

Piotr Adamczewski

Poznań School of Banking, Poznań, Poland
Adamczewski@wsb.poznan.pl

ICT IN ENTERPRISE ARCHITECTURE OF E-COMPANIES IN LIGHT OF STUDIES ON THE SECTOR OF SMALL AND MEDIUM ENTERPRISES IN WIELKOPOLSKA

Abstract: An active sector of small and medium enterprises (SME) is a prerequisite of a properly functioning market economy. This sector encompasses various companies: those producing very simple goods and products as well as technologically advanced ones, which take advantage of the newest scientific achievements. A large part of these SMEs in Poland is having a very hard time competing with large companies. The multinationals have lower production costs, more points of sale, can spend more on advertising and operate on thinner profit margins. The ICT (Information and Communication Technology) can help even the odds. ERP (Enterprise Resource Planning) systems are more and more adopted in large companies. It appears that this trend is also being followed by small- and medium-sized companies. We have conducted a questionnaire-based survey to identify how Wielkopolska SMEs perceive this phenomenon of ICT and ERP systems.

1. Introduction

Enterprise architecture is defined as a coherent model of organisation, which integrates objectives and strategic tasks, business processes and data and technologies of their processing, indispensable for execution of those objectives. It is defined as a coherent model of organisation, which integrates:

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Degree of popularisation of practical application of ICT in all areas of human activity allows for assertion that we deal with a new stage of information technology

support of enterprise functioning. According to the theory of American futurologist Alvin Toffler, evolution of humanity may be framed in the so-called three waves [Toffler 1986]:

- first wave – agricultural revolution,
- second wave – industrial revolution,
- third wave – information revolution, when building of information technology society was initiated, and whose essence in the area of economic activity performed in the convention of e-business is constituted by e-companies.

The term “information technology society” refers to the society which not only possesses developed means of information processing and communication, but also those means are the basis for generating national income and provide sources of maintenance for the majority of society. Its characteristics may be presented in the following way:

- information becomes basic economic resource, means of income growth and accumulation as well as competitiveness (digital product),
- information, to a growing extent, becomes a factor of social and political life,
- people absorb more and more information as consumers,
- the growing role of information is forced by fast development of the sector of communication means and services; political and economical entities-subjects use more and more information, which in turn forces expansion of this sector.

Economic and social aspects of information technology society may be synthetically defined as:

- society is characterised not only by development of new technologies (particularly information technologies), but also new ways of labor management and organisation, new professions,
- information sector in economy may be divided into subsectors, coping with, respectively: generating, processing and distribution of information,
- a basic dimension of economic changes in association with development of means of communication is globalisation process; it is due to them that „shrinking” of time and space could occur, as the essence of globalisation,
- information technology society is characterised by de-ranking of economic structures, which, among others, means moving away from Fordism and Taylorism,
- process of production and management decentralisation takes place,
- virtual enterprises occur, banks for instance,
- network economy develops; logic of network has become an important element of *now economy*, characterised by ability to generate knowledge, transfer and manage information, and on its basis to undertake actions in real time on a global scale,
- network as a form of economic organisation concentrates on executing specific business projects; the unit of production process is not a company, but a business project,

- logic of network refers also to the area of political activities, social relationships, human contacts (the so-called network individualism).

State of saturation with ICT solutions and advancement of construction of information technology society in Poland is illustrated – according to data of Polish National Statistical Office [GUS] from September 2007 – by the list of indicators below:

- 93% of Polish companies use computers in their activity, and 89% of those have Internet access (of which 46% is broadband connection),
- 100% companies of financial sector use Internet in their business on daily basis,
- 14% of big companies apply wireless connections,
- more than 61% companies contact all authorities via Internet,
- 27% companies are provided with goods and services through e-commerce, but only 9% companies conducted e-sales.

2. ICT infrastructure in enterprise architecture of e-companies

E-company, as economic system applying advanced information technology infrastructure in its internal organisation and communication – also external – presently constitutes the essence of functioning of information technology society in business areas. It practically means support of basic enterprise structures and execution of *now economy* concept in on-line mode [Adamczewski 2007b; Luftman 2003] with information technology, including levels of:

- technical (equipment) infrastructure,
- system and communication infrastructure,
- application software,
- business processes integration with external contractors of the enterprise.

