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'Business Intelligence' a Strategic Focus for Enterprises! Part I: Findings and Implications from Longitudinal Analysis and Systematic Review

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***Abstract* — Business intelligence (BI) solutions are continuing to gain considerable attention from enterprises of all sizes, owing to a growing requirement for analytical tools that can enable organizations to make actionable and agile decisions and sustain their organic growth. Other factors providing momentum to various analytics solutions among enterprises are the need to enhance customer experience, improve operational efficiency, and identify and remove unproductive business processes. However, without a proper vision and carefully devised BI strategy, organizations will not be able to turn raw data into more actionable insights and achieve the required results. Consequently, the success of a BI project will primarily depend upon the proper alignment of the IT strategy with the overall business objectives, which will allow organizations to seamlessly integrate and deploy these solutions to support and drive core business initiatives.**

***Keywords* — Analytics, Apache Spark, BI, BI Strategy, CRM, ETL, Hadoop, IT Strategy, IT Ecosystem, OLAP, SAAS, SCM.**

I. INTRODUCTION

The BI solution segment has been transforming in the last few years, resulting in the development of disruptive solutions, the availability of new deployment models, and consolidation of the vendor landscape. BI tools have evolved from being a simple batch reporting, limited capacity data warehouse solution supporting traditional ETL processes, to a more advanced data warehousing solution and predictive analytics tool with in-memory capabilities. The current BI suites offered by most vendors have the capacity to store, extract, and analyze terabytes of raw data and convert them into useful and interactive information with the help of advanced dashboards and visualization tools, enabling organizations to make informed business decisions [1].

In the last few years, BI tools have transitioned from being a capital intensive tool, primarily adapted by large enterprises, to an indispensable solution for enterprises of all sizes. They enable organizations to extract, integrate, analyze, and interpret business information in a timely and proactive manner, and achieve a competitive advantage in the current tight and subdued business environment. Recent developments in the fields of cloud-based and mobile BI solutions have also provided a much needed boost to the BI market. The main obstacle to the pervasive adoption of BI solutions over the years has been the significant investment in the applications and infrastructure required to support the proper functioning of any BI solution. With the availability of on-demand and software as a service (SaaS) based analytics solutions, organizations have the option to deploy any advanced analytics solution on a pay-per-use basis without committing to substantial investments, which improves their return on investment and time to market [2].

Meanwhile, in the last year, big data has become important in enterprises' BI strategies, and organizations are considering the type of big data solution they plan to deploy when devising their data strategy. The prospect of gaining highly targeted business and market insights by analysing unmanageable and unstructured data sets is creating huge market potential for such solutions. Recent developments in the field of Hadoop, Apache Spark, NoSQL, and in-memory computing are shaping the big data segment, with vendors investing in research & development (R&D) and acquisitions to develop or acquire different BI solutions based on such platforms in order to increase their share of wallet. The below mentioned Table (1) and Fig (1) illustrates the number of large enterprises responded for ICT survey.

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Table 1:
Large enterprises ICT survey data geographic breakdown

Countries	Count
India	42
Spain	38
France	38
UK	36
US	34
Italy	28
Germany	25
Brazil	25
Russia	24
Japan	18
Canada	17
China	16
Others	120

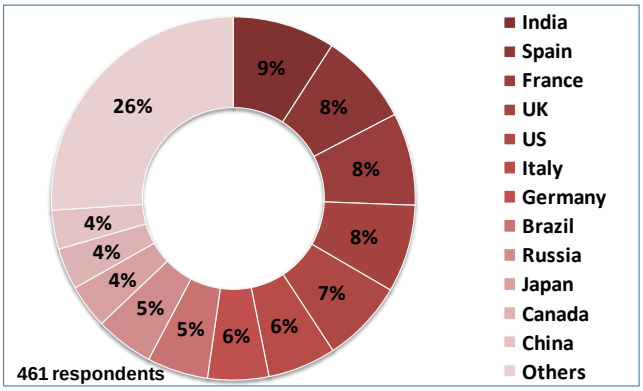

Fig.1. Large enterprises' ICT survey data geographic breakdown

II. Supporting Arguments And Empirical Evidences

1. *Transition from self-service BI to self-service data integration*

There is an increasing need for self-service BI, owing to the growing requirement of business users to gain access to huge volumes of enterprise data and the inability of IT departments to provide the required data for analysis. Moreover, the development in the big data space coupled with enterprises' need to make real-time business decisions and gain agility has further provided strength to the self-service BI model.

