

## Considerations Regarding Business Intelligence in Cloud Context

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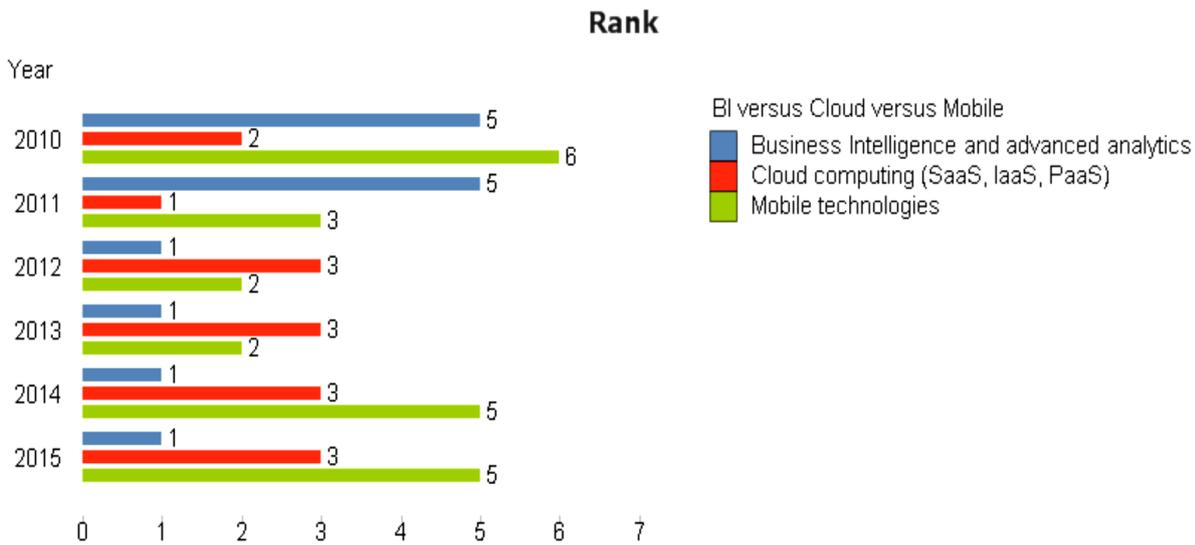
*This paper explores one of the newer challenges related to the field of Business Intelligence: cloud-based business intelligence. The purpose of this paper is to investigate how business intelligence and cloud computing could be used together to provide agility in business. Also, the paper presents briefly the different deployment models for cloud-based BI such as: BI software as a service (BI SaaS) and business analytic platform as a service (BA PaaS). The paper gives an overview of the current state of cloud-based business intelligence market and presents a comparative analysis between the cloud-based BI leaders, using the different criteria. Finally, the paper identifies the strengths and weaknesses of cloud-based BI.*

**Keywords:** Agile Business, Business Intelligence, Cloud-Based Business Intelligence, BA PaaS, BI SaaS

### 1 Introduction

Considering the current situation, the businesses must adapt quickly to changes that appear continuously, in a global and dynamic economy, they must be agile. In a world that changes permanently, the leadership position is temporary, only agility creates a competitive advantage for companies. Also, there is too much information that changes faster than the information systems. Information is a strategic resource for companies, and decisions must be taken based on a huge amount of real-time information, from a high variety of internal and external sources, unstructured and structured sources. In the article „*The ten dimensions of business agility*” [7], Craig le Clair, from Forrester Research, has identified the main factors that influence business agility. They are grouped into three categories: marketing (market responsiveness and channel integration), organization (knowledge dissemination, digital psychology and change management) and IT technologies (business intelligence, infrastructure elasticity, business processes architecture, software innovation and sourcing and supply chain). We can see that cloud computing (that offers a scalable and elastic infrastructure) and business intelligence are two important factors that can influence the agility of a business. Also, during

2010-2015, according to Gartner Group consulting company [3], BI and cloud computing were considered high priority technologies for CIO. In 2014, the market survey included 2339 CIOs from 77 countries, with a total of 300 billion dollars revenue. We can observe that BI has been ranked first from 2012 until today, 50% of those interviewed have considered that BI technology is very important for companies activity Figure 1. Cloud computing ranked first in 2011 and since 2012, it has been constantly ranked third until today. Also, the top two IT technologies which will be subjected to massive investment in 2015 are: business analytics and cloud computing. Cloud computing and business intelligence are part of the core technological platform for digital businesses, named by Gartner Group “*the nexus of forces*”. This technological platform will change the way we see the society and businesses, and also, will create new business models. Also, this platform will modify the way businesses interact with customers, it will change the collaboration with employees and partners and it will improve business agility. The information will be accessible, shareable and usable by anyone, anytime and anywhere.



