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BUSINESS INTELLIGENCE – PAST, PRESENT AND FUTURE

Literature reviews

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Abstract

In a society constantly evolving, with information technologies being in a permanent transformation, the managers of agile, flexible organizations, which are equipped with the latest tools for making decisions and with people well trained to use them, will be able to successfully meet the challenges of the future.
This paper presents the evolution of Business Intelligence and a comparative analysis between two modern developments of it, such as Mobile Business Intelligence and Cloud Business Intelligence, with accent on the advantages, disadvantages, implications and benefits at the company level. These are useful tools suitable for the management of the companies that are obliged to operate in a global economy facing with crisis.

1. Introduction

Nowadays, many companies have to handle with many obstacles such as the financial and economic crises, too many regulations, too much complexity, and are willing to improve their processes of making decisions by implementing Business Intelligence systems.

The managerial teams of the companies, regardless their size, can achieve a sustainable competitive advantage by looking carefully into how they make decisions, slow or rapidly, using adequately the modern technologies provided by IT companies.

2. Approaches of Business Intelligence

For the first time, the concept of "*business intelligence"* was used in an article by Hans Peter Luhn, an IBM researcher, in 1958. Luhn's point of view was "*Business is a collection of activities carried on for whatever purpose, be it science, technology, commerce, industry, law, government, defence etc. The communication facility serving the conduct of a business may be referred to as an intelligence system. … Intelligence is the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal*." (Luhn, 1958).

In the 1990s the concept of BI (Business Intelligence**)** became widely used, just after Howard Dresner has launched the idea that the data in IT systems can be exploited by the business itself, or as he mentions *"BI - a broad category of software and solutions for gathering, consolidating, analyzing and providing access to data in a way that lets enterprise users make better business decisions"* (Gibson, Arnott, Jagielska & Melbourne, 2004).

The most recent scientific papers define Business Intelligence from three points of view as seen in Table 1 (see Appendix). Shariat and Hightower (2007) characterize BI as a mix of processes, technologies and products: processes for collecting and analyzing business information; technologies used in those processes; and the product as "the information (knowledge) obtained from these processes".

The Benefits of Business Intelligence to a company could be to:

- Establish the best selling products and find out if they maintain their validity in all sales points of the company,
- Establish the inventory of a product or parts of it,
- Determine those customers whose purchases are reduced in order to offer special incentives to keep them,
- Determine and pursue performance metrics in order to adopt corrective actions if it is necessary,
- Apply scorecards and dashboards for executives in order to rapidly recognize the operational exceptions, or the moment when expenses will probably exceed the budget,
- Compare sales on certain dates of the year, from one year to another, and to predict the sales for the next year,
- Integrate historic and operational data for analysis purposes, to provide the accuracy and consistency of the truth within the organization,
- Follow the customers' orders and the dates of shipping the goods, in order to adapt the production cycle and the supply chain to reduce the cost for carry and the cost for inventory.

Business Intelligence solutions market is still at a low level in Romania compared to other markets, but technological and economic situation increases the interest for such solutions company, is presented in an analysis done by Relevance, a company dedicated to the development of Business Intelligence solutions (Relevance, 2013).

The local market of Business Intelligence solutions is less developed, but with interesting insights into the future.
In January 2013, the Romanian developer of BI solutions, Relevance, recommended to the companies from Romania:

- to build a 2-3 year term strategy about Business Intelligence solutions,
- to properly identify the value of the business and
- to test it together with the potential supplier, before making a major investment in a Business Intelligence solution.

The advance of mobile technologies, social networks, lower prices for IT equipment, and the economic crisis have caused major changes in the behaviour of end customers and of the companies. The speeds of producing information and of circulating higher data volumes have increased considerably, so grew the need to identify the opportunities for business and to make adequate decisions.

