Available online at www.sciencedirect.com
ScienceDirect
Procedia - Social and Behavioral Sciences 195 (2015) 230 – 239
Procedia Social and Behavioral Sciences

World Conference on Technology, Innovation and Entrepreneurship

A Review of Business Analytics: A Business Enabler or Another Passing Fad

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Abstract

Business Analytics has emerged as a potential business enabler in both public and private sectors and is one of the fastest growing fields. By implementing Business Analytics initiatives in their organizations, decision makers can integrate disparate data sources, predict trends, improve performance, see key performance indicators, identify business opportunities, and make better and informed decisions. The purpose of this study is twofold: first, it provides a working definition, background, and a review of Business Analytics (BA) / Business Intelligence (BI) / Big Data (BD) theory and practice. Secondly, it discusses if BA/BI/BD is another passing fad or a business enabler.

Peer-review under responsibility of Istanbul Univeristy.

Keywords: Business Analytics, Business Intelligence, Big Data, Decision Making

1. Introduction

Across various public and private sectors, companies capture and maintain enormous amounts of data on their customers, products, and services they provide. To leverage this technical data stored and maintained in various digital platforms such as databases and data warehouses, and to translate it into actionable insights a new field called Business Analytics (BA) also known as Business Intelligence (BI) or Big Data (BD) has emerged in recent years. BA has evolved and become a part of every major business decision making process, and it has the potential to transform businesses as it empowers decision makers with data and supports them to make strategic, operational, and tactical decisions.

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Peer-review under responsibility of Istanbul Univeristy.
doi:10.1016/j.sbspro.2015.06.354

BA has emerged as a potential business enabler in both public and private sectors and is one of the fastest growing fields. Some companies have even built their entire business models around this concept and run their businesses based on their ability to collect, analyse and act on data (Davenport, 2006). Given the fact that we live in a world of interconnected people and computers generating and making more and more data accessible, BA holds great promise for companies across various industries. BA can be critical to an organization's operations and a crucial part of decision making process. It may revolutionize the way companies harness their data generated internally such as transaction data or gathered from external sources such as social networks, mobile devices, web-sites, and data sensors. It gives decision makers the power to integrate multiple data sources and discover more insights in them, thus enabling them to gain a holistic view of their business and customers, improve operational efficiency, move toward a data-driven decision making environment, and deliver business-critical solutions. BA can help organizations capitalize on the value of historical and real-time data by harnessing the power of statistical and mathematical models. Using such models, manager can monitor key metrics and operational data and measure and manage corporate performance. By implementing BA initiatives in their organizations, decision makers can integrate disparate data sources, predict trends, improve performance, see key performance indicators, identify business opportunities, and make better and informed decisions. Further, by leveraging BA capabilities and models, decision makers can identify business drivers of business success, align business goals and the company's progress, and develop value-based strategies and fact-based insights of business performance analysis. The purpose of this study is twofold: first, it makes an attempt to provide a working definition, background, and a review of BA/BI/Big Data theory and practice. Secondly, it discusses if BA/BI/BD is another passing fad or a business enabler.

2. Literature Review

Business Analytics (BA) may be defined as "a broad category of applications, technologies, and processes for gathering, storing, accessing, and analyzing data to help business users make better decisions" (Watson, 2009). Vendors and academics interchangeably use "Business Analytics (BA)", "Business Intelligence (BI)" and "Big Data (BD)" to refer to similar topics. For instance, the term "business intelligence" is used by the information technology community, whereas "business analytics" is preferred by the business community (Sircar, 2009). In this study however, the term "Business Analytics" is used to be consistent with the leading vendors and academia.

The growing use of information technology (IT) in the business world has led to the development of large and complex datasets for various organizational functions. Understanding their businesses and making decisions based on very large datasets has become an important challenge for organizations. The IT industry refers to this development as "Big Data" to indicate the complexity and size of data sets. Traditional database applications do not have the capabilities to analyze such big data and address the decision-making needs of organizations. BA is the current solution for analyzing big data by using advanced mathematical and statistical models, databases, and interfaces to answer "what has happened" and "what will happen" questions (Wicom et al., 2011).