**Fig. 1.** Cloud and BI in CIO's technology priorities

The main characteristics of cloud computing are: “uses the internet technologies, offers a scalable and elastic infrastructure, offers shared resources, fault tolerance, offers services with metered use that are accessible through a standardized interface (for example, web client) over the Internet” [2]. The services are offered at the customer's demand and they are flexible, and the resources are dynamically supplied and they can be shared by a large group of clients. Therefore, cloud computing has the potential to help BI systems to become more agile, more flexible and more responsive to changing business requirements. Also, cloud computing is a platform for business applications, for social media, for sharing and hosting data. The following paragraph presents the concept of cloud-based BI and the deployment models for cloud-based BI. Also, the paragraph presents a comparative analysis between the cloud-based BI leaders, using the different criteria.

## 2 Cloud-based BI

According to Gartner's definition, cloud-based BI refers to “any analytics effort in which one or more of these elements is implemented in the cloud be it public or privately owned. ...The six elements are data sources, data models, processing applications, computing power, analytic models, and sharing or storing of results” [http:// searchbusinessana-

lytics.tech-target.com/news/2240019778/Gartner-The-six-elements-of-cloud-analytics-and-SaaS-BI]. According to [1] cloud-based BI refers to „the BI technologies and solutions that employ one or more cloud deployment models”. Cloud-based BI is a relatively new concept, which refers to the components of a BI system delivered as services, but also to the data used by the BI system, data which can be stored in cloud. The components of a traditional BI system (ETL instruments, data warehouse, BI tools and business analytics solutions, business performance management tools and BPM applications) can be delivered as cloud services. As shown in Figure 2, any combination is possible, depending on the company requirements and objectives. For example, data sources can be loaded on the client servers to ensure their security, and the applications and instruments for business analysis can be stored in the cloud. However, data security can be compromised because data must be accessed and analyzed over the Internet. This is a hybrid deployment model for cloud-based BI. Other deployment models for cloud-based BI are: public (all data in the cloud) and private. Cloud-based BI solutions are much more flexible than traditional BI solutions. Therefore, a cloud-based BI solution may be a feasible answer to the challenges of a dynamic global economy.

Cloud-based BI refers to: BI SaaS (BI software as a service), BI for PaaS (platform as a service), BI for SaaS and BA PaaS (business analytic platform as a service). BI SaaS is also known as on-demand BI and includes:

- BI SaaS tools that can be used to develop BI applications for deployment in a cloud;
- packaged BI SaaS applications that can be deployed in a cloud environment (for example, applications for business analysis or business performance management applications);
- data integration services for BI;
- developing/ testing services for BI.

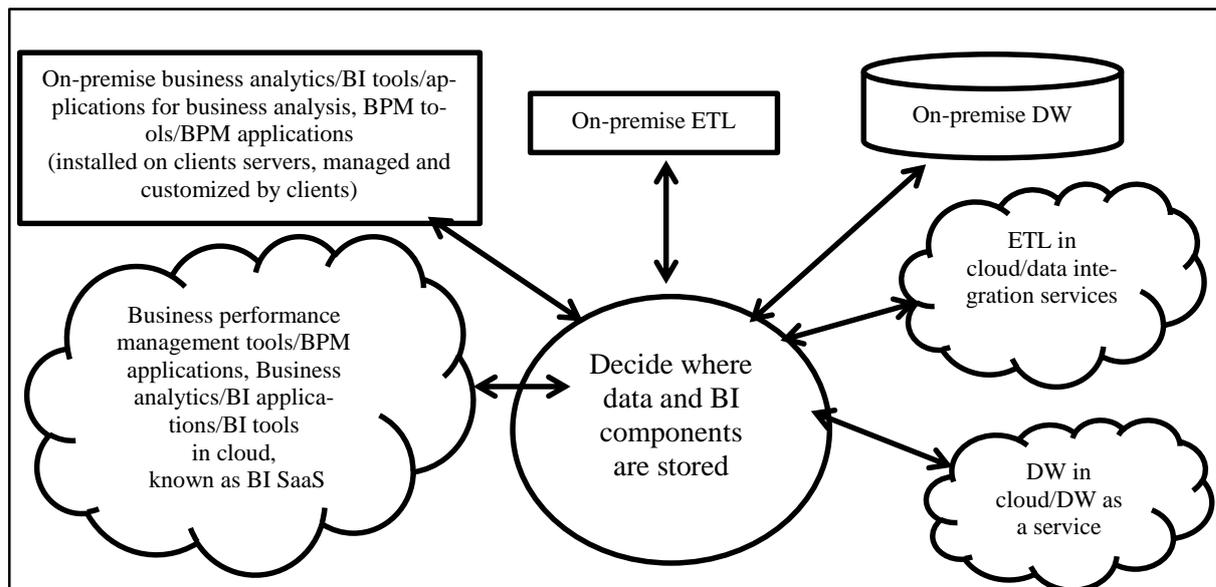


Fig. 2. Location of BI data and BI components

BI for SaaS refers to the inclusion of a BI functionality in a SaaS application (for example, Microsoft Dynamics CRM online, a SaaS solution, includes a dashboard capability).

BI for PaaS is a set of analytically services /information delivery services integrated into a platform (PaaS) and managed by PaaS. For example, Oracle BI Cloud Service is part of the Oracle Cloud PaaS.