Specific information technology ecosystem of an e-company must be based on advanced solutions of ERP class (*Enterprise Resource Planning*). Traditionally understood ERP systems as solutions of the enterprise integrating information technology infrastructure are not sufficient anymore [Adamczewski 2008a; 2008b]. Their basic functionality has been enriched with Customer Relationship Management systems (CRM), Supplier Relationship Management systems (SRM), Supply Chain Management systems (SCM), and Product Lifecycle Management systems (PLM). Simultaneously, development of ERP systems aroused demand for information technology solutions defined as Business Intelligence. They mean no less than effective support of decision processes based on the so-called Business Analytics. It involves tools and applications for analysing, monitoring, modelling, presenting and reporting data supporting decision making. To this purpose data warehouses, operational analyses of supply chains, analytical CRM and SRM systems, financial analyses and enterprise efficiency indicators are used. The users of such solutions are strategic levels of companies, based on certain data aggregates.

Application on a mass scale of Internet technologies in information systems has strengthened mechanisms of globalisation of economic activities and integration

of association chains between business partners. It is accompanied by information revolution in progress, whose task is to provide information necessary for effective support of corporation decisions. Those challenges may be matched only by the systems of ERP II class, with highly broadened functionality in comparison to ERP class. Business processes executed within their framework much exceed area of functioning of a single enterprise. They combine information flows in the scope of integrated economic areas, involving business partners, financial and insurance institutions, science and research institutes and other links of the organisation surroundings, applying internet technologies to this purpose, as well as electronic market mechanisms (among others internet auctions and exchanges) [Adamczewski 2007a; Hakkinen, Hilmola 2008].

ERP II systems allow for expansion and deepening scopes and functionality of integrated solutions and for focusing on tasks which are strategically important for activities of an enterprise. They apply new business information technologies and categories of solutions, including: data warehouses and Business Intelligence class solutions (OLAP – *OnLine Analytical Processing*), Knowledge Management (KM), Advanced Planning and Scheduling techniques (APS), methods of assessment of Corporate Performance Management (CPM), Balanced ScoreCard (BSC) [Becerra-Fernandez et al. 2004; Orzechowski 2008].

Range of popularisation of ERP systems in terms of information technology support of modern organisations allows for a thesis that they are perceived as an element of information technology architecture, which practically constitutes a condition of their effective functioning.

ERP systems are subject to evolution, among others, under influence of new business demands, changes in information solution technologies and technical infrastructure. They are characterised by strong orientation towards building relations with clients and business partners and so-called system intelligence.

The scale of popularisation of this class of information technology solutions in Poland is characterised by 14 percent dynamics in scale of last two years, and prognoses in this scope are also optimistic, as ERP systems became a distinguishing factor of modern functioning of global economy organisations. This phenomenon can be also noticed in small and medium enterprises sector. They prove, in terms of quality, a new stage of informatisation of Polish companies, where highly processed data (information) constitute a basis for knowledge management system. It mainly refers to ERP class and Business Intelligence solutions which are applied in the framework of modern management methods in competitive market.

In the beginning of 2008 the author conducted a pilot questionnaire study in terms of degree of application of ICT technology in small and medium enterprises sector of Wielkopolskie Province. The structure of registered total of more than 341 thousand enterprises in Wielkopolska is the following:

- 322 thousand (94.45%) of enterprises employing up to 9 people (micro enterprises),

- 15.5 thousand (4.54%) employing 10-49 people (small),
- 3 thousand (0.88%) employing 50-249 people (medium)¹.

Collected research material (in total 754² responses) allows for the following general conclusions:

- 98% enterprises have a permanent Internet access,
- type of Internet connection – nearly 52% use DSL connection, 23% – ADSL, 10% – ISDN, 9% – wireless connection, 6% – telephone modem,
- collocation is applied by 45% enterprises, and hosting – by 28%,
- main areas of Internet application are marketing – 75%, business catalogues – 70%, partner programmes – 55%,
- most frequently applied application software includes financial and accountancy domains, human resources, CRM, warehouses and fixed assets; in 34% ERP class systems are applied, and 5% of respondents admit to applying Business Intelligence class solutions,
- 82% enterprises apply e-supplies, 50% – e-sales of their products and services,
- 18% enterprises indicated positive experience in terms of application of mobile systems (particularly in the sales area).

Quoted study results indicate a growing share of advanced information technology solutions in support of operational and tactical level of management of small and medium enterprises sector in Wielkopolska, including particularly ERP class systems. It also confirms strategies of the suppliers of those solutions, which imply offering pre-configured solutions in the scope of particular businesses. It is worth emphasizing that among main investment plans in terms of ICT the following were mentioned: ERP systems with elements of SCM (Supply Chain Management), solutions of Business Intelligence Class and Knowledge Management and mobile systems³.

3. Directions of ICT development in small and medium enterprises

Growing demands of competition in the sector of small and medium enterprises force companies to reach, to a growing extent, to more advanced information technology solutions, where ERP systems take a prominent place. Analysis of evolution of these systems indicates main directions of functional spread in construction of business processes in the framework of the entire logistic chain. This spread includes in the first place intelligent support of complex customer service and support of partner relationships in this chain. In order to execute those objectives the most

¹ There were 429 large companies in Wielkopolska, employing more than 250 people, which constituted 0.13% of total registered entities.

