

*D. S. Zukhba, MBA, PhD, Ass. Prof., SU «Donetsk National Technical University»,
daurzukhba@mail.ru*

Mutual influence of value of innovations and dialectics of ERP systems development is demonstrated. It is shown that the significant qualitative changes in modern ERP systems lead to changes in their accessibility to potential customers, and that is especially important for small innovative enterprises. Recommendations on the effective usage of ERP systems were developed, including those relevant to the formation of the cost of innovative products.

Keywords: value, innovation, market, model information communication technology (ICT), Software, Software component, enterprise resource planning (ERP).

Statement of problem. Modern information communication technologies create new opportunities for automation of enterprise resources planning. It is also a very important condition for innovation activity development both inside the sector of software and its components vendors and for their customers. It is due to the new quality level of management and analysis of production activities created by ERP system.

At the same time, both ERP and the overall market environment for its implementation are not stable, on the contrary, they are actively evolving, becoming determinants to identify the value of innovative products and assets.

Analysis of recent papers. ERP systems and various types of innovation development are of interconnected and interdependent nature. In modern conditions the concept of ERP extends beyond the enterprise itself. As result of quick (by historical standards) evolutionary development it involved more and more various aspects of information service from material resource planning in the past, through the involvement of financial, human and other tasks to suppliers and customers relationship management with the usage of cloud storage and analytics technology.

In this increasingly complex environment, many clients' questions remain topical, and they become even more important for the practice of management. Despite the presence of the relevant literature (see [10], [5], in particular), the problem is not completely solved. Decision-makers are influenced by permanently changing market situation. Its monitoring de-

termines the choice of answers to the following questions: How to choose adequate ERP system? What benefits and advantages it gives? What are the new competitive opportunities in this innovative by its nature modern market environment?

Aim of the paper. The purpose of this paper is to reveal the causes and consequences of co-evolution of two processes: development of ERP systems and creation the value of innovation.

Materials and methods. ERP systems historically arose as a response to the challenges of the increasing complexity of enterprise management. These challenges are particularly visible in large enterprises. For them multiple tasks defined complication of interrelations in the business processes. Scale of activity has determined high price of possible mistakes in management. At the same time it created the potential to reduce operating and other costs through implementation of effective information technologies (IT).

A necessity to manage inventory has become an immediate impetus for the emergence of the ERP predecessors' software. The loss of synchronization in supply of raw materials and its components to the enterprise's warehouse was one of the major problems, as well as accounting, tracking the status of in-process and localization of specific components batch to final products. For that reason appeared consistently Inventory Control Packages (ICP) и Material Requirements Planning (MRP) software. This software allows to reach tactical goal of meeting needs in components of the

manufacturing process at any moment of time. At the same time, it allowed to reduce the permanent stock, and thus relieve the warehouse and reduce the necessity for working capital.

Subsequently, it was proposed to add several new functions to the existing ones, including monitoring compliance of production quantity with components used for operation activity, monitoring delays of orders, control the volume and dynamics of sales, supply chain management and customer relations and a number of others. The main qualitative innovation has been the creation of feedback in the system of planning and production, providing a reaction to external factors such as demand growth, suppliers' state of affairs, etc. The idea of applying the 'closed loop' concept in MRP systems emerged.

Creation of systems, called MRP II (Manufacturing Resource Planning) became the next step, with enhanced functions. They were intended for the planning of all resource types, including financial and human resources. There were created the opportunities of scenario analysis «what-if». There was approved the relevant standard – MRP II.

Integration of planning the financial resources management functions and ensuring the transparency of production processes have led to emergence of Enterprise Resource Planning or ERP systems. In 2000-s, gradually emerged up a new approach of ERP II (Enterprise Resource and Relationship Processing), including new aspects of the planning and operation of the enterprise in particular SCM (Supply Chain Management) and thus – relationship with suppliers and customers and CRM (Customer Relationship Management).