A platform as a service (PaaS) is “a broad collection of application infrastructure (middleware) services (including application platform, integration, business process management and database services” [http://www.gartner.com/it-glossary/platform-as-a-service-paas]. PaaS usually includes IaaS layers. PaaS makes the development, testing, and deployment of applications quick, simple and cost-effective. The public PaaS marketplace includes: application PaaS (for example, force.com), integration PaaS

(for example, IBM WebSphere, BOOMI), business process management/BPM PaaS (for example, Appian), Database PaaS (for example, database.com), business analytic PaaS, etc. A *business analytic PaaS* (BA PaaS) represents a shared and integrated analytic platform in the cloud and delivers the following services: BI services, DW services, data integration services and infrastructure services Figure 3. BA PaaS is designed for developers, unlike BI SaaS, which is designed for business users.

For example, Microstrategy Cloud Platform is a public BA PaaS that includes BI services, DW services, data integration services that enable customers to move data into the MicroStrategy Cloud Data Warehouse environment and infrastructure services which provide storage, network and compute infrastructure.

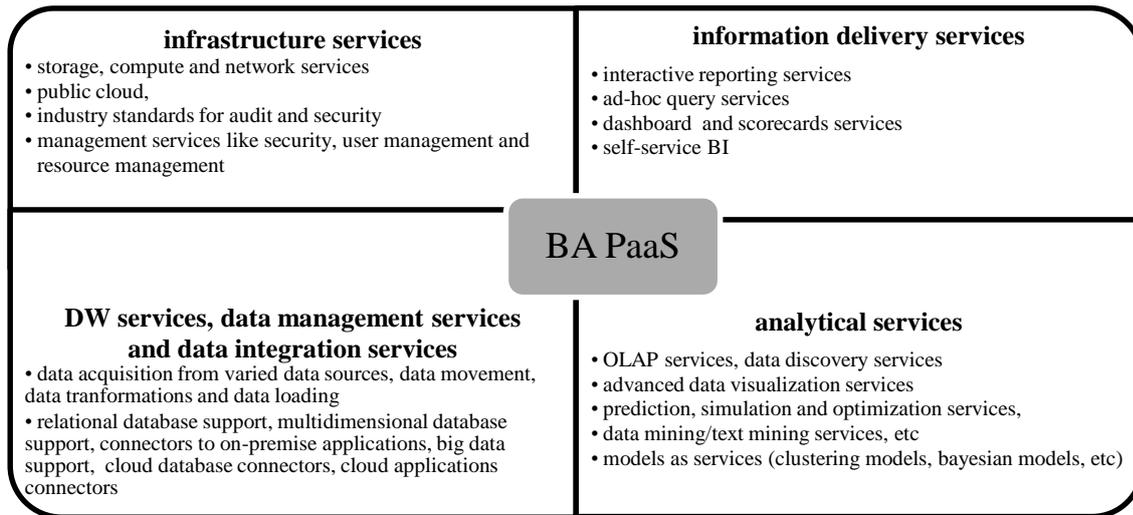


Fig. 3. BA PaaS

According to Gartner Magic Quadrant for Business Intelligence and analytics platforms - 2015 [13], the BI market leaders are: Tableau, Qlik, Microsoft, IBM, SAP, SAS, Oracle, Microstrategy and Information Builders. However, the main leaders for cloud-based BI solutions are those from challengers' quadrant and the niche players' quadrant: Birst (a pioneer in cloud-based BI), and GoodData. Figure 4 presents the cloud deployment scores for each vendor, according to [14]. Each vendor

has been evaluated on the following cloud deployment capabilities: “*self-service elasticity, self-service administration, data warehouse and data integration capabilities, connectors to cloud-based data sources, direct connect for cloud and on-premises data sources (hybrid) and packaged content*” [14]. We observe that Birst have the highest score -3.7. GoodData is not included in survey. Also, according to [1] the top cloud BI vendors are Birst (1<sup>st</sup>), GoodData (2<sup>nd</sup>), Adaptive Insights (3<sup>rd</sup>), Information Builders (3<sup>rd</sup>) and Microstrategy (4<sup>th</sup>).

