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## BUSINESS INTELLIGENCE TECHNOLOGY: CAPABILITIES, APPLICATION AND FEATURES IN UKRAINE

*Статтю присвячено застосуванню новітніх аналітичних інструментів, що сприяють підвищенню конкурентоспроможності суб'єктів економіки. Особливу увагу приділено вивченню ринку BI-систем, визначено його тенденції та основні гравці. Проаналізовано особливості та перспективи реалізації BI-технологій в Україні.*

**Ключові слова:** BI-технологія, ринок BI, BI-інструменти, конкурентоспроможність.

*Статья посвящена применению новейших аналитических инструментов, способствующих повышению конкурентоспособности субъектов экономики. Особое внимание уделено изучению рынка BI-систем, определены его тенденции и основные игроки. Проанализированы особенности и перспективы реализации BI-технологий в Украине.*

**Ключевые слова:** BI-технология, рынок BI, BI-инструменты, конкурентоспособность.

*The article is devoted to the application of new analytical tools to help improve the competitiveness of the economic agents. Special attention is paid to BI market, its trends and the main players are defined. The features and prospects of implementation of BI technology in Ukraine are analyzed.*

**Keywords:** Business Intelligence (BI) technology, BI market, BI tools, competitiveness.

The process of making complicated managerial decisions in the constantly changing environment of real economy functioning mechanism is a very difficult task that requires the profound situation analysis. All real processes taking place in modern social, economic and business systems are dynamic and can be described with enormous data arrays only. The key issue for the stable development of a system is the processing of this data and getting new knowledge about its capabilities and potential. Therefore it is reasonable to make optimal managerial decisions with the help of scientific methods that reflect the specific character of system performance. Under such circumstances the development of holistic decision-making mechanism becomes crucial. The basis for such mechanism would be the principles of proactive system management, and the data mining would be the primary tool.

Analytical applications and databases intended to implement the intelligent way of business management (Business Intelligence, BI) are the most promising tools offered on the market of data processing and visualization technologies used for managerial decision-making. BI tools are intended for business performance measurement and managerial decisions assessment with an aim of securing the effectiveness of decision-making process. The origin of BI technology inspired the origin of information analysis systems of new generation that include different data mining tools.

There are many publications devoted to the development of BI technology and applications used in applied economics including specialized journals, such as "Information Technologies for Management" [1] and "Management Systems and Machines" [2], scientific publications [3-5], publications in the Internet, for instance PC WEEK/UE [6-8], "Computer Review" [9-11], "CNews Analytics" [12], and websites (portaltele.com.ua [13], si.ua [14], ain.ua as well as websites of the companies present on the BI market – Citia BTC [15], RBC Group, BIT-Impulse, TComTech, Intellect-Service – stand out). Generally the main attention in such publications is paid to the usage of BI system tools for solution of specific applied problems.

There are several main premises for the development of such holistic decision-making mechanism that will take into account modern requirements for quality of managerial

decisions. They are as follows: development of theoretical, methodological and instrumental levels of such mechanism, synthesis of relevant economic and mathematical models, and securing the realization of proposed methods through application and development of information technologies and systems. Hence the research connected with the analysis of capabilities and perspectives of modern BI systems and technologies, BI tools market, quantitative and qualitative indicators of BI technology application. In this respect the research of international experience, world BI market trends and their manifestation in Ukraine is particularly topical. The application of latest analytical tools that support decision-making by individual economic agents must become an important step to increase their competitiveness and form development strategy that will have a strong impact on the increase of Ukrainian economy competitiveness.

The objectives of this research are: investigation of BI systems features (in comparison with other corporate software) that enable the application of the management mechanism on the basis of data mining; estimation of Ukrainian companies automation level as well as the level of BI tools application for decision-making process support; analysis of world, Russian and Ukrainian BI market trends and obstacles for BI systems development in Ukraine. All that will help analyze informational support for efficient business strategies for the agents of Ukrainian economy.