Today we face the explosive development of this kind of IT that is not yet have arisen as a well-established name. Let's conditionally call it ERP+ system. This approach can be characterized as adaptation software for the specific demands of the customers, open source, low-cost, cloud-based technology. Some of its peculiarities will be analyzed in more detail below.

Summarizing all mentioned above, we can observe gradual complication of ERP systems and their development in the direction towards coverage of the increasing functionality, creating opportunities of new solutions, complicating according to development of its de-

mand and complication of problems which should be solved.

In its turn, it meant increasing importance and economic value of such innovative software products for the customers and expansion of the potential in creation of innovations and identifying the value of innovation on the market.

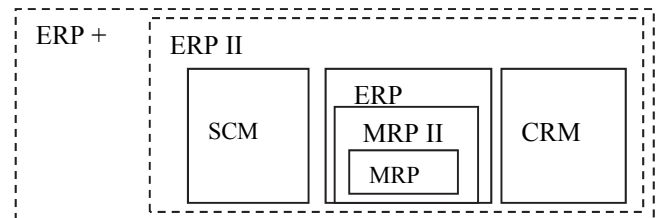


Figure 1. The hierarchical representation of ERP systems

In general, the evolution of ERP systems can be represented as a diagram – see Figure 2. (Built on the basis of research ERP Systems Market Primer [7] and author's own analysis).

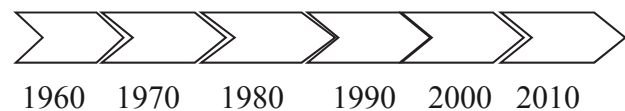


Figure 2. Evolution of ERP systems

Thus, there are several major trends in the dynamics of ERP systems. First, it is developed in accordance with requirements of demand and real possibilities of computer technology, and software architecture of various functionality. Second, there is an expansion of planning and management aspects at ERP technology. Thirdly, there is creation of new and improvement of existing modules relationship management, both in the structure of the enterprise and beyond. Fourth, significant qualitative changes in the relevant software occurred almost regularly since its inception with a frequency of about once every ten years. Fifth, the software itself at every stage of its existence and development was an innovation is in certain aspect, and at the same time, was a prerequisite for the development of innovation in the manufacturing sector. It has facilitated to the rapid evolutionary creation and development value of innovative goods and services.

Important questions for understanding quantitative parameters and qualitative tendencies of ERP market development are volume,

structure and forming of competitive advantages for different technological solutions. The overall estimate of software market according to study by Global Software Top 100 Edition 2011 [8] is \$235 bn. in 2010 and it grew by 7% compared to 2009, despite the overly negative global conjuncture.

The maximum increase of sale volumes was achieved by Oracle – 12.8% out of 10 world biggest software companies (see Table 1) One can also observe a relatively high degree of concentration and centralization of the market – the 10 leading companies possess a market share of approx. 60%, and the 4 biggest of these ten – approximately 25%.

One can also observe a sufficient regional concentration of 100 leading software-producing companies. As seen in Table 2, the overwhelming majority of them are located in USA.

Table 1
The world biggest software-producing companies in 2010

Rating	Company	Sales of software, \$ mln.	Growth rate of software sales, %	Total revenue, \$ mln.	Share of software sales
1	Microsoft	54 270	10,6	67 383	80,5
2	IBM	22 485	5,1	99 870	22,5
3	Oracle	20 958	12,8	30 180	69,4
4	SAP	12 558	10,5	16 654	75,4
5	Ericsson	7 274	-4,2	30 307	24,0
6	HP	6 669	7,9	126 562	5,3
7	Symantec	5 636	1,3	6 013	93,7
8	Nintendo	5 456	-19,8	13 766	39,6
9	Activision Blizzard	4 447	3,9	4 447	100,0
10	EMC	4 356	10,0	17 015	25,6

Source: [8]

Table 2
Localization of main software-producing companies

Rating	Country	Number of software-producing companies from Top 100 list
1	USA	63
2	Japan	10
3	France	6
4	Great Britain	4
5	Germany	3
6	China	2
7	Canada	2
8	Netherlands	2
9	South Korea	2
10	Other countries	6

Source: [8]

At the same time, the main companies, which produce software for enterprises in 2008, were distributed in a somewhat different pattern, according to data by Enterprise Software Top 10 [6].