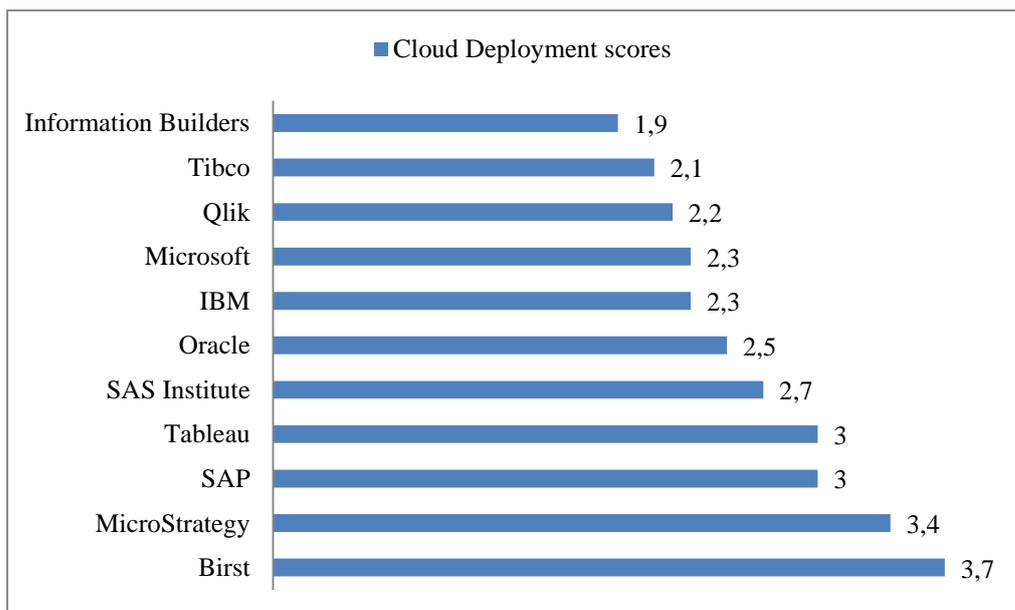
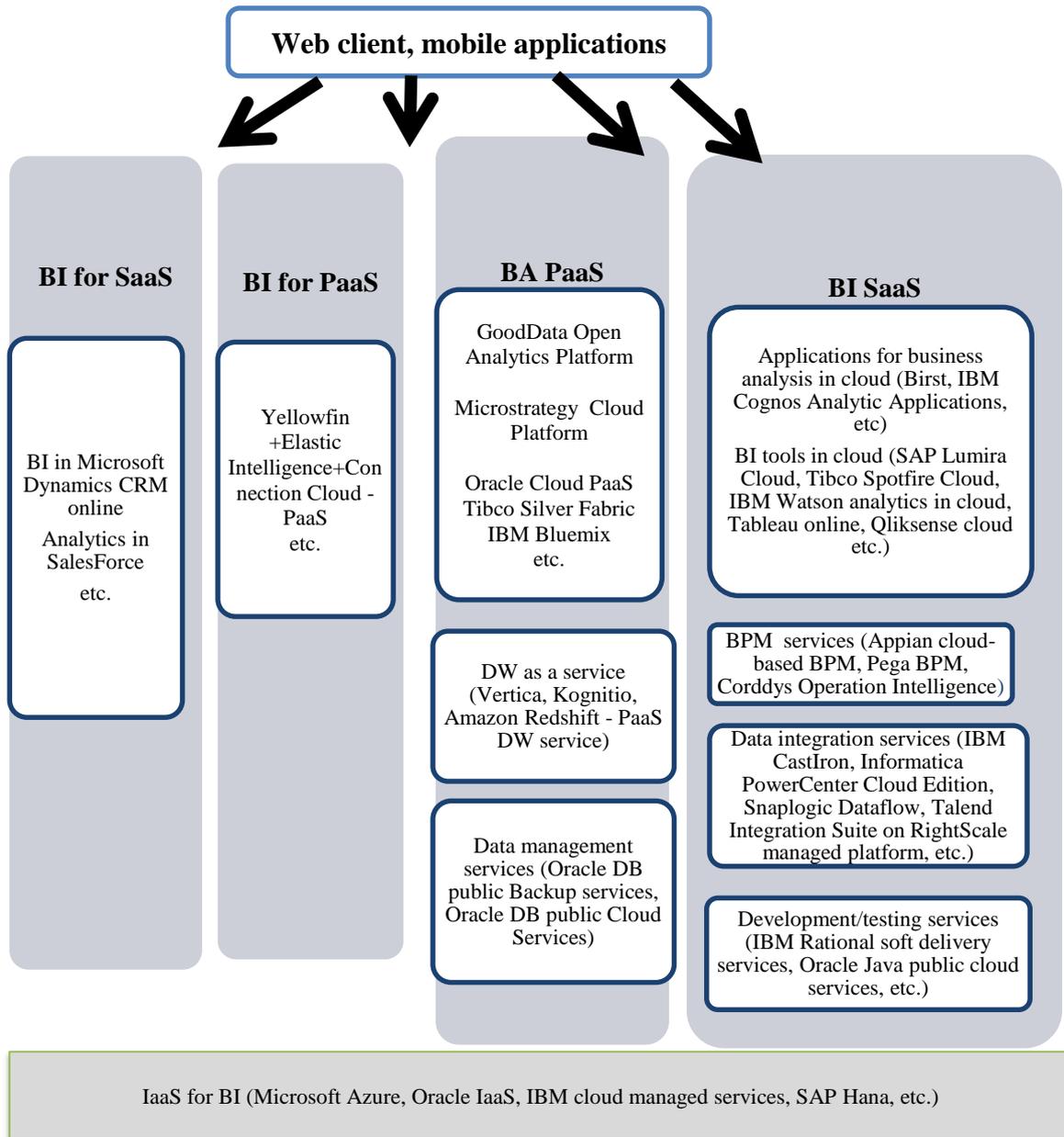


Fig. 4. Cloud deployment scores for BI vendors [source: adapted from [14]]

Figure 5 presents a summary of the deployment models for cloud-based BI and examples of solutions for each deployment model.