3. Trends of Business Intelligence

Ten strategic technology trends in 2014 were presented at Gartner Symposium/ITxpo 2013 in Orlando, where were gathered tens of thousands of IT executives, in October 2013. Among other aspects of interests, those trends were referred to (High, 2013):
Mobile device diversity and management. The variety of devices and contexts of use, allow access to work in any place, this has put pressure on companies in the information technology and financial services. In future, mobile workforce size will increase (using bring with your own device (BYOD) programs) and companies will need to define their expectations for the employee-owned hardware in order to find the balance between the adaptability of the company and the need of the confidentiality.
Mobile apps and applications. Improved performance of JavaScript will allow HTML5 and browser to become the main development environment for enterprise applications. As a result, IT application developers (after Gartner's estimates more than 100, at present) will focus on expanding the user interface models using voice and video to connect people in new and different ways, with implications on changing the user behaviour, addressing to her or his emotions and actions.
The Internet of everything. The Internet expands into the company's assets and the consumer goods such as televisions, cars, home facilities and so on.
Hybrid cloud and IT as service broker. In the future, cloud service brokerages will evolve and the private cloud services will be designed with the possibility of interoperability, in order to combine the personal clouds with the external private cloud services.
Cloud/client architecture. Because mobile users continue to demand more complex uses of their mobile technologies, it will lead to a need for higher levels of server-side computing and storage capacity.
The era of personal cloud. The need for increasingly more personal cloud technologies will lead to a shift towards services and surpassing the devices.
3-D printing. The increase of 3-D printers is projected to 75% in 2014, and 200% in 2015. Therefore, 3-D printing is a real and viable mean to reduce costs through the achievement of improved designs, streamlined prototyping and short-run manufacturing.
Smart machines. Among the smart machines which will be thriving in the future, will be included: smart advisors, autonomous vehicles, personal assistants contextually aware, and advanced global industrial systems
Web-scale IT. A web-scale IT is a combination of large cloud service providers as Google, Amazon and Salesforce.com which re-inventing the way of delivering IT services, focusing on the aspects of scale, speed and agility. In future, IT organizations should align with and emulate the processes, architectures,

and practices of these leading cloud providers.

Software-defined anything. Software which defines anything (SDx) refers to improved standards for infrastructure programming and interoperability of data centres lead by automation towards cloud computing, Dev Ops and a rapidly supplying of the infrastructure.

DevOps (Development and Operations) is a method of developing software which is focusing on the communication and collaboration among the following departments: development, quality assurance and production.

4. Mobile Business Intelligence

Mobile Business Intelligence is the ability of the persons to access BI related data such as dashboards, key performance indicators, business metrics, and on mobile devices. The concept of mobile BI has its origin back to the early 1990s when mobile phone use first began to become widespread. Companies which support mobile BI have immediately seen the potential of the mobile phones to simplify the distribution of business-critical data to mobile or being away workers. However, the era of smartphones generated widespread attention for mobile business intelligence, for more than a decade.

Vertana Research, in 2014, examined business intelligence on mobile technology to determine current and planned use of the organizations and the capabilities required for successful deployment. The study revealed that (Cosentino, 2014):

- 40% of organizations are interested in mobile BI and wish to improve the use of information;
- Fewer than 50% currently access BI capabilities on mobile devices;
- 71% expect their mobile work force to be able to access BI capabilities in the next 12 months;
- Nearly 50% of executives said that mobility is very important to their BI processes;
- Today's mobile workforce requires the ability to access and analyze data simply and in a straightforward manner, using an intuitive interface such as touch-screen or designed to support gestures;
- The most important criterion valorised by the people in the organizations willing to implement mobile BI is ease of accessing and use.

The analysis shows that the top supplier is MicroStrategy, which qualifies as number one vendor and is followed by 10 other important vendors: IBM, SAP, QlikTech, Information Builders, Yellowfin, Tableau Software, Roambi, SAS, Oracle and arcplan.

A Dresner's study over the mobile BI adoption by organizations of different sizes, conducted in 2012, revealed that (Dresner, 2013):

- Introduction of mobile BI is fairly modest;
- Majority of organizations report that fewer than 10% of users have access;
- Adoption is less than 10% for 48% of small organizations and for 87% of large organizations;
- 20% of small business participants report that their mobile BI introduction is 81% or higher. Therefore, adoption in the small organizations is significant.
- Organizations of all sizes said they will be using mobile BI substantially by 2015.

The analysis shows that although there is little progress from year to year, the hope is the young people by their engaging into organizations, they will come with new breath of knowledge and use of mobile BI.

