service operations, streamline supply chains and reach new customers. Traditional companies are forced to change their current business models and create new ones.

It must be stressed that the application of IT has the strongest impact on standardization or elimination of process variations. For that reason, BPR and IT infrastructure strategies, which are both derived from organizational strategy are in need of effective alignment to ensure the success of the BPR initiative (Al-Mashari and Zairi, 1999). The merger of the two concepts has resulted in the latest concept: business engineering (BE). The entirety of BE lies in radical, process oriented solutions that have been greatly enhanced by the IT.

3. ERP OVERVIEW

Enterprise Resource Planning systems automate and integrate the core functionality of an organization. ERP facilitates the flow of information among the different functions of an enterprise, but it also enables information sharing across organizational units and geographical locations (Markus et al., 2000).

3.1. Brief history of ERP

According to Kalakota and Robinson (2000) the evolution of ERP systems could be devided in 4 phases: Manufacturing Integration, Enterprise Integration, Customer-centric Integration and Inter-enterprise Integration.

Phase 1: Manufacturing Integration (MRP)
In the 1970s, the production oriented information systems were known as manufacturing resource planning (MRP) systems. The aim of the MRP was to schedule and release manufacturing work orders and purchase orders. In the 1980s the extended version of MRP called MRP II was developed in order to focus into other business functions, including order processing, manufacturing and distribution. Since its data and processes were not integrated with those in the rest of the enterprise, MRP II was improved and renamed ERP.
Phase 2: Enterprise Integration (ERP)
In the mid-1990s ERP is the latest enhancement of MRP II with the added "back-office" functions such as finance, warehousing, distribution, quality control and human resources management, integrated to handle global business needs of a networked enterprise (Siriginidi, 2000). The main goal of the ERP was to facilitate information sharing and integration across these different functions and provide automated solutions to a wide range of business processes. The goal of integration was: Use technology to develop process standardization across multiple business units in order to improve the efficiency and generate greater return on capital (Kalakota and Robinson, 2000).
Phase 3: Customer-centric Resource Planning (CRP)
The range of ERP functions has expanded at the end of 1990s to include "front-office" functions such as sale, marketing and e-commerce. E-commerce applications needed to be connected to back-end systems and thus forced many of the ERP software providers (including SAP, PeopleSoft and Baan) to reinvent themselves as CRP providers. While traditional ERP solutions were equipped to support the "make-to-stock/configure-to-order business model", CRP systems are able to meet the e-commerce "build-to build-to-order/fulfil-to-order" requirement. Effective manufacturing and service delivery in the e-commerce model requires customer-centric, continuous planning instead of the classic ERP assumption of long planning cycles.
Phase 4: Inter-enterprise Integration (XRP)
Since the world of the 2000s has become one of interconnected enterprises creating global information systems, the scope of ERP systems comprises the entire value chain of the enterprise, its customers, suppliers and trading partners. The main goal of the XRP system is to provide intelligent decision support capabilities in order to reduce inventories, foster strategic pricing, improve cycle times and increase customer satisfaction throughout the supply chain and selling chain management. To achieve the goal, an XRP model must support the integration of external and internal business activities with supplier's and customer's information and processes.

3.2. ERP Software Industry Trends

Competition in the ERP software industry is very strong, with over 500 software producers fighting for market share. The producers could be divided in two groups: (1) the companies that offer an integrated suite of applications and (2) those that make innovative niche products and solutions for supply change management, customer relationship management, advanced demand planning softwer (APS) and e-business applications. The major players in the first group are SAP AG, Oracle, PeopleSoft and J.D. Edwards, while the second group consists of several leaders like Siebel Systems and Ariba. Table 1 provides a breakdown by company of license revenue, market share and estimated growth. By 2001 SAP reported that it alone accounted for more then 36.000 software installations in 15.000 companies across 120 countries (SAP, 2001).

Company (2000 data)	Sales (in $ millions)	Market Share	Estimated Growth
SAP AG	5.939	30%	10%
Oracle	2.870	15%	14%
PeopleSoft	1.736	9%	17%
J.D. Edwards	980	5%	2%
Geac	901	5%	0%
Others	7.228	36%	8%

Table 1: **Profile of leading ERP companies (Source: AMR, 2001)**

While businesses such as Cisco Systems, Eastman Kodak, and Tektronix have gained the expected benefits of ERP systems, many companies like Hershey (Stedman, 1999), Nike (Konicki, 2001) and Whirpool (Collet, 1999) have experienced difficulty. For example, FoxMeyer Drug, a $5 billion pharmaceutical wholesaler, recently filed for bankruptcy. FoxMeyer argued that major problems were generated by a failed ERP system, which created excess shipments resulting from incorrect orders (Kalakota and Robinson, 2000). Dell Computer spent tens of millions of dollars on an ERP system that was too monolithic and too rigid for their changing global operations.