**Fig. 5.** Cloud-based BI deployment models

Also, Table 1 presents the cloud-based BI market leaders and their solutions: Birst, GoodData, SAP, Microstrategy, Tableau, SAS, Oracle, IBM, Tibco, Qlik, Information

Builders, Microsoft and Bime. There are presented the main features for each cloud-based BI solution.

**Table 1.** The cloud-based BI market leaders

Vendors	Solutions	Features
Birst [5]	Birst public cloud BI- a BI SaaS on AWS	<p>Birst Data Discovery</p> <ul style="list-style-type: none"> <li>- supports: visual discovery, ad-hoc analysis, dashboard, mobile analytics;</li> </ul> <p>Birst Enterprise edition</p> <ul style="list-style-type: none"> <li>- includes: a cloud-analytic datawarehouse, dimensional database management services, data integration services, ETL services;</li> <li>- provides connectors for: cloud-based data sources (such as Salesforce, NetSuite, Google Analytics and Marketo), on-premise databases, flat files, on-premise and cloud applications;</li> <li>- uses a subscription-based pricing model with the option of “concurrent user pricing”;</li> <li>- offers „live data connectivity” via Live Access;</li> <li>- provides limited capabilities for advanced analysis and data mining;</li> </ul>
	Instant Cloud Analytics with Birst on SAP Hana Cloud Platform- a BA PaaS	<ul style="list-style-type: none"> <li>- integrates SAP Hana platform with Birst’s SAP connectors, and the Birst’s architecture;</li> </ul>
GoodData [4]	GoodData Open Analytics Platform- a multi-tenant BA PaaS on Amazon Web services (EC2, EBS, S3)	<ul style="list-style-type: none"> <li>- includes: Hadoop, HP Vertica (for multidimensional analysis), MongoDB, NetApp, Rackspace, OpenStack, PostgreSQL, SafeNet, HTML5, Ember.js, Okta, Insights as a service with Analytical Designer and Data Explorer for data discovery;</li> <li>- supports: visual data discovery, collaboration, reporting, analytic applications for marketing/sales/service, Big Data ETL/ELT, data warehousing, advanced analytics and visualization, self-service data discovery;</li> <li>- provides connectors for: traditional enterprise data sources, cloud applications and social sources, big data sources, public data such as Salesforce.com, Twitter;</li> <li>- subscription-based data services price: up to \$2500 per project, depends on data volume [<a href="http://www.kdnuggets.com/2014/04/gooddata-open-analytics-platform.html">http:// www.kdnuggets.com/2014/04/gooddata-open-analytics-platform.html</a>];</li> </ul>
Tibco Spotfire [17]	Spotfire Cloud Work group- a BI SaaS	<ul style="list-style-type: none"> <li>- provides connectors for: excel, csv, text, Microsoft Access databases, SAS data files, ESRI shape files, Amazon Redshift, Cloudera HIVE/Impala, IBM DB2/Netezza, Microsoft SQL Server/Server Analysis Services, Oracle/Esbase, MySQL, PostgreSQL, SAP Hana, etc.;</li> <li>- supports: complex visualizations and advanced analytics (predictive modeling, k-means clustering, data relationships, and an integrated R engine);</li> <li>- offers max 250 GB cloud storage;</li> <li>- subscription price: 200\$/month [<a href="http://spotfire.tibco.com/buynow">http:// spotfire.tibco.com/buynow</a>];</li> </ul>
	Tibco Spotfire Cloud Personal – a BI SaaS	<ul style="list-style-type: none"> <li>- you can import, explore, and visualize spreadsheets, flat files, SAS data files and ESRI shape files;</li> <li>- offers max 100 GB cloud storage;</li> <li>- subscription price: \$30/month or \$300/year;</li> </ul>
	TIBCO Cloud Bus service	<ul style="list-style-type: none"> <li>- integrates SaaS and on-premise applications under a single subscription price;</li> </ul>