5. Cloud computing and Cloud Business Intelligence

In the 1950s, the concept of cloud computing has became visible with the development of the microchip and of the

mainframe computer. Users were able to access the computer through terminal or client computers and, to promote efficient use of CPU (Central Processing Unit – the "brain" of the computer) resources, the practice of time-sharing and multi-tenancy (includes three levels of consumer integration: data centre, infrastructure and application) evolved. From the 1960s to the late 1990s, improvements to time-sharing models, server balancing and remote access (VPN – Virtual Private Network extends a private network across a public network, such as the Internet) laid the groundwork for what would come during the dot-com boom in the early 2000s.

The rapid development of computing power and the emergence of the internet during the 1990s opened the way for important developments in cloud computing. Early pioneers like Google, Salesforce, and Amazon support the ability of the cloud to deliver computing power independently of hardware and locally installed software. Since the middle of 2000s, the cloud computing industry has grown exponentially, and will become an industry of $210 billion by 2016 (Columbus, 2013).

NIST (National Institute of Standard and Technology) defines cloud computing as: "A model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." (Mell & Grance, 2011)

Cloud Business Intelligence is a new concept of delivering business intelligence capabilities —"as service" using cloud based architecture that comes at a lower cost yet faster deployment & elasticity. Software as a Service (SAAS) BI is also being used by many small and medium sized enterprises who seek to speed up their businesses with BI and analytics tools (Gurjar & Rathore, 2013).

Cloud Business Intelligence offers some important advantages over on-premise applications, such as:

- *Ease of use* - Cloud Business Intelligence applications, like other cloud applications, are easier for end-users to set up and operate. This means reduced costs and less IT involvement.
- *Accessibility* - Cloud Business Intelligence applications can be accessed on any mobile device or on any web browser.
- *Better Data Connectivity* - Easily automate data transfer from other cloud business applications, such as CRM or marketing automation, via ready-made cloud connectors.
- *Scalability and elasticity* - Cloud applications can be quickly scaled to adapt for an increase in the number of users within an organization.
- *Deployment speed* - Cloud applications are very easy to implement, since they require no software installations or additional hardware.
- *Security* - All important cloud computing vendors provide data centres with the latest virtual and physical security practices. Indicee uses Amazon Web Services' (AWS) secure data centres in the USA. The software supports the latest browser security technology, protects data in transit with end-to-end SSL v3 encryption, and assigns to every customer a separate database.

Cloud is a major part of the future of Business Intelligence and offers several advantages in terms of availability, cost benefits, speed and flexibility of deployment.

6. Social Business Intelligence

Social business intelligence (social BI) refers to a management technique that integrates group sharing in order to improve existing processes, products and projects. Social business intelligence is managed by the analytical software that combines the functions of traditional project management software with commitment techniques from social media. The most important feature of social business intelligence is that it requests customer input and feedback at early points in the process rather than after a product is launched.

"Social media intelligence aims to derive actionable information from social media in the context of rich application settings, develop corresponding decision-making or decision-aiding frameworks, and provide architectural designs and solution frameworks for existing and new applications." (Zeng, et al., 2010)

7. Conclusion

Regarding Mobile Business Intelligence, as it was noticed in the specialized studies, in 2010, people wished to look at the key performance indicators (KPIs), at the reports, and perhaps to some alerts. Starting with 2012, they begin to request new features like *interaction* and *navigation*, which orients the IT companies in developing new applications as *Social Business Intelligence*.

Among the advantages offered by *Cloud Business Intelligence*, the following are highlighted:

- *Lower Costs (SaaS BI)* - Generally, cloud business intelligence is delivered as an online service. This model is known as "Software-as-a-Service" or "SaaS". SaaS BI is more affordable because there are no large upfront license or implementation fees, no hardware costs; moreover maintenance is included in the service.
- *Faster Deployment* - SaaS business intelligence enables rapid deployment without any required physical implementation. Indicee is a good example in this sense.
- *Greater Mobility* - With cloud business intelligence, people can access data from anywhere, at anytime, on any internet device.
- *Accessible to Business Users* - Business intelligence is complex and managed by IT teams. This creates bottlenecks and hinders the decision-makers in other business areas from getting the answers they need. Indicee's cloud BI makes it possible for data-savvy business users to manage the complete BI process, because of some smart tools for modelling and querying.

Despite the advantages of applying BI solutions in organizations, there are few alternatives aimed at SMEs. A useful alternative for SMEs could be the Software-as-a-Service (SaaS) solution.