Having BA capabilities has already become an important goal for organizations. BA/BI ranks among the top five search terms on Gartner's website (Schlegel, 2011), recently published books are becoming hits (Wicom et al., 2011), and leading companies such as Accenture, Deloitte Consulting, and IBM have launched analytics centers and practices. The field of BA is experiencing enormous growth and the accelerated growth rate of structured/unstructured data is fueling this growth. As argued by Davenport and Dyche (2013), no single business trend in the last decade has as much potential impact on incumbent IT investments as BA. According to a study done by International Data Corporation (IDC), business analytics is one of the top two IT priorities for large enterprises (SAS-b, 2011). Manyka et al., suggest that by 2018 "The United States alone could face a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts with the know-how to use the analysis of big data to make effective decisions." Thus, recognizing its importance, numerous companies have already implemented BA initiatives and technologies to gain a competitive edge.

BA gives companies the ability to handle a new type of data such as voice, text, log files, images, and video (Davenport and Dyche, 2013), and decision makers increasingly view this new type of data and the ability as an important driver of innovation and a significant source of value creation and competitive advantage (Tan et. al., 2015). Similarly, a study by (Gartner, 2011) suggests that the ability to manage big data will be a core competency for enterprises. Companies are investing in BA initiatives for various reasons. For instance, Hagen et al., (2013) argue that some of the drivers for which companies across various industries have implemented BA initiatives include to make faster, better, and proactive decisions, improve capabilities, increase automation, eliminate redundant tools, and streamline processes. A comprehensive study done by IBM (2012) asked a number of companies to rank their top functional objectives for big data within their organizations. The report suggests that they invest in BA to achieve customer centric outcomes (49%), optimize operations (18%), manage risk/finance (15%), and develop new business models (14%). A similar study done by SAS-b (2011), points out that companies are looking to analytics to help them solve a variety of critical issues; but the primary focus is on money. According to the same study, the top three issues for analytics to solve are: reducing costs, improving the bottom line, and managing risk.

Companies are for the most part employing BA initiates in areas where reliance on quantitative information is typically more prevalent such as strategic planning, finance, and marketing. These functional areas address issues that require analysis and prediction (SAS-b, 2011). Hagen et al., (2013) agree and suggest that building capabilities in BA will not only improve performance in traditional segments and functions, but also create opportunities to expand product and service offerings. A similar study done by SAS-c (2013) shows that organizations are looking to analytics to improve the way they do business and to use technology, specifically analytics, to drive better decisions. (2013). Like many new information technologies, BA can bring about dramatic cost reductions, substantial improvements in the time required to perform a computing task, or new product and service offerings (Davenport and Dyche, 2013). However, companies investing in BA technologies should address certain challenges and pitfalls to fully realize the benefits their BA initiatives have to offer. For instance, Davenport (2006) argues that companies should understand that to make optimal use of BA and the data they constantly collect and store, they should invest in finding the right focus, building the right cultures, hiring the right people, and installing the right technology. Similarly, a report published by SAS-a (2014) lists the top three big data challenges as lack of skills/expertise, difficulty accessing all data, and not effectively using their most valuable data to drive decisions. Furthermore, the complexities of dealing with big data, integrating technologies, finding analytical talent, and challenging corporate culture are the main pitfalls to the successful use of analytics within organizations SAS-c (2013). Finally, a company's "data-driven mind-set" will be a key indicator of big data's value to companies (Davenport and Dyche, 2013). Davenport (2006) identifies three key attributes of companies that want to compete on analytics: widespread use of modeling and optimization tools, an enterprise approach, and senior executives' advocates. In addition to such characteristics, companies driving effective "analytics cultures" are reaping the rewards of business analytics (SAS-b, 2011). IBM (2012) argues that companies that want to run a successful BA initiative must commit initial efforts to customer-centric outcomes, develop an enterprise-wide big data blueprint, start with existing data to achieve near-term results, build analytics capabilities based on business priorities, and finally, create a business case based on measurable outcomes.

2.1. Dimensions of BA/Big Data

BA/BD may be broken into four dimensions: Volume, Variety, Velocity, and Veracity (IBM, 2012). The first three dimensions were first introduced by (Laney, 2001) in a Gartner research note entitled 3D Data Management. Later, IBM (2012) introduced Veracity as the fourth dimension (Figure 1).

Volume refers to the magnitude of data (Gandomi and Haidar, 2014). The amount of data available to companies has been growing enormously. Data scientist has to process massive amounts of data generated by and streamed from internal and external data sources. This sheer amount of data poses technical challenges for data scientist

(Gartner, 2011). Extracting relevant information from data and using it to make critical decisions becomes more difficult as data volumes become too large and complex.