Table 3
Leading companies producing software for enterprises

Rating	Company	Software sales revenue, \$ mil.
1	SAP	10 500
2	Oracle	6 105
3	Sage	1 496
4	Infor	1 100
5	Microsoft	1 000
6	Salesforce.com	959
7	Lawson	463
8	Unit4 Agresso	326
9	Epicor	283
10	Visma	254

Source: [6]

As soon as the profitability of production and implementation of the ERP became evident, producers began to use their income on massive consolidation in the industry through acquisitions of competitors' assets. As can be seen from Table 4, almost all the leaders of this market were doing acquisitions of other companies in order to take a more favorable competitive position in the market. The acquisitions were so active in the past that many companies which previously were part of the top list in the 90s, today, do not exist as separate legal entities. And this process continues.

Table 4
Acquisitions done by leading enterprise software companies

Rating	Company	Acquired companies
1	SAP	Top Tier
2	Oracle	Peoplesoft, Siebel
3	Sage	Tekton, Emdeon
4	Infor	SSA, GEAC
5	Microsoft	Dynamics, Navision
6	Salesforce.com	–
7	Lawson	Intentia
8	Unit4 Agresso	Coda
9	Epicor	Scala, NSB Retail
10	Visma	Accountview, Volym

Source: [6]

According to the research «Clash of the Titans: An independent comparison of SAP,

Oracle, Microsoft Dynamics»; 2012 [4] by Panorama Consulting Solutions, in the period from February 2006 to May 2012 the leading position in the ERP systems market belonged to SAP [14], Oracle [12] and Microsoft [9]. SAP had the largest market share of all producers, holding over one fifth of the market – 22%. It is followed by Oracle with 15%-share of the market, and Microsoft with 10%-share. Companies of the second market segment, including Infor and Epicor, hold around 16% of the market; the third segment is represented by companies with 37% of the total market.

Large ERP systems vendors were able to achieve such a high success mostly due to their focused efforts to maintain the key consumers of their products. They could also be consumers, large companies, as it appeared they had the most obvious need for the development of IT, they could afford the luxury of implementing complex and expensive ERP and get most out of them. And one can prove this logic statistically. According to research data by AMR Research, 2007 [2] scale of the companies which consume ERP products is distributed in a following way: companies with income less than \$ 30 mil. – 15 %, from \$ 30 mil. to \$ 250 mil. – 22 %, from \$ 250 mil. to \$ 1 bln. – 32 %, more than \$1 bln. – 31 %. As we can see, biggest companies are prevailing.

What did this mean for consumers? The result had many aspects. As an example, we shall study the supply statistics for one of the market producers. The prices for Oracle Corporation products [11] range between \$5,000 for Database Diagnostic Pack to \$47,500 for Database Enterprise Edition license. Expenses for updating and support of the software are substantial as well. They comprise from \$1,100 for Database Diagnostic Pack to \$10,450 for Database Enterprise Edition, annually. Some modules for these parameters can be even more expensive; for instance, the Communication Data Model license costs \$50,000 and annual support costs amount to \$11,000. Prices for some of the Oracle E-Business Suite Applications are in the similar ranges [13]. Are such prices acceptable for clients? Naturally, this strongly depends on who is the potential client and how are they going to use the software. For large enterprises such level of IT expenses with large sales volume and income can be perceived as appropri-

ate for the advantages of their use. For most small and medium businesses, however, such IT expenditures are an obstructive barrier that eliminates the possibilities of their implementation in business. Moreover, for some time such market condition was satisfactory for the main part of the actors. Indeed, specialization on a strictly defined range of tasks allowed maintaining both effectiveness of solutions offered and high share of value added in the price of finished product on account of a certain degree of market monopolization.

