THE ANALYSIS OF AVAILABLE ERP SOLUTIONS AND TRENDS IN INDUSTRY OF MANAGEMENT INFORMATION SYSTEMS

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Abstrakt*: The development of information technology has changed familiar patterns of business behavior. The adoption of appropriate solutions, driven by current IT, became necessary for almost all market participants who want to survive and thrive in today's business environment. When we talk about the Enterprise Resource Planning systems we imply that it provides plenty of opportunities for collecting, processing and distributing information about business processes. However, many forget that the concept of ERP originated in commercial circles, and that borders of its scope are very vague and dynamic. Therefore it is important to understand what ERP means today and in what direction it will develop further as well? We investigated the characteristics of modern solutions in this family of management systems, to provide answers for these questions. We believe that proper understanding of the ERP role in today's and future business conditions is essential for successful competing on global market.*

Keywords*: Enterprise Resource Planning system, Management Systems, Information Technology*

INTRODUCTION

The necessity of continuous development monitoring of information technology is apparent because of the speed of their development which is why the experts and academics increasingly discuss contents related to their analysis and application outcomes. The degree of application of the system for business planning (Enterprise Resources Planning – ERP) can be seen as an indicator of economic growth and development, which speaks of the actuality of this theme and of importance of monitoring available solutions.

Examples of different and often opposing definitions of ERP can be found in very large number, which is why the intetntion of the autors ot this paper is to handle this problem from the moment of its creation, ie ,from the begining of the development of this system on the market.Proper understanding of this popular and current term such as ERP is very important for academic and scientific circles. Analysis of available literature indicates how the definitions which are presented in literature are incorect and not updated, and how much are the SCM (Supply Chain Management), CRM (Customer Relationship Management) systems, accounting software and business intelligence and analytical tools are a default part of any serious ERP solution and how they are conceptually inseparable.

This paper presents the results of online survey of the most important commercial and open-source packages offers. This paper also presents concept of production CAD/CAM/ERP hybrid. The research was conducted during August and the begining of September in 2011.The aim of this paper is that by comparing the most important commercial and open-source ERP packages to show their characteristics and to indicate the direction of their future development.In accordance with the objectives, the characteristics of the strongest and most expensive products offered by the best known companies were compared. At the same time,the difference between their current offers was presented. Pointing out the characteristics that constitute the core of every modern ERP systems, the authors assumed further developing of this market and elements to be found in the mandatory offer.

We analyzed the available information from websites suppliers of five the most commercial ERP family solutions , as well as five the most active open-source projects.The sample, ie. the group of the best known suppliers are the following companies: SAP, ORACLE, SAGE GROUP, INFOR, MICROSOFT

The above mentioned hybrid CAD/CAM/ERP solutions are not included in their entity because they are numerous and specialized software products and are not very familiar to the general IT public.Therefore it was decided to present two

such solutions, as they are available on Serbian market through general dealer.

CHARACTERISTICS OF ERP SYSTEM

The name of ERP has primarly commercial origin and that is why it is impossible to determine its precise characteristics without market analysis. It is clear that it is about Enterprise resources planning, but the term „resource" has very broad scope-the scope that has increased during the time along with development of intelectual property awareness and the value of knowlledge and experience of the organization members. Piuccoli notes that the name ERP itself does not have too much sense for those unfamiliar with formation of that management system group because the systems that bears that name completely have changed their functional scope and purpose during the time (see /6/ page 360-361). Since the time when it fulfilled its initial purpose of recording inventory and production work orders, ERP has completely changed, which is why there is a confusion in the academic literature with regard to this concept.