Variety means different types of data, which includes tabular data, hierarchical data, documents, e-mail, video, still images, audio, stock ticker data, and financial transactions (Gartner, 2011). To have a much more complete picture of their customers and operations companies are combining unstructured and structured data (Davenport and Dyche, 2013), and using various raw data sources such as transactions, log data, events, emails, social media, sensors, external feeds, RFID scans or POS data, free-form text, geospatial, audio, still images/videos (IBM, 2012). However, it's important to remember that the primary value from big data comes not from the data in its raw form, but from the processing and analysis of it and the insights, products, and services that emerge from analysis (Davenport and Dyche, 2013).

Velocity refers to the rate at which data are generated and the speed at which it should be analyzed and acted upon (Gandomi and Haidar, 2014). Dealing quickly and in a timely manner with data velocity is a challenge for most data scientist and decision makers.

Veracity is defined by IBM (2012) as data uncertainty. It refers to biases, noise, and abnormality in data (Normandeau, 2013). In other words, veracity may be defined as uncertainty due to data inconsistency, incompleteness, ambiguities, latency, deception, and model approximation (Corrigan, 2012).

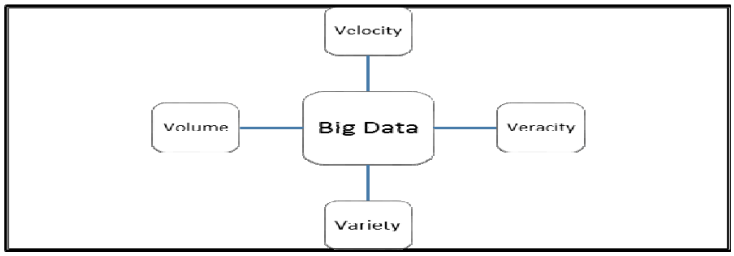

Fig.1. Dimensions of Big Data

2.2. Types of Analytics

Three types of analytics are employed by organizations: descriptive, predictive, and prescriptive (Davenport and Dyche, 2013).

Descriptive analytics uses business intelligence and data mining to provide trending information on past or current events. Descriptive analytics drills down into data to uncover details such as the frequency of events, the cost of operations, and the root cause of failures (IBM, 2013). Descriptive analytics provides significant insight into business performance and enables users to better monitor and manage their business processes (Lustig et al., 2010).

Predictive analytics uses a variety of models and techniques to predict future outcomes based on historical and current data (Gandomi and Haidar, 2014). In predictive modeling, data is collected, a statistical model is formulated, predictions are made, and the model is validated as additional data becomes available (Gartner IT Glossary. n.d). Predictive analytics is what translates big data into meaningful, usable business information (Abbott, 2014). It unleashes the power of data, and allows decision makers to learn from data how to predict the future behavior of individuals (Siegel, 2013).

Prescriptive analytics may be defined as a set of mathematical techniques that computationally determine a set of high-value alternative actions or decisions given a complex set of objectives, requirements, and constraints, with the goal of improving business performance (Lustig et al., 2010). Prescriptive analytics enables decision-makers to not only look into the future of their mission critical processes and see the opportunities, but it also presents the best course of action to take advantage of that foresight in a timely manner (Basu, 2013).

3. Methodology

3.1. Research Method and Data Collection

This study was conducted utilizing publicly available data/information/publications maintained in well-known databases such as sciencedirect.com. While the internet is full of web sites where a wealth of information can be found on any subject, in this study we made use of the following major databases recognized and used by the academic world across the globe (table 1).

Table 1. Databases and their websites

Database/Publisher	Website
Elsevier	www.sciencedirect.com
Wiley	www.wiley.com
Springer	www.springer.com
Emerald	www.emeraldinsight.com
Taylor & Francis	www.tandfonline.com
INFORMS	www.informs.org
ACM Digital Library	dl.acm.org

We realize the aforementioned table is not exhaustive and understand that some other databases and publishers may be added to the list. Nevertheless, the above list of the publishers represents a good number of publishers or a significant portion of knowledgebase a majority of researchers, scientist, academicians would use when doing a scientific literature review.

The above databases can be accessed through any college and university network. Thus, we logged in to each database one by one and queried each one using the three key words/criteria: Business Analytics, Business Intelligence, and Big Data. In this study, we reported on every published study in the area of Business Analytics, Business Intelligence, and Big Data between the years 2000 and 2014. Every publication containing any of the three key words in its abstract, title, or in the body of the publication was tallied.