During the initial phase, self-service BI primarily dealt with data discovery tools including functions such as data visualization and dashboards, among others, enabling casual business users to visualize and intuitively interact with data to make informed business decisions without any support staff or user manual. However, with the rising complexity of the data generated in an organization, owing to various structured and unstructured datasets, vendors are continuously looking to provide advanced analytics solutions with predictive analytics and in-memory features. On the one hand, these developments have expanded the horizon of self-service BI in supporting various unstructured data sets, and on the other; they require vendors to provide data preparation functions such as ETL, data wrangling, data-specific storytelling, integration, and other smart features embedded in their self-service BI tools.

Over the years, enterprises have had a tough time loading data into data warehouses using the traditional ETL process as it's quite time consuming; consequently, vendors are continuously striving to embed data loading, integration, and cleansing features into their BI tools as a self-service functionality. Such self-service data integration capabilities will significantly decrease the time and complexity of data preparation, and will also allow business users to carry-out the data integration process themselves rather than waiting for their IT department to do so. Apart from automated data integration and ETL processes, vendors are also looking to include other features in their data discovery tools such as data linage, pattern detection, interactive user interfaces, enhanced visualization, and data blending, thereby enabling casual business users to prepare data from disparate data sources [3].

Vendors such as Informatica and Qlik have already accelerated their efforts to tap the growing requirement of self-service BI integration, and have launched products such as Informatica Rev and Qlik Sense Enterprise 2.0. Other smaller BI vendors, including SnapLogic, Trifacta, Tamr, Logi Analytics, and Paxata, are also looking to make their presence felt in this self-service data preparation domain. In addition, established BI vendors such as Microsoft and SAP don't want to be left behind, and have launched products such as Power Query and SAP Agile Data Preparation tool to enter the self-service data preparation segment.

The below mentioned Fig (2) shows the overall ICT budget change pattern (flat, growth or shrink) from FY 2013-14 to FY 2014-15.

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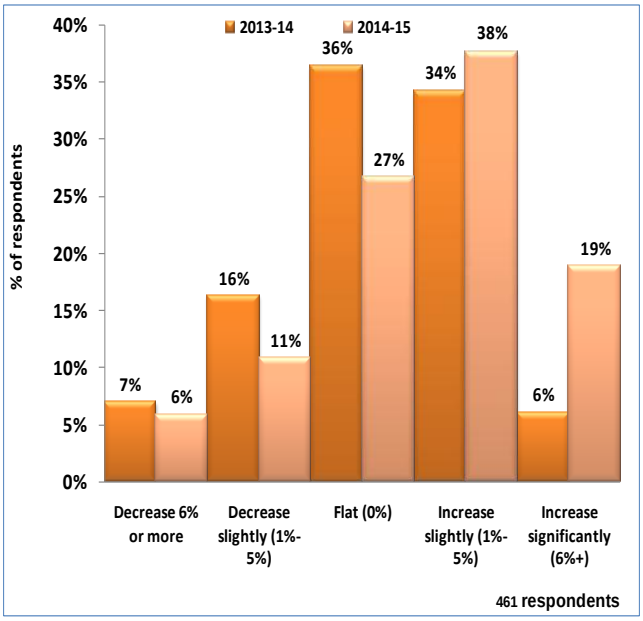

Fig.2. ICT budget change (growth or shrink) from 2013-14 to 2014-15

2. Mobile BI continues to attain an important space

For the last few years, mobility has been at the top of CIOs' agendas and they have been looking to empower their employees with various mobile devices and applications, in order to improve productivity and gain flexibility. While mobile applications that support various enterprise applications such as ERP and CRM have witnessed significant uptake, mobile BI applications still have a long way to go to attain their true potential. Although most software vendors have adopted a 'mobile first' strategy, there are still some questions relating to the delivery model, the devices they want to support, and the capabilities they are looking to offer in order to gain differentiation [4].