There is no unified classification of BI systems. The main approaches are formed by studies of three companies investigating the BI market: Gartner (functional approach), Forrester (two groups of systems: those aimed at transformation of raw data into valuable relevant information used for decision-making and those aimed at data preparation and usage in analysis, reporting, productivity management and information delivery) and IDC (two groups of systems: QRA (end-user query, reporting and analysis) systems and advanced analytics systems) [1-3, 5].

Summarizing the information concerning BI components and their functions [1-4, 6, 14], one can define multi-level BI architectural stack (Table 1).

According to classification by Gartner, BI tools must perform at least the functions of information integration,

presentation and analysis [5]. Main categories of BI software tools are just the same as in IDC classification (QRA tools and advanced analytics software). The capabilities of

products of both categories define their application for management mechanism on the basis of data mining.

Table 1. Business Intelligence Architectural Stack

Delivery	Desktop gadgets		Office suites		Mobile	Disconnected		Industry vertical applications	Enterprise applications: ERP, CRM, SCM, ERM	Appliance	Strategy	Methodology	
	Portals		Interactive voice response, ATM, point-of-sale										
Reporting	Dashboards		Alerts		Advanced data visualization								
	Search	Geospatial	Reporting – ad hoc, analytical, production										
Performance management	Metrics/KPIs		Planning		Scorecards								
	Strategy/objectives management												
Supporting applications	Collaboration	Life-cycle mgt.	Localization	QA	Version control								
	Metadata – integration repositories				ECM	eLearning	MDM						
Analytics	Data/text mining		Guided decisions		NLP		Guided search						
	Time series	OLAP	Operational DSS		Predictive analytics								
	Usage analytics		Statistical analysis		Web analytics								
Discovery and integration	Accelerators/query optimization				Adapters/tool kits								
	BAM/CEP		BPM/BRE integration		Discovery accelerators								
	DQ – cleansing, profiling		EAI/SQA		EII		ETL/CDC						
	Integration – third party applications												
	Operational data stores (ODS), data warehouses (DW), data marts (DM)												
Data	Report mining		Services registry and repository										
	Columnar DBMS		Hierarchical/XML		In-memory DBMS								
	Multidimensional OLAP		Multivalue DBMS		RDBMS								
	Streaming DBMS		Search DBMS										
Infrastructure	Network		Services		Storage								
								Hosted BI (SP)		Center of excellence		Governance	
								BI SaaS		SP/application outsourcing			

Source: Forrester Research, Inc. [1]

The modern BI systems market offers a wide range of products that support decision-making. This is one of those few markets that have not suffered from the global financial crisis, but on the contrary became stronger. This fact can be explained by increased attention to all the tools that help save money during the slump in economy, and that is one of the key functions of BI systems [10, 14].

Different companies operate actively on the BI systems market; there are both the vendors of BI products only and the manufacturers of complex corporate software that often can merge BI systems vendors and integrate their products into own systems. BI products can be divided into two groups: "horizontal", i.e. easily scaled and incorporated into different existing systems due to the standard set of tools they include, and "vertical", i.e. used for specific purposes that can hardly interact with third-party software [6].

70% of the world BI systems market is occupied by major vendors, such as SAP (BI product SAP BusinessObjects), IBM (IBM Cognos 8 Business Intelligence), Oracle (Oracle Business Intelligence), SAS (SAS Enterprise Business Intelligence), and Microsoft BI. In 2011 SAP was still a market leader (with the market share of 23.6%), followed by Oracle (15.6%), SAS (12.6%), IBM (12.1%) and Microsoft (8.7%). BI systems market is growing very rapidly, as the growth rate in 2011 equaled 16.4%, and the market size reached the level of \$12.2 billion according to Gartner research (by IDC methodology the market size is bigger, reaching \$33.9 billion in 2012, and Oracle is the market leader with 20% market share). Modern market structure is the consequence of mergers of small companies by large vendors in 2007-2008 (SAP with BusinessObjects, IBM with Cognos and Oracle with Hyperion).