In the literature we can find very different ideas about the role of ERP in organization and its characteristic.We see that some authors see it as separate management software which is in the same line with CRM and SCM systems as well as it does not overlap with them in scope and function (see /1/ page 13).On the other hand, very respected authors in the field of E-business consider ERP as intranet solution which sometimes involves connecting of enterprise network with key suppliers.(see /5/ page 33).Sunih Chopra agrees with this view, but emphasises that SCM and ERP are basically the same informational systems but SCM helps in decision making while ERP only follows what is happening in supply chain (see /3/ str.71). The informatics experts have different view and they explain the ERP as a system to connect all of the independent control systems such as CRM and SCM and to enable their better coordination and integration into a unified information system (see/4/ pages 2-31). In accordance with this and to a more precise form, the definition of the term is given by Dave Chaffey who states that the ERP integrates all of the major business functions such as manufacturing, distribution, sales, financial management and human resources (see /2/ page 166). We must note that the last definition is closest to reality which we found in market research.

Table 1a: Basic functions included in modern commercial ERP system

#	Code	Description in English
1	**CRM**	**Customer relations management**
2	**SCM**	**Supply chain management**
3	LOG	Logistics
4	**FIN**	**Finance management**
5	ANC	Accounting
6	PMN	Project management
7	PRM	Portfolio management
8	**MCH**	**Manufacturing**
9	EDM	Engineering Data Management
10	QMN	Quality management
11	**PRO**	**Procurement**
12	**INV**	**Inventory / Warehouse**
13	CUT	Customization Tool
14	**HRM**	**Human Resources Management**
15	**SEL**	**Sales and selling management**
16	**MRK**	**Marketing**
17	**SRV**	**Customer services**
18	SEC	Health and security management
19	**BIR**	**Business intelligence and reporting**

Many companies have established their position on market by using the results of development of information technology, while some of them have progressed in variable business condition which are characterized by increasing competition.The effects of introducing ERP on company growth are shown in revenue growth of company *Compaq* which has raised from 7 to 35 billion dollars during four years of its application. (see /7/ page 58)

The first step of researc presented in this paper was a preliminary overview of the characteristics of all modern commercial ERP systems in order to indentify the properties on which we would further compare them.Thus, the tables 1. and 2. were formed, and three-letter code marks that we will use below were accepted.

Table 2: Some more "special" characteristics of ERP

#	Code	Description in English
20	WEB	Web based platform
21	CCP	Payment processing service / e-retail
22	PRL	Pay-roll service
23	DSG	Design of product / CAD
24	CAM	Computer Aided Machining

All observed features do not have the same importance or scope, some of them even overlap-but the taxonomy adopted was the best possible solution considering the medley of ERP software

commercial offer. In table 1.a. the lines with more important elements of ERP are bolded in order to be easily recognized.

COMPARATIVE ANALISYS OF COMMERCIAL ERP SOLUTIONS

In the analysis represented in Table 3. the description of the strongest / the most expensive products of each company was used in order to gain insight into the functional modules in whose development the company is involved. The results of this study identified the following characteristics as the core of every modern ERP system:

- Financial Management and Accounting (FIN, ANC)
- Customer relationship management and sales management (CRM, SEL)
- Supply chain management and logistics planning (SCM, LOG0)
- Inventory management and procurement (INV,PRO)
- Project management and planning activities (PMN)
- Business - business intelligence and reporting (BIR)

Table 3: Survey of functional differences between commercial ERP vendors

Brand	SAP	ORACLE	SAGE GROUP	INFOR	MICROSOFT
Product	Business Suite	E-Business Suite	Accpac ERP	Infor10 ERP Enterprise	Dynamics AX
PRM	Yes	Yes			
MCH	Yes	Yes		Yes	
EDM	Yes			Yes	
QMN	Yes	Yes		Yes	
CUT			Yes	Yes	
HRM	Yes	Yes	Yes		Yes
MRK		Yes	Yes		Yes
SRV	Yes	Yes	Yes	Yes	
SEC	Yes				Yes
WEB	Yes	Yes	Yes		
CCP	Yes	Yes	Yes		
PRL	Yes	Yes	Yes		Yes
DSG					
CAM					
	All commercial suppliers have: CRM, SCM, LOG, FIN, ANC, PMN, PRO, INV, BIR, SEL				
source:	*sap.com*	*oracle.com*	*sageaccpac.com*	*infor.com*	*microsoft.com*

Sources are pages and PDF brochures from the web sites of the companies. Research conducted on September 3rd in 2011.