Once the information was retrieved, we then refined and filtered our search within each database by topic, content type, discipline, frequency of the key words in each publication, publication type, and subject. In the following sections we summarize our findings. The tables and figures presented in the following section are created using Excel 2013, which itself can be used as a business intelligence application.

3.2. Analyses and Results

We first queried sciencedirect.com, which is maintained by Elsevier, one of the largest publishers in the world. Figure 2 summarizes the total number of publications containing the three keywords of interest published between the years 2000 and 2014. As seen in figure 2, there is an exponential increase in the number of publications covering the three key words. While there was a few publications in the early 2000s, as of the end of 2014, in just one database there were more than 2500 outlets containing the criteria BA, BI, or BD. Figure 2 indicates that BA/BI/BD capabilities, applications, and tools have emerged as one of the fastest growing fields in recent years.

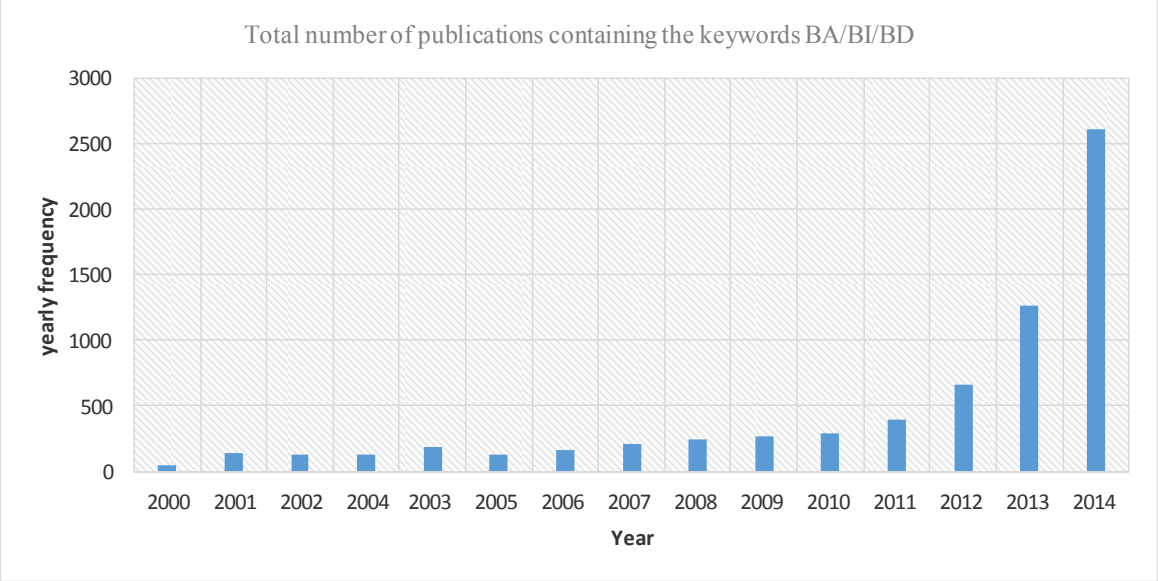

Fig. 2. The number of publications containing the keywords BA/BI/BD

We then broke down the total numbers by BI, BA, and BD. As seen in figure 3, while in the early 2000s, there was almost no publication containing the criteria BI, starting in 2013, however; BD is alluded to more frequently than the other two keywords. This may be because the term "big data" is used more and more frequently by the IT/IS community to communicate their findings to the general business community. The term BI is the second most frequently cited keyword in the same database of numerous publications.