The structure of Commonwealth of Independent States (CIS) BI systems market and, in particular, Russian market differs from the world market's one. Market dynamics is 5-7 years behind (e.g. BI has already been popular all over the world in 2000, and in Russia the growth rates started increasing in 2005). An important role is played by the local vendors, whose products have various advantages: they

require no localization, take market specific needs and business environment conditions into account, and are cheaper on the whole. However, the drawback of such products is a comparatively low quality and few benefits from usage, as well as fragmentariness of problem solving process. Universal BI systems manufacture requires much investment in research and development area, therefore Russian vendors are just advancing towards extension of BI systems capabilities from mere analysis of accumulated data to prediction and modeling of different scenarios. BI systems are viewed in CIS chiefly as a comfortable reporting means, while in developed countries the understanding of these systems main tasks is more profound.

Generally Russian BI market development is dynamic, the main branches of implementation being trade, financial sector, public sector, fuel-energy complex, pharmaceuticals and telecommunications industry. The "pure" BI market size equals about \$200 million (IDC estimate for 2011), and twice as much together with BI tools supplied with other corporate software. The annual sales growth rate reaches 35% and is three times bigger than the world market growth rate. Furthermore, the segment of mobile BI tools develops even more rapidly (annual growth rate up to 100%), taking into account that Russian vendors will hold monopoly position for 2 or 3 years before European and American vendors enter this segment of the market). Market leaders in 2011 were "Prognoz" – BI system from the local vendor (62 implementations resulting in 26.61% market share), Qlikview (40 implementations, 17.17% market share), IBM (35 and 15.02% respectively), SAP BusinessObjects (24, 10.3%), Microsoft BI (6, 2.58%) [12-13]. BI systems remain the third most popular corporate software products after ERP and CRM systems in Russia. However, the figures mentioned represent the public implementation projects, and the share of non-disclosed projects is estimated to be 4 times bigger. For instance, "Prognoz" announced to have fulfilled 504 projects embracing therefore up to 50% of Russian BI market ("Prognoz" is present on Ukrainian market as well; State Tax Service of Ukraine,

State Committee on Water Management of Ukraine and NEC "Ukrenergo"). A clear trend is to be defined on the Russian BI market: the public sector prefers Russian vendors (sometimes due to state security considerations), and financial sector, trade and real estate prefer European and American vendors [12, 13].

When examining Ukrainian market, one should note that Ukrainian companies automation level is still far behind the world one, therefore the world market trends appear later in Ukraine. The differences between Ukrainian market trends and the world ones are caused by differences in levels of competition on BI markets, enterprise scales and internal requirements for service level and product quality.

BI systems belong to high-technology products, therefore there are mainly foreign products manufactured by world market leaders in this area present on the Ukrainian BI market. There also products of Russian vendors, such as "Prognoz", "BaseGroup Labs", "Sitronics", "Microtest", "TopS BI", "Columbus IT Russia" and "BARS Group". BI functionalities are to some extent included in "1C" and "Galaktika" products that are popular with CIS market.

The most popular BI tools in Ukraine are Reporting & Analytics tools, including dashboards, ad-hoc reporting tools, budgeting and consolidation solutions and data mining tools. SaaS technologies, BI mobile applications and combination of planning, predicting and analytical reporting tools are viewed as interesting, yet not widespread innovations.

Such examples of successful BI systems implementation in Ukrainian companies stand out: Microsoft BI and SQL 2008 implementation in Fozzy Group; large Oracle BI projects in National Bank of Ukraine, "Prominvestbank", as well as "Eurochem" where administrations costs were reduced by 20%; SAP BusinessObjects implementation in MTS, "Kyivstar", "Ukrsibbank", "Alphabank", "Deltabank", TAS insurance company, etc. [7, 15].