In terms of the development of mobile BI applications, the HTML5 platform is providing software vendors with an appropriate tool to design a lighter version of their desktop-based BI solutions along with the capability to support most mobile devices such as smart phones and tablets. With the ability to provide feature rich, visually appealing dashboards, along with cross-device portability and touch-screen functionalities, HTML5 has generated a significant buzz among various established and niche BI vendors. Niche vendors such as Yellowfin, Naveego, and Jaspersoft are among those who have been quick to respond to the market demand and have developed mobile BI applications based on HTML5, which support various mobile operating systems including iOS, Android, and Windows.

Most established vendors such as Microsoft, Oracle, SAP, and SAS have also understood the adoption potential of a mobile enabled BI solution, albeit slowly, and in order to sustain their market penetration these vendors have to move faster in this direction in order to compete with the new-age and niche BI vendors. Moreover, with strong capital investment capabilities, these vendors are focusing on both organic and inorganic growth strategies to tap the mobile BI segment. For example, Microsoft is keen to adopt an inorganic strategy, with the acquisition of Datazen, a mobile business intelligence and data visualization solutions provider, in order to strengthen the capability of its Power BI solutions. Similarly, SAP is focusing on R&D and product development and launched SAP Mobile BI 6.2 to support both iOS and Android devices.

Meanwhile, one of the concerns relating to the adoption of mobile BI solutions is their ability to work offline in case of connectivity issues or if the user is in an area with a blind spot. Consequently, vendors are paying significant attention to developing mobile BI solutions that have the capability to seamlessly switch between online and offline, and work on a downloadable document in an offline mode. Most vendors such as Oracle, SAP, Microsoft, and Qlik, have developed mobile BI solutions with offline capability, enhancing the usability of their application for users.

3. Growing demand for social media analytics and collaborative BI tools

Social media has become a mandatory channel for enterprises to understand consumer preferences and comprehend the market dynamics. The vast volumes of unstructured data being generated on various social media platforms such as Facebook, Twitter, blogs, and wikis has become an untapped source of information for enterprises. Although many analytics vendors are developing social analytics solutions to enable enterprises to analyse this abundant amount of data and make actionable and real-time business decisions, the development in this space is still in the nascent stage [5].

Another important development in the social media space is affinity-based marketing, i.e. identifying prospective customers and then targeting them based on their preferences, interests, hobbies, or professional backgrounds. This will require BI vendors to integrate the social media analytics platform with CRM tools or the amalgamation of all the various social media platforms to create a master database of prospective customers.

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Moreover, such an integrated platform will also enable enterprises to track any complaints or suggestions from their customers, resulting in an improved customer experience.

Many social networking providers such as Facebook, Twitter, and LinkedIn have already embedded some sort of basic analytics functionality in their applications, enabling enterprises to leverage the dashboards, trend analysis charts, and other analytical tools to understand the latest market trends and customers' preference for their brands. For example, in August 2014, Twitter expanded the access of its Tweet Performance Analytics to all users. Similarly, in March 2015, Facebook unveiled its App Analytics, enabling app developers and marketers to understand users' preference for specific applications, estimating the purchase rate, and improving their advertising strategy.

Apart from these social networking providers, other established BI vendors such as IBM, Google, and SAS, and IT service providers such as TCS and Accenture are also quite keen to enter this new market place in order to gain a competitive advantage. Furthermore, various niche BI vendors and start-ups are looking to make their presence more visible in the social analytics segment, thereby increasing the competition in this domain. For example, Social Nuggets recently launched its social analytics tools to provide real-time market insight and consumer trends in the tablet computing market. Similarly, Spredfast developed a new tool, Spark, to enable enterprises to listen, analyse, and predict trending social media topics and transform their marketing and sales strategy based on those insights.

Although collaborative BI is a concept that has gathered attention in the last few years, the potential of such a solution is fairly huge especially for cross functional teams in an organization, who are working on huge data sets. With the help of these solutions, geographically dispersed teams can share their findings, analysis, and queries in real-time, thus improving decision making capabilities and reducing the chance of any errors. While these solutions are receiving attention from small or niche BI vendors such as Yellowfin, Forecast5, and Panorama, among others, established BI vendors are still cautious about making any significant move in this space.