Business Intelligence Analysis is a'cool" expression in IT and business circles and from the market point of view the interest to mention it in every offer is clear. However, only a detailed analysis of the characteristics of tools from BIR segment would show the real differences between the qualities of supply. This analysis goes beyond the ambition of this paper, so we will remain on the statement that: everybody offer business-intelligence analysis, but the question remains how big are the differences in quality and real added value that the users have.

In the results we recognize a group of modules (functional units) that can be frequently seen in the system offers and it can be assumed that the further development of ERP market will make them compulsory elements of the offer:

- Management of post-sale services and customer service (SRV);
- Human Resources Management (HRM);
- Alternative system on the web platform, i.e., optional web interface for the asses to the system (WEB);
- Management of payment and their automatic execution (PRL).

During the analysis of the offer it was observed that most of the suppliers particularly set aside module for management of post-sale services and customer services (SRV) , while the systems of other (ex. Microsoft) are very likely to follow complete business processes through CRM or sales module, but they are not singled out in offer. While Human resource management is result of evolution of management as science and socio-economics trends in the world, the presence of web technology in ERP systems (WEB) and the possibility of automatic payment activity (integration with IS banks) are (PRL) logical consequences of technological evolution of the business environment. It is evident that the biggest providers offer subsystems for on line card payment (CCR) ,which are often accompanied by the entire Web /CMS e-commerce solution(we did not particularly monitor this characteristic during the analysis but it is usually presented where CCR is .

Table 4: Number of observed characteristics offered by the vendors

#	COMPANY	# characteristic
1	SAP	20
2	ORACLE	19
3	SAGE GROUP	17
4	INFOR	15
5	MICROSOFT	14

Research: September 4th 2011

The penetration of information technology in business processes is accompanied by modules for organization of specific business activities which move the ERP focus from registration-analytical to organizational –operational functions. Thus, SAP and Oracle offer a product portfolio management (PRM) ,manufacturing (MCH) and quality system (QMN).The Infor company went a step further by providing the technical documentation management (EDM) i.e., project documentation and NC programs for CNC machines and production lines. The move made by this company is logical because the market is saturated and needs to find new niches to avoid competition. SAP is certainly striving to cover all segments of market, but there will always be room for specialized suppliers (Table 4.).

THE STRATEGY OF ERP SOLUTIONS VENDORS

Managing business information is not too demanding technology and it is followed by large investments in research and development. That is why the focus of the competitive struggle is in the ability of ERP system is to adapt to the specific needs of the business processes of the organization that it introduces. So, in the battle for market, a key role play dealer networks or local distributors who need to adapt the system and to train the customer? Establishment and maintenance of such network represents a challenge even for big companies, and smaller market players have resorted to a new tactics. The Sage Group and Infor companies offer a variety of tools that the customer can use and adjust the performance of his system (CUT) by himself .Those tools are intended for IT personnel of the client that does not need to have special knowledge and skills about software development.

According to the content of the offer and the way it is presented to the website visitors, we can conclude that the suppliers have formulated market strategy on this way:

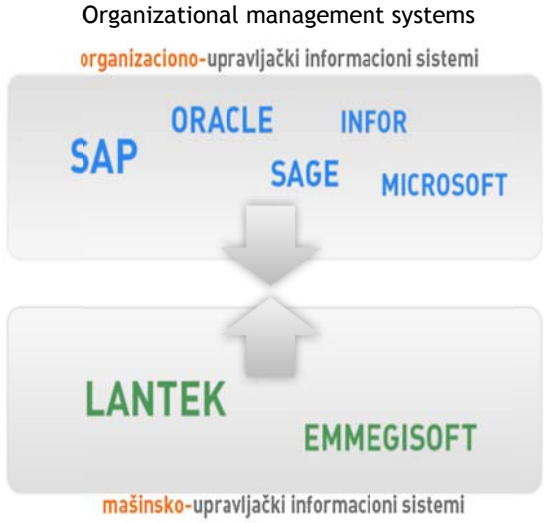
- SAP tends to cover all business processes in all industry segments, what is a big challenge given the specifics of business processes in various industries. It is hard to say how much is that successful, but there is a general impression that SAP is the market leader and that his system is the best in the branch.
- ORACLE sees itself as ideal vendor for all industry segments, but for now it does not have ambition to cover individual and very specific business processes such as managing technical documentation and programs for machines. Its strength in the market makes the popularity of this brand that is due to other software products and long tradition in IT world
- SAGE Group does not see its main market segment in companies that deal with physical production, so its offer do not contains special functions for production processes monitoring, while it is, at the same time, enriched with marketing tools and functions for business on the web
- INFOR is focused on the production companies for which it strives to develop systems which will in detail monitor production processes and processes of product development by managing, not only information and documentation, but also other forms of digital resources (3D models,NC programs for machines , etc.)
- MICROSOFT solutions have the best starting position for it has as a background the best known IT brand in the world. However, they are not designed with ambition that SAP and ORACLE have-to follow all the specific processes-but they keep with key aspects of ERP system with additional support for extending and customizing by the users.

CAD/CAM/ERP/SOLUTIONS

We have noticed that traditional producers of business software and ERP solutions tend to expand their market segment and penetrate deeper into business processes of production and specific operations. The rapid development of machine control started with NC control (Numeral Control) that the operator used to enter numerical values of certain parameters of machine operation. We can see it on the example of NC press brakes for sheet metal bending where the operator would ,using NC control, determine the position where the borderer of the last (X) axis should go (determines the length of the page which is folded), and where the main frame of Y axis should go (which determines the bending angle).

Today, machine control includes very powerful industrial computers (*CNC-Computer Numerical Control)* which are changing the parameters of NC controllers according to given task and thus they perform additional automation of production processes, which is also called CAM *(computer aided manufacturing*). The programs they execute are usually called NC programs or G-code and they are usually designed with CAD/CAM software that connects technical drawing, universal and abstract by its nature, with particular machine on which is necessary to make a product with the available processing technology.

The previously described characteristics of modern production are good basis for further integration: information management systems at the organizational level with information management systems at the machine level. This is definitely the way that followed above mentioned ERP solutions producers but they are being followed by CAD/CAM software producers which see the opportunities for further business growth in expansion toward organizational information system (picture 1.)



Picture 1: The ratio of two segments in the software industry and its trends

In previous analyzes market leaders of ERP / management software were analyzed because the market is relatively homogeneous, i.e. all of the key characteristics that a product must meet are known, and the customer base is very broad. In the case of specialized ERP solutions which have their origin in the CAD/CAM programs, it is very difficult to make a global view because of heterogeneity of the user base: CAD/CAM programs are related to technology and machine processing case so we can not directly compare them because they are not competition to each other.

As an example, we can give the company LANTEK which offer ERP solution that is integrated with its traditional product: CAD/CAM solution for continuous sheet cutting (laser, plasma, water, oxy-cut), bending and punching of sheet metal. Another company that on the base of CAD/CAM has built complete ERP is EMMEGISOFT, but its traditional product supports processing of ALU and PVC profiles in terms of cutting, drilling, welding and the like. Although both companies make ERP which is specialized for the manufacturing companies and direct production management, they are not competitors because they are oriented toward different industrial segments. However, by examining the characteristics of their offer, we can find out something more about this ERP system type (table 5).

Solutions that specialized ERP systems bring are incredible. Emmegisoft in its brochure promises: "At a moment when a visitor in a remote selling place defines with a seller his ALU windows order for his office space, the system automatically forwards this information to the main server which generates NC programs for machines that are necessary for the realization of the order. The system further classifies NC programs to CNC computers of automated processing centers and production starts immediately." While LANTEK is an independent company, EMMEGISOFT is a part of Emmegi Group, which manufacture specific machines for ALU and PVC profiles and due to that is really able to make such a deep integration of organizational and production processes.