Many Ukrainian companies cooperate with European and American vendors, for instance, SAP BusinessObjects is implemented by 12 SAP partners. RBC Group, the main Qliktech partner, whose system is used by 30 Ukrainian companies ("Velyka kyshenya", "Novaya liniya", "Agromat", "Farmak", "Darnytsya", "Gerkules", "UniCredit Bank", "Sandora", "Novus", etc.) and became popular due to in-memory technology and data discovery tools, cooperates with Oracle and IBM as well. Overia company with headquarters situated in Dnipropetrovsk is one of the main Microsoft partners, along with Lime Systems (with headquarters in Donetsk) that produces its own software, including Lime Business Intelligence system. Lime Systems is active mainly in banking sector, one of its clients being, for instance, EBRF (European Bank of Rational Financing), where Lime BI has been implemented. Ukrainian company TComTech is a partner of InfoSuite AIS – BI systems vendor with research and development department working in Ukraine [15].

One of the most significant Ukrainian companies active in the areas of BI systems manufacture and consulting is BIT Impulse with headquarters situated in Lviv. AVK, "Halychyna", "Biola", "Comfy", "Cosmo", "Eldorado". "Brocard", distribution networks "Barvinok" and "Nash kraj" are among its clients. The main product of this company is BAT Enterprise – the system of analytical reporting and BI for large and medium enterprises, as well as BAT Desktop intended for report visualization for individual users.

Ukrainian company "Intellect-Service" produces IS-PRO ERP system that includes several BI tools. This ERP system is used by 6,500 enterprises in Russia and Ukraine.

Main Ukrainian manufacturer of corporate software for banking sector and insurance companies is CS company (with headquarters in Kharkiv). Its main product is ABS B2

system, used by the third of Ukrainian banks, but this company produces CS:BI system as well. This system uses Oracle Database 11.2 owing to partnership between Oracle and CS and was implemented in 4 banks over 3 years ("Kredobank", "Sich", VTB and "Daughter Bank of "Sberbank of Russia") [8].

Generally BI market of Ukraine is a perspective niche market, entered by new vendors (e.g. DBMS Vertica), that develops constantly, yet slowly. The problem lies in attitude towards BI system as something collateral that is convenient for some internal processes of the company; in lack of understanding of all possible benefits from BI implementation; and in lack of readiness to revise the conventional scheme of working with information that results in lower labour productivity than that of foreign companies. Shadow activities of Ukrainian companies, small volumes of activity and accounting information, unsolved problem of poor data quality (according to some estimations, from 15% up to 40% of yearly budget of banks is spent unreasonably due to poor data quality) – all these factors lead to lower actuality of BI tools for Ukrainian companies.

The main trends of world BI systems market due to which the newest systems are viewed as BI 2.0 and 3.0 (2<sup>nd</sup> and 3<sup>rd</sup> generation, it being considered that 3<sup>rd</sup> one is the nearest future perspective involving joint decision-making and increasing role of social networks) are as follows [1, 5, 9, 11, 15]:

1. BI tools standardization. Some Ukrainian companies have not encountered this process, because of lack of understanding of BI systems importance that is still characteristic feature of domestic enterprises. Other will certainly encounter this problem, as they have already been using different tools of BI and other corporate software.

2. Cloud BI and SaaS (Software as a Service) BI spreading. Taking into account that cost minimization is particularly topical for Ukrainian companies (owing to large taxes, etc.), this tendency could have appeared on Ukrainian market as well, but it is practically impossible as Ukrainian businessmen treat new technologies with mistrust, shadow activities become impossible or very hard to perform, legislative obstacles for transmission of information about clients to third party, global vendors are suspicious of Ukraine, etc.

3. Open-source BI applications (i.e. applications with open source code) spreading. Large companies, still being the major clients of BI applications vendors, especially in Ukraine, are ready to pay more for security guarantees from renowned brand products vendors. However, the global financial crisis promoted the growth of attention to open-source BI applications (e.g. manufactured by Actuate, Jaspersoft, SpagoBI, Pentaho, Infobright, Ingres), as their usage optimizes company's expenses. Thereby open-source BI applications have good perspectives in Ukraine as BI technologies are spreading and penetrating into the domestic market, however they are currently used just by small companies as an experiment.