The research studies expect that once the other big BI vendors begin to focus on developing such solutions, the competition in the market will increase, and customers will have access to more innovative and cost-effective collaborative BI solutions. The below mentioned Table (2) and Fig (3) illustrates the number of large enterprises responded for ICT survey across the industry verticals.

The respondent size for retail banking counts for 56, similarly respondent size for healthcare counts for 43.

Table 2:
Large enterprises' ICT survey data industry breakdown

Industry	Count
Retail banking	56
Telco/service provider	49
Government	47
Healthcare	43
Energy	42
Financial markets	40
Retail	33
Education	33
Manufacturing	29
Insurance	29
Utilities	28
Pharmaceuticals	15
Media	15

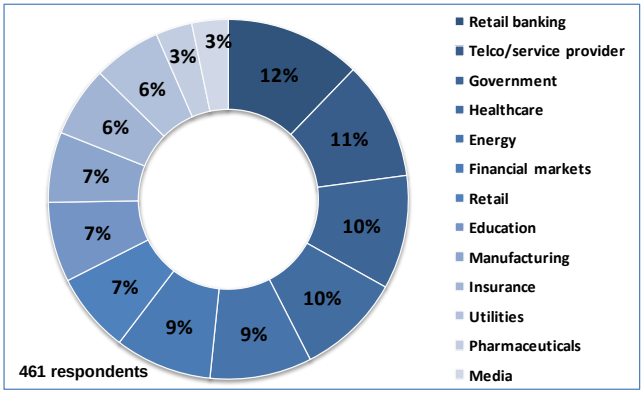

Fig.3. Large enterprises' ICT survey data industry breakdown

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III. Key Inhibitors And Issues

1. Inability to extract desired value from BI tools owing to confused terminologies

Rapid development in the field of BI solutions has provided plenty of options for enterprises to deploy a BI solution according to their requirement and budget. However, the lack of understanding of BI-specific terminologies and skill levels has restricted the adoption of analytics solutions in organizations. Since the BI domain is a broad field, which evolved from a data warehouse and reporting solution, to include predictive modelling and big data solutions enabling enterprises to store and analyse structured and unstructured business data, the distinction among business intelligence, content management, and business performance management solutions is continuously blurred. Most top-level executives such as CFOs are skeptical when it comes to investing in IT and advanced analytics solutions, as they look to understand the business benefit and return on investment of deploying such capital intensive analytical tools [6].

In most cases, top level management and the finance department are not in sync with the IT and operations department with regards to the use of advanced BI tools; consequently, either the plan to invest in analytics solutions is dropped, or, in some cases, deployed without any proper feasibility and usage study, which results in a project failure, thus dissuading the organization from making any further investment in these areas [7].

The below mentioned Table (3) and Fig (4) illustrates various factors influencing large enterprises' decision to choose an IT provider in FY 2014. Various factors such as geographical reach, contract flexibility, financing options payment terms, expertise in industry and many others have been rated by respondents on a scale of one to four and shown below.

Table 3
Factors influencing large enterprises' decision to choose an IT provider

Factors	Average rating (On a scale of one to four)
Financing options/payment terms	2.7
Geographical reach	2.7
Contract flexibility	2.8
Breadth of solution offerings	2.9
Financial stability	3.0
Specific functionality expertise/depth	3.0
Expertise in your industry	3.0
Price	3.1
Leading-edge technology	3.1

Fig.4. Factors influencing large enterprises' decision to chose an IT provider

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2. Security concerns relating to cloud-based and mobile BI solutions

As BI tools deal with business critical and sensitive information, security and integrity remains an important challenge for organizations, primarily when the solution is deployed on a cloud or mobile platform. Although the deployment of BI solutions in a cloud environment reduces capital and operational costs, it also increases the threat of losing business- and customer-related information. Moreover, with the proliferation of mobile devices and commercialization of technology becoming more acceptable, vendors are continuously looking to develop BI solutions for mobile platforms [8]. It is expected that deploying mobile BI solutions will encourage enterprises to integrate compatible mobile device management and application management solutions with their mobile BI solutions to protect their enterprise data from being compromised and misused.