At the same time organizations in different areas of the economy had different requirements for architecture of the ERP system and its model itself, which was not always possible and easy to do within the framework of traditional ERP software. One of possible solution was active use of module-based ERP architecture. Different functional modules can not only be bought separately, but also improved, added and reconfigured, and even combined with modules from different producers, creating an own system defined by the customer's requirements and preferences.

A new logical step in the development of module principle is the concept of building of a system by the client based on its independent integration and usage of modules, each of which is best for its class (so called best-of-breed). Market analysts point to this as a modern trend in development of ERP systems, for example, in the aforementioned research by Panorama [4].

A completely different model of commercialization turned out to be the use of open-sourced ERP software. By allowing free access to its code, producers virtually created a new quality of the product for their clients: it could be modified, as it would be required for each organization. Furthermore, such modification did not require significant financial and human resources. De-facto, this is one of the versions of exercising «presuming» (a portmanteau of «producing» and «consuming»), when the user is actively involved, alongside the direct creator of the product, in forming its consumer characteristics. This allows to achieve fast and flexible response to client's needs, which is especially important in the modern highly-competitive environment.

Today, many different versions of such

ERP have been created. Expert reviews and ratings of open-source ERP systems are beginning to appear as well: [1], [15], [16]. Among the systems of this kind that are analysed most frequently are OpenERP, Openbravo, Apache OFBiz, Compiere, WebERP, ERP5, Opentaps, Dolibarr, ADempiere, PostBooks. The most important quality of open systems for the consumers is the actual ability to create innovative solutions in IT that fit his own specific requirements, on their own or using relatively simple outsourcing, and, which is also important, in a relatively short time. Moreover, in some cases such software can be completely free or almost free.

There is another trend, which is indirectly connected with the previous one. Their common feature is low price and the desire to offer solutions not only for large but for small and medium-sized organizations as well. What is more, not only those vendors of ERP deal with such a business, who are newcomers and innovators trying to find their specific market niche, but also the leaders of the industry including all the aforementioned TOP-3 of ERP companies' vendors. Understanding the problem of barrier existence entering this market and, at the same time, the prospects of further development of this segment motivates manufacturers to create qualitatively new model of ERP. They are intended for the clients who are able to produce innovations for their customers, and therefore, being the potential drivers of growth of the entire economic system. A combination of install flexibility for a specific company with low price allows these ERP manufacturers to not only rely on the expansion of the service area in the market, but also, what may even be more importantly, to cultivate today's relatively small businesses in successful businesses of tomorrow. The prospect of an effective innovation activity and the creation of such innovations, which have a great value to consumers, play the key role in the real opportunity of potential success. Thus, the creators of IT innovation, in particular in ERP field, in which the testing of innovations takes place, create the preconditions for the appearance of value chains among its clients-innovators and their customers.

The answers to the challenges of the necessity to provide the implementation of globalization trends, rapid adaptability, collaboration,

data access and processing in real-time, support for mobile workplaces, risk management are the vital needs in modern conditions with respect to the enterprises management. Not just support of the business processes is required, but also the ensuring them with cross-functional information support, which allows to make effective management decisions. Thus, based on the understanding business processes, necessity to create the possibility of simplifying them to such an extent that the information on them in real time could be provided with relevant people in the correct format. One of the decision options was to promote an approach to the development of software with a business model Enhancement Pack, which allows users to install only the functionality they need, and improve it as they need it to change.

Some vendors offer real revolutionary solutions that can change the very philosophy of the use of ERP. One example of such software is the product of BOB'S WORLD, which in many ways stands out among other technological ERP approaches creating new prospects for the development of this segment of the market and its consumers. According to the company, it is fully integrated business software from a single user interface, a single database and a single technology that can be rapidly and cheaply adapted for the specific needs of the client, as in the beginning of its operation, as well as in any subsequent period of time. Installing the program and its change is possible within 24 hours from the receipt of the corresponding application from the user. Such a change can be accomplished either by the user or by a specialized service company at his request.