Vendors	Solutions	Features
	TIBCO Clarity Cloud Edition	- a data preparation, profiling and cleansing tool; - subscription price: 100-225\$/month;
	TIBCO Silver Fabric- a PaaS, in any private, public, or hybrid cloud infrastructure.	- supports: Tibco SOA Suite, Oracle SOA, Web servers, Databases and in-memory data grids and big data technologies (Hadoop, MapReduce, Hbase);
Information Builders [6]	Information Builders cloud hosting services – a PaaS for BI and information management	- uses a public-cloud environment or dedicated private cloud resources; - includes more than 10 data centers; - provides: WebFOCUS BI platform in cloud, iWay integration technologies in cloud, cloud managed services; - provides connectors for cloud and on-premises data sources; - provides a cloud hosting service for testing and developing of BI applications - Skybox; - provides: iWay cloud service for Amazon EC2 /AWS– a SaaS and WebFOCUS analytics for SaaS providers; -a monthly subscription price based on usage;
SAP [15]	SAP Lumira public cloud version of Lumira– a BI SaaS	- provides: in-memory, self-service analytics, data visualization; - runs on SAP Hana Cloud Platform; - offers max 1Gb cloud storage; - free through online registration;
	SAP Lumira Cloud Enterprise Edition – a BI SaaS	- provides 5 gigabytes of shared storage and supports private collaboration among multiple users; - subscription price: 25\$/22eur per month, 5 users min, first 5 GB of storage are included, additional storage 25\$/22eur per month, per GB [ <a href="http://scn.sap.com/docs/DOC-41354">http://scn.sap.com/docs/DOC-41354</a> ];
	SAP Hana cloud platform - a scalable, secure, modular and open standard PaaS for BI, on private cloud Hana Enterprise Cloud	- includes in-memory computing infrastructure services, database services and application services; - free for developer edition (only 1 user, 1 Gb of storage) \$507 per month for starter edition (unlimited users, 32GB Hana) [ <a href="http://hcp.sap.com/pricing.html">http://hcp.sap.com/pricing.html</a> ], different subscription prices for small business/enterprise;
Microstrategy [8]	MicroStrategy Cloud-a BA PaaS on private cloud or AWS  MicroStrategy Secure Cloud / Microstrategy 10 Secure Enterprise on AWS (launched in July 2015)	- includes: MicroStrategy BI services, an analytical database (such as: Actian Matrix, Microsoft SQL Server, Informatica, Netezza, Teradata) and data integration capabilities (Informatica PowerCenter, Informatica Cloud, SQL Server Integration Services), a PRIME (Parallel Relational In-Memory Engine); - MicroStrategy Direct Connect technology provides access to on-premises or cloud-based data sources; - MicroStrategy Cloud Infrastructure as a Service (IaaS) provides storage, network, and compute infrastructure;
IBM [5]	IBM Watson Analytics -a BI SaaS	- a self-service cloud-based data discovery tool; - focus on search-oriented visual analysis, predictive analytics, statistical analysis, self-service analytics, data visualization; - uses a natural-language query;

Vendors	Solutions	Features
		<ul style="list-style-type: none"> <li>- free cloud BI with limitations: 1 user, 100000 rows, 50 columns, 500 Mb storage;</li> <li>- subscription price for professional edition: 80\$/user, 10000000 rows, 500 columns, 100Gb storage, access to: social data from Twitter, Cognos data and other data sources [<a href="http://www.ibm.com/marketplace/cloud/watson-analytics/us/en-us#pricingButton2">http://www.ibm.com/marketplace/cloud/watson-analytics/us/en-us#pricingButton2</a>];</li> <li>- Watson Health cloud (in collaboration with Apple, Johnson &amp; Johnson and Medtronic)- a cloud based BI application;</li> </ul>
	Cognos Business Intelligence on Cloud – a BI SaaS	<ul style="list-style-type: none"> <li>- runs on the IBM SoftLayer global cloud infrastructure;</li> </ul>
	IBM Cloudant- a NoSQL Database-as-a-Service	<ul style="list-style-type: none"> <li>- provides: real-time indexing features for ad-hoc full text search via Apache Lucene, online analytics via MapReduce, advance geospatial querying;</li> </ul>
	IBM Cloud includes IaaS, PaaS and SaaS	<ul style="list-style-type: none"> <li>–includes: IBM Cloud Managed Services (a fully managed IaaS) or IBM SoftLayer self-service IaaS; IBM Bluemix PaaS - based on Cloud Foundry and Openstack open technologies and runs on SoftLayer infrastructure, with over 100 services; over 100 IBM SmartCloud Solutions (SaaS and BPaaS) such as: IBM SPSS Decision Management software as a service, IBM Cognos Sales Performance Management on cloud, IBM smarter cities solutions on cloud, IBM commerce on cloud, etc;</li> </ul>
Microsoft [5]	Power BI Preview with Power BI designer—a BI SaaS	<ul style="list-style-type: none"> <li>- free cloud BI;</li> <li>- offers max 1 Gb cloud storage;</li> </ul>
	Power BI for Office 365	<ul style="list-style-type: none"> <li>- Microsoft Power BI is a cloud-based suite of data access, data management and data analysis (ad-hoc reporting, complex data visualizations and dashboards);</li> <li>- includes R programming and Q&amp;A, a natural-language query interface;</li> <li>- subscription price for Power BI Pro: \$9.99 per user, per month and provides 10 gigabytes of storage [<a href="https://powerbi.microsoft.com/pricing">https://powerbi.microsoft.com/pricing</a>];</li> <li>-provides connectors to Microsoft Dynamics CRM, Marketo, Salesforce and Zendesk;</li> <li>- offers „live connectivity” to SQL Server Analysis Services;</li> </ul>
	Microsoft Azure platform (PaaS)	<ul style="list-style-type: none"> <li>- a cloud platform (IaaS and PaaS) for BI applications;</li> <li>- runs in its own data centers;</li> </ul>
Oracle [10]	Oracle BI cloud service – a BI SaaS	<ul style="list-style-type: none"> <li>- offers support for data loading and data modeling;</li> <li>- includes Oracle Big Data Discovery -a visualization and analysis tool, for analysis of Hadoop data;</li> <li>- subscription price: 250\$ per month per named user [<a href="https://cloud.oracle.com/business_intelligence?tabID=1410551506786">https://cloud.oracle.com/business_intelligence?tabID=1410551506786</a>];</li> </ul>
	Oracle cloud Paas	<ul style="list-style-type: none"> <li>- includes: Oracle Database cloud service, Oracle Java Cloud service, Oracle Database backup service, Oracle BI cloud service (BICS), Oracle messaging cloud service, Oracle documents cloud service, Oracle Database cloud-Exadata service, Oracle Archive Storage Cloud Service, Oracle Big Data Cloud Service and Big Data SQL Cloud Service, Oracle Integration Cloud Service, Oracle Mobile Cloud Service, Oracle Process cloud service, Oracle Node.js Cloud;</li> </ul>