3. Dearth of skilled resources

Rapid development in the area of BI has resulted in a huge talent gap in the market, and enterprises are finding it tough to employ personnel possessing the skill sets to create complex predictive models and analyse the unstructured data coming from various third-party sources [9]. While most of the advanced BI tools are fit for use by power users, casual and business users do not have the skills to work on these solutions. This lack of skilled resources has continuously hampered the penetration rate of analytics and big data solutions among enterprises. Moreover, most of the advanced analytics tools such as predictive analytics and big data solutions such as Hadoop and NoSQL are open source, and lack the maturity and user-friendliness compared to some of the traditional data warehouse and data management solutions, thereby restricting their adoption rate [10].

IV. Discussions And Implications For Enterprises To Harness Business Intelligence

1. Growing volume of data and the need to achieve data governance

Enterprises are grappling with the issue of handling rising volumes of structured and unstructured data from various sources including customer and sales data from the CRM tool as well as from various social networking sites, wikis, and blogs, among others.

With enterprises investing significantly in storing such an abundance of data, it is all the more important for them to analyse and extract some meaningful insights from these data sets and make actionable decisions and improve their return on investment [11]. Consequently, enterprises are keen to invest in various BI and analytics tools in order to understand customers' perception towards their brand and devise impactful marketing and sales strategies to reduce their customer churn rate and attract new customers.

The emergence of machine-to-machine communications, or internet of things (IoT), is also creating demand for predictive analytics and big data tools to analyse the huge amount of data generated from different connected devices, sensors, and machines in real-time, and track and monitor their operations and provide necessary feedback for process improvement. Moreover, traditional BI solutions and RDMS tools are not equipped to handle such a growing stream of data. As a result, vendors are developing BI tools with in-memory capabilities to analyse terabytes of transactional and operational data quickly and provide critical business insights to enterprises.

The below mentioned Table (4) and Fig (5) reveals Large enterprises' overall ICT budget allocation in the FY 2014 and FY 2015 (how did large enterprises spend their overall ICT budget in FY 2014? How will this change in 2015?) . The survey result shows that large enterprises allocated 26% and 22% of their overall ICT budget to hardware and software respectively in FY 2014, whereas large enterprises allocated 23% of their overall ICT budget to software segment in FY 2015, while the allocation for hardware segment remains the same in FY 2015.

Table 4
Large enterprises' (external) ICT budget allocation, 2014 and 2015

Category	2014	2015
Hardware	26%	26%
Software	22%	23%
Services	16%	16%
Communications	15%	15%
Consulting	13%	12%
Other	8%	8%

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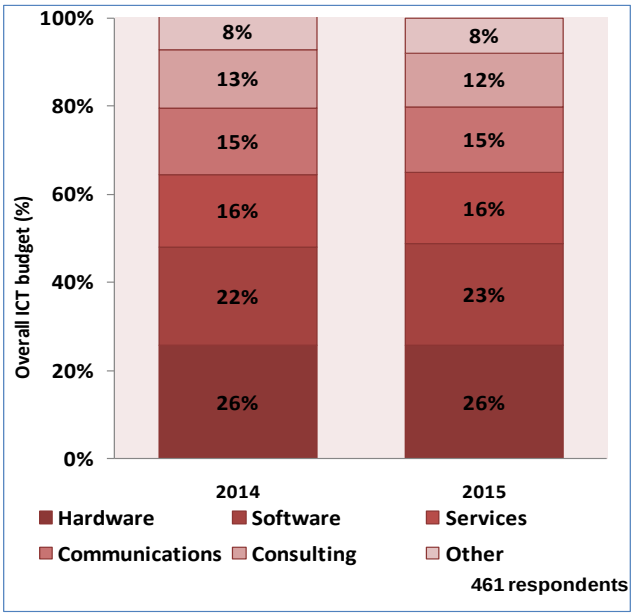

Fig.5. Large enterprises' ICT budget change from 2014 to 2015

2. Rising competition and the growing need to gain differentiation

The increasing globalization of the business environment has enabled enterprises to cater to a broader customer base and improve their presence in new geographies and verticals. On the one hand, the globalization trend has created new business opportunities and avenues for revenue generation for enterprises, and on the other, it has also resulted in growing competition across all the verticals and domains [12]. Moreover, owing to the economic slowdown in all major developed and emerging economies, enterprises are finding it tough to sustain their profit margins and growth rates, which in turn has resulted in fierce competition across all industries. Enterprises are looking for ways to enhance their operational efficiency and improve customer experience in order to decrease the churn rate and add new customers to enhance their client base [13]. This has created the need for advanced business intelligence and analytics solutions among enterprises, so that they can analyse their business and customer data, gain some interesting insights and revamp their product and marketing strategy, as well as make sound business decisions in real-time to achieve a competitive advantage.