Table 5: Survey of supported functional units of analyzed suppliers ERP specialized solutions

Brand	Lantec	Emmegi
Product	Integra	FP Suite
CRM	Yes	Yes
SCM		Yes
FIN	Yes	
ANC	Yes	Yes
MCH	Yes	Yes
EDM	Yes	Yes
PRO	Yes	Yes
INV	Yes	Yes
SEL	Yes	Yes
DSG	Yes	Yes
CAM	Yes	Yes
	Both analyzed vendors do not have following modules/functions in their ERP platforms : **LOG**, **PMN**, PRM, QMN, CUT, **HRM**, MRK, SRV, SEC, **BIR**, WEB, CCP, PRL Total number of supported modules is 10 for both vendors	
Sources:	*lantek.com*	*emmegisoft.com*

Sources are web presentations and company brochures; analysis was made on September 4th 2011

We can conclude that the future of ERP system is in automatic programming of production facilities, and the main obstacle that should be overcome is further standardization of machine manufacture,

computer control in whole and machine program syntax –NC codes. This process has been started several times for different types of processing: for example, NC code specification for sheet metal punching: G-code, was adopted .However, the main challenge is in rapid progress in mechanical processing technologies as well as in strait competition between equipment manufacturers who have not been organized yet in technological consortia as in the case of software manufacturers.

A key market segment for manufacturers of this ERP systems type are the existing CAD/CAM system buyers and the companies that use a lot the supported types of machine processing. The ultimate market ranges of CAD/CAM/ERP vendors determined by the absence of some of the basic modules that, by default, are expected in modern ERP systems:

- Logistic Management(LOG)
- Project Management (PMN)
- Human Resource Management (HRM)
- Business Intelligence Analysis (BIR)

Also, based on the presented analysis and results, modules whose presence would also be advisable for expanding their customer base are the following:

- Quality Management (QMN)
- Management of marketing activities(MRK)
- Post-sale management(SRV)
- Web platform support (WEB)

The future of these systems is in the introduction of expected organizational modules and further approach to characteristics of classical ERP. Without the development of these modules the vendors will not reach the traditional ERP system buyers, but will remain restricted to their narrow market inherited from CAD/CAM business operations. Their buyer will have to buy solutions of other software companies for their optimization of uncovered business processes, which is a particular danger for future business considering that SAP and INFOR want to get closer to production process and it is very possible to "attack" both CAD/CAM market at the same time.

OPEN CODE ERP SYSTEMS

For uninformed, open source movement is a brood of hippie idealists who fights against injustices of capitalism by sharing the fruits of their effort and knowledge to everyone for free. When we further analyze open source organizations and their projects, we realize that they earn very much and that the new business model based on open code is responsible for abrupt expansion of this movement.
By searching a key open-source hosts (CodePlex, Sourceforge, Google Code, JavaForge, LaunchPad, Tigris) we came to a large number of projects that promise a functional ERP solution.

The key difference between those who made partial success in this and were further analyzed by us, and the others is in response to the question: *Whether there was a business model that as an aim had a profit?* Or *it was all about the enthusiasm.*

The business model of the leading ERP open code solutions includes a free platform that supports some of the basic ERP functions and optional upgrade on a commercial basis.Upgrading usually brings new modules, integration with third party services (e-banking, SMS, e-mail...) automatic update of code version and providing of professional technical support-whose absence is often given as main problem of open-source products in general.