² Micro enterprises 399 (52.9%), small 254 (33.7%) and medium 101 (13.4%).

³ At the end of 2008 the author intends to perform basic questionnaire study on the same population.

modern information technology solutions are applied, which also involve wireless remote access to data bases and data warehouses of ERP base system.

Growing demands aimed at ERP systems generally result from functioning of real time enterprise (RTE), which is most fully executed on the ground of e-business solutions. Main development tendencies, which are already clearly outlined on the ground of solutions of this class, may be defined as follows:

- ever broader range of business services,
- full IT support of virtual structures,
- popularisation of internet technologies (including corporate portals, network services and Web browsers as basic interface to ERP systems),
- broader application of mobile solutions which shall enable access, for authorized users, to company information resources via medium of choice,
- switching to the component architecture,
- deepening functional and technological integration,
- automatic system configuration with its significant parametrisation, which has impact on shortening of implementation process,
- broader application of data warehouses necessary for quick obtaining management information and knowledge management systems,
- complete openness to other segment solutions through integration with CAD/CAM systems, industrial automatics, GIS, GPS and other systems,
- fuller information technology outsourcing (including mainly ASP model and data centres).

ERP systems are subject to evolution under influence of, among others, new business demands, technological changes of IT solutions, dynamic evolution of technical infrastructure. It is projected to ever more expanding functional structure of solutions. Modules from the scope of sales and distribution are expanded to the level of Customer Relationship Management (CRM), Supplier Relationship Management (SRM), and supply and manufacturing logistics becomes integrated in terms of Supply Chain Management (SCM).

Since Internet network forces companies to build deeper relationships with customers, suppliers and partners, ERP systems become an attractive strategy both from the point of view of business itself and selection of used application software. It means necessity of gradual migration of ERP systems to ERP II, and, at the same time – increase in adaptation abilities of companies exploiting them. Simultaneously, functionality of these solutions is expanded with BI applications, whose development tendencies are defined by:

- simplicity of application of these tools by the users, who are not IT specialists,
- compliance of solutions with functioning strategy of a company, illustrating specific indicators in the form of the so-called manager cockpits,
- confidence in sources of data origin, and their streams (metadata) in the framework of entire information chain,

- innovation construed as ability to find new areas of application in terms of support of business decisions.

Evolving business needs and development of IT technologies have greatest impact on development of information structure of e-companies. Current economic situation, sharp competition between suppliers of these solutions and growing organisation and information culture among management level also have influence on the shape of these solutions. It is even bigger, as more advanced ERP class systems are integrated with Business Intelligence solutions. It is directly projected to more effective information and decision processes which constitute basis for *now economy* concept, which on the ground of modernly functioning companies is reflected by achieving and strengthening competitive advantage [Adamczewski 2006a; Wang et al. 2007].

Economic transformations and evolution of business relations cause devaluation of traditional sources of competitive advantage, such as capital, infrastructure, access to the market or quality of offered products and services. E-companies, in order to effectively compete on the market, must assign crucial significance to flexibility of an organisation and its ability to implement innovative business models and process reorganisation. Examples of many Polish companies indicate that vision of a business managed in a modern way entered a dynamic execution stage, and, ultimately, effective knowledge management in e-company grows to the rank of a paradigm [Adamczewski 2006b; Olszak, Ziemia 2007; Waltz 2003].

4. Conclusion

Pragmatics of implementation and exploitation of ICT in the sector of small and medium enterprises in Wielkopolska and performed deliberations allow for drawing the following general conclusions:

- building advanced ICT solutions becomes a distinguishing factor of modern e-companies,
- ERP systems constitute a key element in enterprise architecture of e-companies as a specific information technology ecosystem,
- dynamic evolution of ERP systems expands their functionality with SRM, PLM, CRM, SCM and BI modules,
- ERP create a basis of integrated information technology systems with advanced Business Intelligence (BI), which constitute a basis of ultimate knowledge management system in e-company,
- ICT solutions cannot be based only on appropriate information technologies (“hard” factors), but they also must take into account “soft” factors (organisation culture, intellectual potential of personnel and their creativity), which, placed in rational organisational structures and effectively organised business processes constitute a condition of obtaining a desired synergy effect,

- increase in interest of companies in information technology solutions offered in ASP and SaaS models is clearly noticeable.

Statistics from the last year unequivocally confirm growing indicators of ICT solutions implementation in the sector of small and medium enterprises, which gives fair promise to Polish enterprises for their operations on global markets.

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