Vendors	Solutions	Features
		- Oracle IaaS includes Oracle IaaS Public Cloud Services, Oracle storage cloud service and Oracle Compute Cloud service;
SAS [12], [16]	SAS Cloud Analytics –a BI SaaS	- supports: reporting, dashboard, decision trees, network diagrams, on-the-fly forecasting, goal seeking, scenario analysis, path analysis , text sentiment analysis;
	SAS Cloud - a private cloud PaaS	- includes: SAS virtual applications (vApps), SAS Visual Analytics with Visual Statistics –an integrated platform for data exploration, dashboarding, ad-hoc reporting and analysis on public cloud (on AWS)/private cloud / SAS cloud environment, SAS central –a role –based Web portal for managing SAS cloud accounts, applications, users and environments and for uploading data, SAS App Engine for delivery and maintenance of SAS vApps through SAS App Central;
Qlik [11]	Qlik Cloud (a BI SaaS) on AWS and Redshift (a Big Data Platform for QlikView Direct Discovery)	- for deploying QlikView or Qlik Sense through AWS, or sharing Qlik Sense applications in the cloud; - includes: QIX in-memory Associative Indexing Engine, Qlik DataMarket (a data as a service) for access to on demand external data sources, Qlik Sense Cloud - a free hosted SaaS version of QlikSense, QlikSense Charts for sharing interactive charts on public sites; - QlikSense Cloud- for uploading and sharing QlikSense applications (max app size 25 MB, max storage 1GB, max 5 users)
Tableau [5]	Tableau Online 9.0- a BI SaaS, a cloud version of Tableau Server	- offers connectors for on-premise data and cloud data such as: Hadoop clusters, Excel files, Google BigQuery, Amazon Redshift, Windows Azure, Google Analytics, Salesforce.com, MySQL, Microsoft SQL Server, PostgreSQL, etc; - connects directly to Google BigQuery and Amazon Redshift; - does not support for multidimensional data sources; - offers max 100 Gigabytes storage; - a free cloud-based version only one month; - subscription price: \$500 per user, per year [ <a href="https://tableau.secure.force.com/webstore">https:// tableau.secure.force.com/webstore</a> ];
BIME [5]	BIME Analytics -a SaaS on AWS	- the first vendor to offer front-end BI capabilities for Big Data cloud based enterprise solution; - offers connectors for more than 35 on-premises and cloud data sources (such as: Salesforce, Google Analytics, Zendesk, Google BigQuery, Redshift, Vertica, SAP Hana, MongoDB, etc.); - offers connectivity to Cloud based services such as YouTube, Gmail, Dropbox, Google Drive, and more; - provides support for big data, cloud-based data warehousing, data visualizations, dashboards; - subscription price: starting from \$490 per month (base plan) for two users, or \$690 (big data) per month for two users, including adapters for big data repositories [ <a href="https://www.bimeanalytics.com/pricing.html">https://www.bimeanalytics.com/pricing.html</a> ];

Others companies that offer BI SaaS solutions are: InsideSales.com (offers a cloud-based predictive sales platform built on Neuralytics, “a predictive and prescriptive self-learning engine” that includes also, C9 Forecast, C9 Pipeline and C9 Advisor); Host Analytics (a leader in performance management and financial applications in cloud) with Host Analytics

EPM suite; Adaptive Insights with Adaptive Suite -a cloud-based BI and corporate performance management suite that includes Adaptive Planning, Adaptive Consolidation and Adaptive Discovery, etc. There are only four free cloud-based BI solutions: Watson Analytics, SAP Lumira Cloud, Power BI and QlikSense Cloud.

In conclusion, there are many and different cloud-based BI solutions. Table 2 presents a comparative analysis between the cloud-based BI leaders, using the following criteria: cloud-

based BI deployment models, data warehousing and ETL capabilities, data discovery capabilities, self-service and connectors for hybrid sources. We observe that Microsoft, Oracle, IBM, SAP and Microstrategy meet all criteria.