Reference list:

[1] Chee, T., Chan, L.K., Chuah, M.H., Tan, C.S., Wong, S.F., Yeoh, W. (2009). Business Intelligence Systems: State-of-the-Art Review and Contemporary Applications. *Symposium on Progress in Information & Communication Technology*, pp. 96-101.

[2] Columbus, L. (2013). Gartner predicts infrastructure services will accelerate cloud computing growth, 19 February 2013, *Forbes*, Retrieved 10 March 2014 from: http://www.forbes.com/sites/louiscolumbus/2013/02/19/gartner-predicts-infrastructure-services-will-accelerate-cloud-computing-growth/

[3] Cosentino, T. (2014). Mobile Business Intelligence: Who is hot in 2014?, 18 February 2014, *SmartDataCollective*, Retrieved 8 March 2014 from: http://smartdatacollective.com/tony-cosentino/185846/mobile-business-intelligence-who-hot-2014

[4] Dresner, H. (2013). Dresner Study Reveals High Expectations for Growth of Mobile Business Intelligence, 5 February 2013, *Sand Hill*, Retrieved 9 March 2014: http://sandhill.com/article/dresner-study-reveals-high-expectations-for-growth-of-mobile-business-intelligence/

[5] Gartner (2014), retrieved from http://www.gartner.com/it-glossary/business-intelligence-bi/

[6] Gibson, M., Arnott, D., Jagielska, I., & Melbourne, A. (2004). Evaluating the Intangible Benefits of Business Intelligence: Review & Research Agenda. *Proceedings of the 2004 IFIP International Conference on Decision Support Systems (DSS2004): Decision Support in an Uncertain and Complex World*, pp. 295-305.

[7] Golfarelli, M., Stefano, R., & Iuris, C. (2004). Beyond Data Warehousing: What's Next in Business Intelligence?. *Proceedings of the 7th ACM international workshop on Data warehousing and OLAP*, Washington, DC, USA: ACM.

[8] Gurjar, Y.S., & Rathore, V.S. (2013). Cloud Business Intelligence – Is What Business Need Today. *International Journal of Recent Technology and Engineering (IJRTE)*.

[9] High, P. (2013). Gartner: Top 10 Strategic Technology Trends For 2014, *Forbes*, 14 October 2013, Retrieved 10 March 2014 from: http://www.forbes.com/sites/peterhigh/2013/10/14/gartner-top-10-strategic-technology-trends-for-2014/

[10] Luhn, H.P. (1958). A Business Intelligence System. *IBM Journal of Research and Development*, Volume 2, No. 4, pp.314-319.

[11] Mell, P., & Grance, T. (2011). The NIST Definition of Cloud Computing (draft), *National Institute of Standards and Technology Special Publication*, 800-145

[12] Shariat, M., & Hightower, J.R. (2007). Conceptualizing Business Intelligence Architecture. *Marketing Management Journal*, 17 (2), pp. 40-46.

[13] Relevance (2013), Trendurile anului 2014 in Business Intelligence [Trends of the year 2014 in Business Intelligence], 15.01.2013, Retrieved 10 March 2014 from http://www.relevance.ro/noutati/

[14] Wixom, B. & Watson, H. (2010). The BI-Based Organization. *International Journal of Business Intelligence Research*, 1(1), pp. 12-24.

[15] Zeng, D., Chen, H., Lusch, R., & Li, S.H. (2010). Social Media Analytics and Intelligence. *IEEE Intelligent Systems*, 25(6), pp. 13–16

Appendix

Table 1
Approaches of Business Intelligence

Approaches	Definitions of Business Intelligence	Authors
Process	"Business Intelligence (BI) can be defined as the process of turning data into information and then into knowledge."	Golfarelli, Stefano, Iuris, 2004
	"Focus on the process of gathering data from internal and external sources and of analyzing them in order to generate relevant information for improved decision making."	Chee, T. et al., 2009
Technology	"Business intelligence (BI) is a broad category of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to help its users make better decisions."	Wixom & Watson, 2010
	"Focus on the tools and technologies that allow the recording, recovery, manipulation and analysis of information."	Chee, T. et al., 2009
Product	**"**Business intelligence (BI) is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions and performance."	Gartner, 2014
	"Describe BI as the emerging result/product of in-depth analysis of detailed business data as well as analysis practices using BI tools."	Chee, T. et al., 2009