A study conducted by the Boston Consulting Group showed that only one out of three ERP applications could be classified as successful (Soh et al., 2000). A recent study indicates that ERP failure rate may even be greater than 50 percent: 40 percent of all ERP installations only achieve partial implementation and 20 percent of attempted ERP adoptions are scrapped as total failures (Trunick, 1999, Escalle et al., 1999). Ptak and Schragenheim (1999) also report that between 60 and 90 percent of ERP implementations do not achieve the return on investment identified in the project approval phase.

Despite the problems identified in ERP applications, the number of companies going in for ERP systems will grow continuously, changing in 3 directions: (1) the ERP vendors will integrate their solutions supporting the e-business and workflow-management; (2) the ERP applications will be upgraded to target additional functional niches (CRM, SCM, APS) and (3) the ERP solutions will be simplified to target hundreds and thousands of midsize and small companies.

4. FRAMEWORK FOR BPR AND ERP INTEGRATION

Recent BPR research papers demonstrated the critical role of information technology in business process restructuring (Broadbent et al.,1999; Teng et al., 1998). Previously, IT was used to help companies automate business processes, but recently, technology is being used to change those processes radically. IT plays the key role as an enabler in business process renovation and there is a strong correlation between the quality of information systems within an organization; and the improvement of an overall corporate culture and the organizations' strategies (Lederer and Sethi, 1996).

The principal claim of several authors is that Hammer's well-known definition is too limited because it suggests BPR is about making changes to processes, while IT plays only an enabling role (Grant, 2002; Koch, 2001; Siriginidi, 2000). The contributions of IT in BPR could be categorized in two different ways (Chang, 2000). First, IT contributes heavily as facilitator to the process of reengineering. Second, IT contributes in the reengineering process as enabler to master the new process in the most effective way (Davenport and Short, 1990). The advantages and disadvantages of IS modelling and ERP system as a tool for realising business renovation is discussed further.

4.1 Business process modelling and information system modelling integration

Different methods are used in order to achieve the goals of BPR. There exist a number of formal techniques for modelling business processes which are based on textual programmable languages or graphical notations, such as dataflow diagrams, state transition diagrams, role activity diagrams (RAD), IDEF, Petri-nets and related notations. Those formalisms can be used to structure properly the software of a process support system. However, to achieve the proper functioning of a support system in a particular domain, a formal model should be filled with a specific content, i.e. description of the actual business processes. The need to establish an explicit link between business and IS modelling has been recognised, but there has been little success to date in achieving the integration and co-ordination between process and IS modelling methods and tools.

Information system modelling should be derived from a model of business processes and the corporate strategic IS plan. Business process modelling is usually followed by IS (ERP systems) development and business process automation. An automated business process is referred to as a workflow (WF), while a Workflow Management System (WFM) is software used for its coordination and control (Mohan et al, 2000). The IS/WF modelling environment provides a structured way of identifying and capturing all information, relationships and business rules that constitute a business process (Kovacic et al, 2001). For efficient workflow development, the process of defining and understanding business processes should be finished before specifying and implementing the corresponding workflow applications. Rather than only viewing the flow of processes, future WF/ERP systems will model and monitor processes affecting the performance of the business.

There is also an intention of integrating process modelling tools into the workflow environment to minimise implementation cost. In practice, mostly all interfaces (methods and tools) between BPM and WFM simply implement a 1:1 coupling between these models. The solutions could be divided in 2 categories:

- The Workflow Management Coalition's (WfMC's) work group was (in 1996) developing the integration between a business process and a workflow model (Interface 1) based on a modelling language. Interface 1 Definition deals with passing Process Definitions from external modelling tools to the workflow engine where there are enacted. The Coalition published a new language as a precursor to the Interface definition. This interface includes a common meta-model for describing the process definition and also textual grammar for the interchange of process definitions (Workflow Process Definition Language – WPDL). This model meets standardisation requirements but has very limited practical applicability.

- There are different tools for the transformation of BPM to WFM and also some 'tool-supported' approaches to the deployment of business process models (i.e. ARIS method and tools) for selected application. Applications can be implemented either by: (1) adapting and assembling process-oriented business objects or by developing applications from scratch; (2) implementing standard business applications (i.e. SAP); (3) implementing workflow systems; or (4) an object-oriented system development using the Unified Modelling Language (UML) (Sheer, 1999). Here, the BR framework consists of the following four levels: Process design, Process management, Workflow and Application. The connections between particular levels are explained, yet the refinement method which supports the transition is not defined. Event-driven Process Chains (EPCs) have become a widespread process-modelling technique because of the success of products such as SAP/R3 (ERP) and ARIS (tools). Unfortunately, neither the syntax nor semantics of EPCs are well defined. As a result, an EPC may be ambiguous and it is not possible for consistency and completeness. These problems are serious because EPC models are used as the specification of business rules processed by WF systems. In using these approaches, experience has shown the tendency to over-analyse existing business processes and IS implementation problems.