In addition, traditional products often do not satisfy the customers' needs not only with the availability parameter, but also with segmentation of offered solutions by functional and / or other parameters, by the need for repeated data entry, mobility reasons, etc. The use of several business applications can lead to inconsistency in their architecture, functionality and practical use. BOB'S WORLD program presupposes the possibility of implementing almost all types of automation functions of enterprise management on a single platform. It is not sold as a turnkey solution, but is offered as a service (so-called SaaS – Software as a Ser-

vice). The price is quite democratic and currently is the nominal value of 1 UAH per 1 hour / 1 workplace. Such pricing policy allows consumers to save substantially. Comparative analysis of user costs for the purchase of various ERP software can be implemented on the basis of statistical dynamics of the cost for the use of four manufacturers' product is shown in Figure 3.

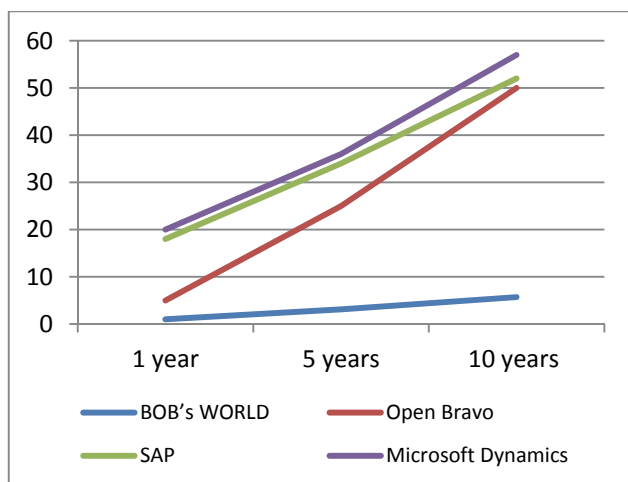


Figure 3. The cost of license for ERP systems for 5 workplaces (thousands of US dollars) [3]

Access to BOB'S WORLD can be provided through the cloud service Amazon. Alternatively BOB'S WORLD can be installed as a virtual machine on the equipment of the consumer. Security of storage and change the data provide at the highest level with the use of multiple authentications and authorization, the roles of specific individuals - users and, respectively, their powers. Cloud technology of storage and processing data allows a high degree of mobility work with the system. On a practical level, it means a possibility of access to the client from anywhere you can connect to the service, including the Internet based, either through the computer or through mobile devices. It does not need to install software and its technical support for the client. The client during the development of their needs improving use of ERP products, such as through its own efforts, and, in case of need, with the assistance of the staff of the vendor. In fact, this is one of the variants of the application the concept of kaizen management, providing incremental innovation and improvement.

Efficiency of use ERP is dependent on several parameters. There are the most im-

portant of them, such as the license price and the cost of its maintenance, and the ability and the cost of reconfiguration, preferably without the involvement of outside performers and the cost of this significant time and financial resources on the side of demand of customers. Parametric modeling of such a relationship can be represented as follows:

$$\text{ERP EFF} = f(\text{B}, \text{P}, \text{CC}, \text{AC}, \text{AP})$$

where:

- B (Benefits) – benefits from the operation of the system;
- Pr (Price) – price for the purchase and installation of the system;
- CC (Current cost) – ongoing maintenance costs of the system;
- AC (Adaptation Cost) – customer costs to implement (if necessary) the flexibility or adaptation of the system;
- AP (Adaptation Period) – time (period) required for the adaptation of the system.

For small and medium-sized enterprises this parametric model is transformed under the influence of a number of other factors, which are more important for this sector of the market. There are: (1) reduction in the base price for the purchase of the system is below certain threshold; (2) availability, including the lower price, of cloud technology of storage, processing and security of data; (3) mobility of use, in particular, access to the system via a smartphone.

At the same time, manufacturers can provide extremely low prices for the installation of the system (up to zero) and its operation due to:

- providing SaaS,
- active participation all customers in the permanent development of the system and its adaptation to the current and future needs of the market,
- rapid involvement of new customers in formation of cash inflows for the ERP vendor.