Table 6: Analysis of supported modules (functional units) in the leading ERP solutions from the open code family

Brand	OpenBravo	OpenTaps	Compiere	OpenERP	xTuple
Product	Community	Open Source	Community edition	Community edition	PostBooks
SCM		Yes			Yes
LOG	Yes	Yes		Yes	Yes
FIN	Yes		Yes		
PMN	Yes		Yes	Yes	
PRM					Yes
MCH	Yes	Yes		Yes	Yes
CUT				Yes	
HRM		Yes		Yes	
MRK		Yes	Yes	Yes	
SRV	Yes	Yes	Yes	Yes	
BIR	Yes	Yes		Yes	
CCP	Yes	Yes	Yes	Yes	
PRL		Yes			
	All analyzed solutions have following characteristics / modules / functional units: CRM, ANC, PRO, INV, SEL, WEB Modules that were not supported in any case: SEC, DSG, CAM, EDM, QMN				
Source:	openbravo.com	opentaps.org	compiere.com	openerp.com	xtuple.com

Research: September 4th 2011

The market of open code products users primarily expects free solution, so in our analyses (table 6.) we presented the characteristics of the basic software versions which usually bear the name

„Community Edition" emphasizing its *open-source* nature.As it is logical to expect, free solutions support a smaller number of functional units than commercial (Table 7,compare with table 4.)

Table 7: Number of supported characteristics of ERP system of open code

#	Bidder	# characteristic
1	OpenTaps	15
2	OpenERP	15
3	OpenBravo	13
4	Compiere	11
5	xTuple	10

based on web presentation analysis and brochures carried on September 4th 2011.

If we rank ERP solutions of open code according to supported business activities, we would conclude that *OpenTaps* is leader on this market, however, the quality, stability and adaptability must be considered before making such assesments. It is interesting that there is not any open-source solution with modul for quality management (QMN), and human resource management is not often a part of free installation.

Commercial solutions are traditionally based on client / server architecture, while the open source system are entirely based on web platform whose cause is open nature of web technologies such PHP language, MySQL database and Apache/Linux server.

The existence of tools for self-adjustment of the system is not, on this market,a default characteristic, what needs to be understood because of the very nature of open code and target market. Organizations that are typical users of these solutions have already some IT competencies and their own programmers who can, by making some changes in open code, customize the system.

CONCLUSION

The market management system is practicaly the biggest software market after the operating system software consideering the number of potential users and budgets at their disposal. Limits of ERP segment in this market are extended by the constant growth of competition, globalization, the IT standards adoption, and education of managing structure in business organizations as well.

We have seen that ERP solution vendors are trying to survive under the condition of high competition by developing solution for specific business operations and orientation to the more narrow market niches. The competition is further increased by CAD/CAM companies which, due to the pressure on its own market and desire to to grow the business, expand their products toward organizational functions.The collision of those two developing tendencies is presented on Picture 1, and we can be sure that this tendency will mark the development of ERP in next decade

Finally, for both groups of commercial vendors a treat in limited form are all better solutions of open code.From our experince in operating systems , we can state that open source will never take the whole market but anyway it will create pressure to separate one small part of the users from commercial offer.

Response to the pressure of open code community will be focused on those areas that require more specialized knowledge and alliance with third companies-which brings us right to conclusion that the manufacturers of control systems and ERP continues to approach to the operational side of manufacturing processes and the management of mechanical plants.

LITERATURE

1. Bidgoli, H. (2010). *Management Information System 2010*, USA: Cengage Learning
2. Chaffey, D. (2009). *E-Business and E-Commece management*, Edinburgh Gate: Pearson Education
3. Chopra, S., Meindl, P. (2010). *Supply Chain Management*, Edinburgh Gate: Pearson Education
4. Laudon, K.C., Traver, C.G. (2010). *E-Commerce 2010*, New Yersey: Pearson Education
5. Kotler, Ph., Keller, K.L. (2006). *Marketing Menadžment*, Beograd: Data Status
6. Piccoli, G. (2008). *Information Systems for Managers*, Danvers/MA, USA: John Wilez & Sons, Inc
7. Ratković, M., Grubić, G., Majdak, S, *Primena sistema za poslovno planiranje resursa u Srbiji*, Zbornik radova: Aktuelni problemi ekonomskog razvitka, Međunarodna naučno-praktična konferencija, Ministarstvo obrazovanja i nauke Ruske Federacije, Tehnološki fakultet, Univerziteta Šukov, Institut ekonomije i menadžmenta, Belgorod 2011.