To resolve this problem of complexity, some authors propose a rule dictionary or rule repository where business rules have to be represented. This repository is the core of a development environment providing appropriate tools for process, workflow, data and organisation modelling, process refinement, as well as import and export capabilities. A rule-repository system also provides the opportunity to implement capabilities for analysis and simulation. The experience leads to the conclusion that this rule-based methodology has advantages over established tool-supported Petri nets (i.e. INCOME) and EPC (i.e. ARIS) rule-refinement approaches.

4.2 The role of ERP in reengineering business practices

In the past, companies used to decide how they wanted to do business and then made a decision about a software package that best supported their business processes. It was changed with ERP systems that required the business processes to be modified to fit the system (Davenport, 1998). Recent ERP solutions are modular and flexible, thus could be customized to a certain degree. There are, however, constraints in design possibilities, while major modifications are complex and extremely costly. The implementation delays and ERP products modifications could result in exponential growth in direct and indirect costs. From the above analysis, it would be always better to finish BPR project in advance of information system modelling and ERP system development. Since the implementation of large information systems is not possible without first changing business processes, reengineering is essential to obtain the most benefit out of the ERP products.

However, the analysis of businesses' practices showed a different approach. Initiating BPR projects in advance of ERP means that the companies must provide resources for two successive projects. It was the reason for many companies to conduct ERP system development, trying to solve all their organizational problems without previously reengineering business processes. An ERP implementation impacts significantly the company's culture, its organizational structure, business processes, procedures and rules.

In addition, ERP applications integrate many best business practices and knowledge that could be worth including as a part of BPR projects. By taking the best practices inherent in ERP applications, companies can change their processes simultaneously with technological change. As a result, a lot of companies changed their business processes to fit the ERP system requirements and the possibilities of ERP systems have been used to underpin BPR (Kooch, 2001, Chen, 2001)). As ERP systems have traditionally taken too long to implement, a dynamic and incremental implementation of ERP components is proposed rather than a massive reengineering.

It must be stressed that a lack of matching business processes with a company's ERP system can derail even the best-run firms. Managers and employees must be able to assess the technological and business process issues involved with specific ERP applications. It is well known that overcoming employee resistance could be a critical factor for the successful completion of a project and top management must provide leadership for all changes, efforts, objections and disagreements that arise in the process of reengineering and ERP implementation. The large sample of enterprises has shown that several approaches to the combination of BPR and ERP are in play and that they lead to different levels of integration.

Many agree that in today's business environment intangible assets comprise 80% of organizational value. Intangible assets usually bring long-term benefits to the organizations. The synergy created and manifested by ERP and BPR, along with new employee energy can provide organizations with unprecedented capabilities they never envisioned prior to ERP implementations (Chenn, 2001). Ahmed (1999) also

point out that evidence of practical experiences of success of business process change related programs require ongoing effort for at least three to five years, even reaching time frames of around 10-20 years for realization of full potential. Consequently, the focus of ERP implementations moved from matching business processes with the ERP system to developing "knowledge-workers" that can quickly understand and work with redesigned processes and realize the ERP-enabled benefits.

5. Conclusion

The paper investigates the problem of realizing benefits of business process restructuring and ERP systems development. Enterprises could use ERP capabilities to improve coordination and information access across their units and to enable effective links between the enterprise and its customers, suppliers and trading partners. This changes the emphasis from an internal focus to an external orientation. ERP systems reinvent the way a company and its people operate. Therefore, as an organization introduces ERP, it also must take simultaneous changes in its business processes and business strategy. According to the literature, BPR is concerned with making changes to business processes, while IT serves only to enable organizational improvements. The practitioners showed that BPR methodology was too restrictive and it should adopt a much broader view on the role of ERP systems in BPR projects.

ERP systems impact overall operational performance in two phases. In the short term the focus should be on stabilizing new processes managed by ERP technology. In this phase it is very important for the companies to understand their business processes before altering them through ERP implementation. Therefore, different methods and tools used to model and measure business processes and requirements were discussed in this paper. In the post-implementation period the ERP investment could be extended in new directions, towards CRM (Customer Relationship Management) and KM (Knowledge Management) systems enabling people to maximize the application of their knowledge to achieve companies' strategic goals.

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