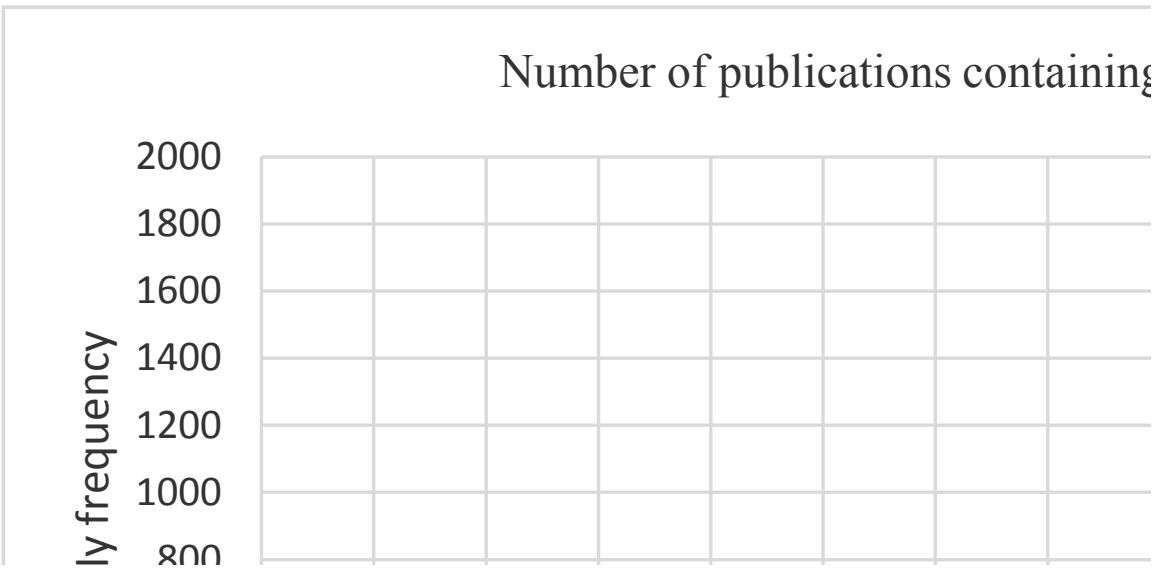

Fig. 3. Frequency of BA/BI/BD by year

As summarized in figures 2 and 3, having analyzed the data in Sciencedirect.com, we summarized the content type and the total number of publications listed in seven different databases containing the three key words. Table 2 is a pivot table which breaks data by the publisher and the three key words. As seen, between the years 2000 and 2014, the total number of outlets/publications making a reference to BA was 1878. Similarly, the same databases contained a total of 17549 references made to the keyword BI. Finally, the key word BD was alluded to 13391 times in the same databases. The database maintained by Springer contained the highest number of publications making references to the three key words.

Table 2. Content type and summary of the number of publications in seven databases

Row Labels	Sum of BA	Sum of BI	Sum of BD	Total
ACM	**350**	**2814**	**1288**	**4452**
Article/Chapter	350	2814	1288	
Emerald	**55**	**834**	**268**	**1157**
Article/Chapter	55	834	268	
INFORMS	**151**	**109**	**59**	**319**
Book Review	1	4		
Chapter	1	1	3	
Miscellaneous	67	31	20	
Notice Editorial	2	2	6	
Primary Article	72	71	28	
Primary Introduction	8		2	
Science Direct	**386**	**3998**	**3366**	**7750**
Book	89	1134	697	
Journal	296	2848	2656	
Reference Book	1	16	13	
Springer	**551**	**7498**	**5863**	**13912**
Article	131	1234	1790	
Book	6	51	36	
Chapter	400	6137	3978	
Reference Work Entry	14	76	59	
Taylor & Francis	**117**	**928**	**820**	**1865**
Article/Chapter	117	928	820	
Wiley	**268**	**1368**	**1727**	**3363**
Books	130	550	417	
Journals	138	818	1310	
Grand Total	**1878**	**17549**	**13391**	**32818**

Figure 4 summarizes the frequency of the three key words vs. the publishers and databases. As seen, in terms of the content type, the highest number of references are made to BI in various chapters published by Springer, followed by Sciencedirect and ACM Digital Library. Looking at the keyword BD, we see a similar pattern. BD appeared 5863 times in numerous outlets published by Springer. Similarly, Sciencedirect contains the second highest number of publications containing the keyword Big Data.