**Table 2.** A comparative analysis

Vendors	BA PaaS	BI SaaS	IaaS for BI	DW+ ETL capabilities	Direct connect for cloud and on-premises data sources (hybrid)	Data discovery capabilities	self-service
Birst	Instant Cloud Analytics on SAP Hana	Birst Data Discovery/ Enterprise edition on AWS	-	Y	Y	Y	Y
GoodData	GoodData Open Analytics Platform on AWS	Insight as a service	-	Y	Y	Y	Y
Tibco Software	Tibco Silver Fabric on AWS/ private cloud/ hybrid cloud	Spotfire cloud work group/personal	-	Y	Y	Y	Y
Tableau online	-	Tableau online on AWS/Microsoft Azure	-	Y	partially (not does support multidimensional data sources)	Y	Y
Qlik	-	Qlik cloud on AWS	-	partially	partially	Y	Y
Microsoft	Microsoft Azure cloud services- a PaaS for BI	Power BI	Microsoft Azure	Y	Y	Y	Y
Oracle	Oracle cloud PaaS	Oracle BI cloud service	Oracle IaaS	Y	Y	Y	Y
Informations Builder	Information Builders cloud hosting services on public/ private cloud	Webfocus BI on AWS	Information Builders cloud hosting services includes cloud management services	Y	Y	Y	Y

Vendors	BA PaaS	BI SaaS	IaaS for BI	DW+ ETL capabilities	Direct connect for cloud and on-premises data sources (hybrid)	Data discovery capabilities	self-service
IBM	IBM Bluemix on private/hybrid cloud	IBM Watson Analytics, Cognos Business Intelligence on Cloud	IBM cloud managed services	Y	Y	Y	Y
SAS	SAS cloud	SAS cloud Analytics	Not available	Y	Y	Y	Y
SAP	SAP Hana cloud platform	SAP Lumira cloud	SAP Hana	Y	Y	Y	Y
Microstrategy	MicroStrategy Cloud	Express (but is retired in June)	Y	Y	Y	Y	Y
BIME	-	BIME Analytics on AWS	-	partially	Y	Y	Y

The importance of cloud-based BI solutions has significantly increased every year from 2012 until today. The major factor for the

cloud-based business intelligence market growth is the huge volume of structured and unstructured data.

**Table 3.** The strengths and the weaknesses of cloud-based BI

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>-the companies can implement a BI service/ a SaaS BI solution faster and easier than an on-premise BI solution. Also, the costs for implementation and maintenance of software/hardware and training costs are reduced;</li> <li>-lower level of effort and lower risks;</li> <li>-by reducing costs, small companies can use the same IT technologies as big ones. The used service is paid, which is financially more effective than investing in hardware and software acquisitions;</li> <li>-it offers immediate access to hardware resources, without any additional investments, it reduces the time to develop BI solutions;</li> <li>-it increases the speed of deployment of BI solutions;</li> </ul>	<ul style="list-style-type: none"> <li>-data security, protection against authenticity fraud and cyber-attacks and security standards; Security is the most important aspect of a cloud-based BI solution;</li> <li>-the costs and time needed for big data transfers in cloud. In a public cloud there can be replicated only some of the stored data in the client data warehouse, or the entire data warehouse can be uploaded into cloud (solution used if transactional applications are in the cloud, meaning all resources are uploaded in the cloud);</li> <li>-integrating data from cloud and on-premise sources;</li> <li>-the lack of a strategy for how to combine and integrate cloud services with on-premises capabilities;</li> </ul>

<p>-easy sharing of information (only Web browser);</p> <p>-self-service BI, it requires reduced IT skills;</p> <p>-the SaaS solutions provider is forced to offer the latest software versions and to configure it. In this way, the SaaS BI version can be updated continuously, so there is much more flexibility.</p>	<p>-auditing (risk assessment, prevention, detection, response to attack) is hard to be accomplished because data are on the outside of organization;</p> <p>-legal issues (who is responsible for regulatory compliance, if the cloud provider sub-contracts the services of another cloud provider).</p>
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Usually, small companies are those who want the implementation of a cloud-based BI solution. Also, small companies prefer public cloud BI solutions. According to [1] and [9], the most interested business departments in cloud-based BI are: sales (with most public BI cloud implementations) and marketing. Also, the most interested industry segments in cloud-based BI are telecommunications industry and retail & wholesale [1]. The main types of cloud-based BI projects are Sales Analytics, Risk Management and Marketing Analytics [9]. Also, the Gartner Magic Quadrant [12] shows that the primary interest is in hybrid and private cloud-based BI. For example, financial services and marketing prefer private cloud, but retail prefers public cloud [1]. The main factors that determine the implementation of a cloud-based BI solution by companies and the main problems which appear during the implementation of a cloud-based BI solution are presented in Table 3.

### 3 Conclusions

The article presented the current state of the cloud-based BI market, and a comparative analysis between the cloud-based BI leaders. Also, the article briefly presented the different deployment models for BI on cloud. The combination of cloud computing and business intelligence can provide a more flexible BI solution that aligns with business objectives. Cloud computing has the potential to help BI to become BI for everyone. Also, cloud and business intelligence provide decision makers the ability to quickly make predictions and decisions that influence performance in business. Cloud-based BI can change the role of decision makers from information consumer to information producer.

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