It should be noted that in making decisions about the use of these systems, the customer takes into account not only the cost but also other parameters, such as convenience, time spent on exploration, intuitive interface, service, warranty, safety, etc.

Parametric modeling of such a relationship can be represented as follows:

$$\text{ERP EFF SMSS} = \text{ERP EFF} + j(\text{ACB}, \text{PB})$$

where:

ACB (Additional Customer Benefits) – additional benefits from systems exploitation by client;

APB (Additional Producer Benefits) – additional manufacturer's benefits from the using, promotes on the market and the providing of ERP service, with new technology of ERP production, including due to the continuous improvement jointly with consumers.

Understanding the additional benefits of the new business model of the production, promotion and use of the most effective in the conscious activity engaged in the interaction of producers and consumers of ERP+. In this case the effect is achieved faster and its scale, the dimension will be higher.

Conclusion. ERP systems are long-time basement for innovation. They are constantly formed as an innovation in response to the new challenges of the market and the changing competitive environment. In addition, the evolution of ERP and other innovations of different nature (product, service, social) are so closely related that there is a phenomenon of co-evolution, and the cost of innovation to a large extent determined by the level of development used in the practice of ERP systems.

In this regard, there are two kinds of consequences:

1. There is a new class of ERP systems that have not only comparable, but also superior to the earlier generation system functionality;

2. This new class of ERP systems is much cheaper for its users in comparison with similar predecessors.

From the viewpoint of market conditions, the low cost of these systems means having another important competitive advantage: lower entry barriers in this market segment for clients - recipients of such kind of services.

Thus, the ERP acquire new market and technological characteristics. Its availability to users – enterprises is significantly expanding, which in turn may provide a more flexible service for their customers, develop faster and effectively their innovative products and make them available to the final consumers.

In addition, these ERP systems have a new consumer characteristics and functionality,

allowing creators announce a new category of «ERP+» systems.

It also leads to price changes in other market segments of ERP systems, as in fact these new products become substitute's goods in relation to traditional and relatively more expensive technological solutions.

The cost of innovation in enterprises that are using «ERP+» technologies is being formed more quickly and more adequately to needs of their users. The quantity of users relatively increases, as at the planning stage of production process a deeper, more comprehensive and flexible study of consumer and technological characteristics takes place.

At present, the IT solutions of this type are just being started to use actively «ERP+» in the market. Because of the reasons, which have been explored above, its opportunities are demanded by market and significant to society. At the same time as prospects for further research it is necessary to specify the verification of the proposed parametric model that will be possible with accumulation of the relevant statistical data base about the practice of «ERP+» systems usage.

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У статті продемонстровано взаємний вплив вартості інновацій і діалектики розвитку ERP систем. Доведено, що суттєві якісні зміни в сучасних ERP системах призводять до зміни їх доступності для потенційних клієнтів і, що є особливо важливим, для малих інноваційних підприємств. Розроблено рекомендації щодо подальшого ефективного використання ERP систем, у тому числі з метою формування релевантної вартості інноваційних продуктів.

Ключові слова: вартість, інновація, програмне забезпечення (ПЗ), інформаційні комунікаційні технології (ІКТ), планування ресурсів підприємства (ERP), модель.

В статье продемонстрировано взаимное влияние стоимости инноваций и диалектики развития систем планирования ресурсов предприятия (ERP). Доказано, что существенные качественные изменения в современных ERP системах приводят к изменению их доступности для потенциальных клиентов и, что особенно важно, для малых инновационных предприятий. Разработаны рекомендации по дальнейшему эффективному использованию ERP систем, в том числе в целях формирования релевантной стоимости инновационных продуктов.

Ключевые слова: стоимость, инновация, рынок, модель, информационные коммуникационные технологии (ИКТ), программное обеспечение, компонент программного обеспечения, планирование ресурсов предприятия (ERP).

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