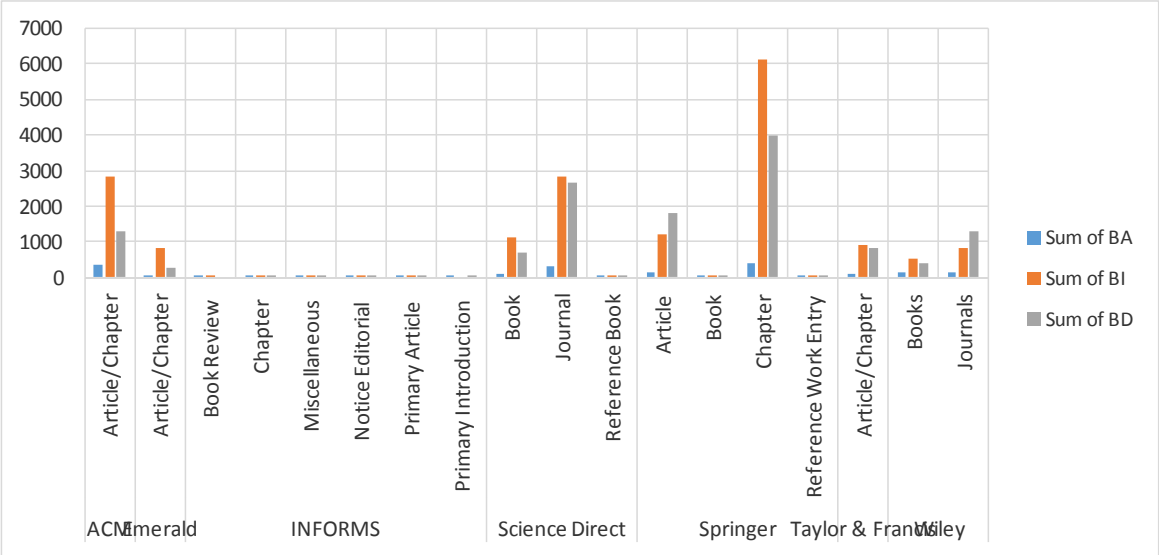

Fig.4. BA, BI, and BD vs. Publishers/Databases

Since Springer has the highest number of publications pertaining to BA/BI/BD, we also looked at the topics and subjects in which the three key words are covered in the database maintained by Springer. Table 3 summarizes the first 15 topics/fields utilizing BA/BI/BD applications. As expected, the computer science field is where the there key words are cited more frequently. Followed by the Computer Science field is the Business and Management field in which BA/BI/BD tools and applications are employed to address various business and management challenges. Surprisingly, Engineering is the third field where BA/BI/BD applications and tools are employed.

Table 3. Topic/subject and BA/BI/BD

Topic/Subject	Frequency
Computer Science	5899
Business & Management	3547
Engineering	1192
Economics	600
Life Sciences	535
Mathematics	343
Statistics	341
Physics	318
Big Data	244
Biomedical Sciences	194
Social Sciences	179
Medicine	176
Education & Language	158
Earth Sciences & Geography	140
Public Health	123

As seen in table 3, in addition to such fields as Computer Science, and Business and Management, where one would be expected to utilize BA/BI/BD capabilities, it appears that BA/BI/BD applications and tools are employed across various fields such as Economics, Life Sciences, Mathematics, Biomedical Sciences, and Public Health. BA/BI/BD capabilities appear to hold great future for various public and private sectors.

To get a more holistic view of the frequency of the keywords BA/BI/BD and the discipline in which they are alluded to, we explored each of the seven databases. Table 4 lists the first 15 disciplines and the frequency of the three key words within each discipline. As seen in table 4, a similar pattern emerges. As expected, the three key words appear 10842 time in the publications pertaining to the Computer Science field. The same three key words appear 4571 times in a title, an abstract, or the body of the publications pertaining to the Business & Management discipline.

Table 4 Frequency of BA/BI/BD by Discipline

Discipline	Frequency
Computer Science	10842
Business & Management	4571
Engineering	2108
Economics	740
Mathematics	664
Medicine	439
Life Sciences	423
Statistics	418
Social Sciences	417
Physics	387
Biomedical Sciences	328
Earth Sciences & Geography	217
Education & Language	198
Public Health	169

In addition to the number of well-known disciplines such as computer science where one would utilize BA applications, table 4 shows that BA capabilities and tools are employed in various disciplines including Medicine, Life Sciences, Social Sciences, Geography, and Public Health. These findings suggest that one should not assume that BA/BI/BG capabilities can only be made use of in IT//IS/Computer disciplines. Contrary to the common perception, advances in information and communication technologies and data visualization have made it possible for decision makers to employ BA capabilities and tools in numerous disciplines.

4. Conclusion

More and more companies recognize the vital role BA plays in addressing their challenges, predicting future outcomes, and capitalizing on the value of data. A growing number of companies rely on BA to plan and optimize their business operations, forecast their business outcomes, improve efficiency, make better decisions, offer new products and services, and capture new market opportunities. In addition, advanced analytics capabilities can help decision makers find more novel uses of data, build their organizations around data, and transform their business models.

Every industry is faced with a different set of challenges and business analytics presents new opportunities for decision makers to deal with such challenges. Numerous studies alluded to in the literature review section suggest that BA has already become a business enabler in various organizations. It can be concluded that with all the tools,

models, technologies, opportunities, and capabilities it presents, BA is not a passing fad, rather it's a much promising paradigm shifter.

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