3. Small and medium-sized enterprises are keen to adopt BT tools

The adoption and deployment of business intelligence solutions requires substantial capital investments, which has restricted the persistent growth of these solutions across enterprises of all sizes.

Before the emergence of cloud- and mobile-based BI solutions, enterprises had to implement on-premise BI solutions, which required huge investments in infrastructure and licensed applications [14]. Consequently, large enterprises with sufficient IT budgets were the only ones able to afford such analytics solutions, while SMEs with limited or low ICT budgets were restricted to using an open source BI solution or basic analytics or reporting tools.

The below mentioned Fig (6) illustrates the adoption trends of the business intelligence technologies (Data warehousing/marts, Analytics, Real-time business intelligence, Social sentimental analysis) among large enterprises in FY 2014. The fig also shows next two year adoption pattern of these technologies respectively.

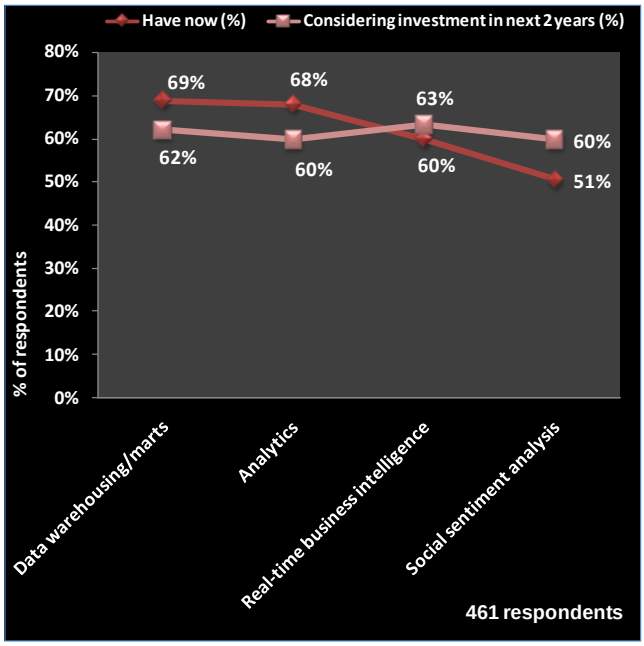

Fig.6. Business intelligence technologies adoption trends among large enterprises in FY 2014 and next two year.

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V. Conclusions And Future Research

"Big data analytics and advanced predictive modeling techniques are reshaping the BI segment."

In the last few years, investment in the BI segment has received significant attention from enterprises of all sizes and verticals. While, in the last decade, it was only large enterprises with considerable IT budgets who were investing in these costly BI applications, the growing volumes of enterprise and customer data coupled with enterprises' need to store and analyse this data to improve their decision making and gain differentiation has made such solutions imperative for all enterprises. In addition, the proposed inquire about paper uncovers that improvements in on-request BI devices have, to some degree, nullified the moderateness consider sending these arrangements, as with a compensation for each utilization valuing model even small undertakings can convey expository instruments and exploit these arrangements without focusing on significant framework speculation..

Apart from the affordability factor, the other fundamental obstruction to the adoption of BI solutions has been the requirement of skilled resources to integrate, extract, and analyse meaningful information from the gathered raw data. Over the years, power users or data scientists have primarily been able to use complex query-based analytical tools, which have restricted the adoption of the solution to expert users and kept casual business users and other operational users at bay. Nevertheless, the paper also represents, the key developments in self-service BI and other data visualization and discovery tools have enabled even casual users, with proper training, to take advantage of these advanced tools, allowing them to dig deeper into the "why" and "what-if" analysis, and make actionable business decisions.

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