4. BI tools application for company's operating activities. Operational BI is mostly an evidence of high level of company's BI system development, therefore it will be spreading in Ukraine as traditional BI tools will be applied by more and more Ukrainian companies.

5. BI technologies application in service-oriented architecture (SOA) that is useful namely for operational BI. This trend is very topical for global vendors, such as IBM, SAP or Oracle that manufacture more and more various products based on SOA that are already well-known on the Ukrainian corporate software market.

6. BI in-memory tools spreading. Such tools do not use database management systems (DBMS), loading data directly to internal memory (RAM). Qlikview, TIBCO Spotfire adhere to this trend and focus on small and medium businesses (SMB), which not very often use BI tools in Ukraine. However, these are the tools that will occupy in the coming years up to 30% of world BI tools market and that will lead to their spreading in Ukraine. Acctiva is the company that has already entered Ukrainian BI tools market and distributes such tools in Ukraine.

It should be noted that BI market research both in Russia and especially in Ukraine cannot be called objective and do not include all the information, because they rely just on the data provided by companies themselves that can overstate and understate the real situation. The market itself is rather fuzzy, as BI solutions may be included in various systems. That is why the market size can hardly be estimated. The first such estimations appeared in Ukraine in 2003 – at that time it was just \$0,69 million. Now the market size increased by several digits, but it is still problematic to estimate it with precision, as there was no research of it has been conducted yet.

On the basis of analysis of modern state of BI technologies application all over the world and particularly in Ukraine one may come to such conclusions as follows.

BI tools play an important role in securing the competitiveness of modern enterprises. A growing number of companies understand the necessity for BI tools usage with an aim of decision-making process optimization bearing in mind all the consequences of the global financial crisis, unstable state of the market and necessity for rational funds usage.

BI systems market develops very rapidly over the latest years, as the actuality of BI tools being a way to save money during the crisis has increased immensely. Russian market of BI tools is already a developed one; domestic vendors are major rivals of global vendors. Russian market growth rate is three times bigger than the world one, and that is an evidence of Russian market's good perspectives.

While there are enough qualitative estimations and profound research for Russian market, it is hard to estimate the market size and dynamics for Ukrainian one, as no research has been conducted so far. Ukrainian market develops slower than Russian one, however global trends become topical here as well: the number of BI solutions users is growing, as well as data storage availability and number of BI mobile applications. BI solutions for SMB (SAP Edge & BO on Demand, IBM Cognos Express) are already present on the market. The income from license vending is reducing owing to the decrease in license cost and application of BI as an addition to implemented ERP systems. Global vendors try to cut the minor companies off the market by supporting these trends. The number of independent BI products vendors has decreased as well, as a consequence of aforementioned market changes. However, fast BI solutions popularity is growing rapidly that has led to an increase of the number

of complex analytic systems. The number of projects on BI solutions migration and updating is also growing as the companies are paying more and more attention to license and service cost and try to reduce expenses by the integration of several different BI platform into a combined one. There are more and more "alternative" BI solutions as well, because the competition with global vendors caused the development of new highly specialized branch products. The BI systems vendors started offering solutions based on in-memory computing in order to increase the promptness of data processing (e.g. IBM solidDB, SAP HANA, Oracle In-Memory Database Cache, etc.).

A comparatively low automation level of Ukrainian enterprises, businessmen mentality, a lack of understanding of BI systems benefits, shadow activities, small volumes of activity and accounting information on the majority of companies, poor data quality – all these problems move back the BI systems development in Ukraine. However, one can say with certainty that BI tools are vitally important to support competitiveness of companies, and have already become an integral part of corporate software used by Ukrainian companies.

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