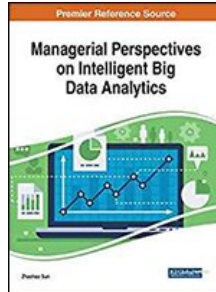


Chapters *To Go*



Managerial Perspectives on Intelligent Big Data Analytics

by Zhaohao Sun

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Chapter 3: The Strategic Adoption of Big Data in Organizations

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ABSTRACT

This chapter investigates the strategic adoption of big data (BD) and analytics (BDA) in organizations. BD represents a large and complex phenomenon which spans different disciplines. BD research is fraught with many challenges. This research develops BD adoption model that could aid organizations in assessing the strategic importance of BD to gain different advantages including gaining a competitive advantage. BD is considered a radical technology and realizing its advantages in organizations is challenged with many factors. The research attempts to outline the different aspects of BD highlighting different contributions, implications and recommendations.

INTRODUCTION

With the current pace of technological development and increased interconnectedness, global competition is soaring and is witnessing ferocious acquisitions, alliances, mergers, and this sometimes lead to the complete abolishment of well established businesses (i.e., Nokia). Technologies such as Internet and social media, electronic commerce, Internet of Things (IoT), sensory data, genomics, and Cloud computing (CC) have led to the exponential growth of data far beyond the comprehension of both technology and people.

There is a big hype around big data (BD) and indeed, it is becoming a very attractive topic for researchers, professional and policymakers around the world. [Columbus \(2016\)](#) indicated that the global BD market will grow from 18.3 Billion US Dollars (BUSD) in 2014 to 92.2 BUSD by 2026, representing a compound annual growth rate of 14.4 percent ([Wheatley, 2016](#)); BD and corresponding business analytics software worldwide revenues will grow from nearly 122 BUSD in 2015 to more than 187 BUSD in 2019, an increase of more than 50% over the five-year forecast period; The market for prescriptive analytics software is estimated to grow from approximately 415 Million in 2014 to 1.1 BUSD in 2019; by 2020, predictive and prescriptive analytics will attract 40% of enterprises' net new investment in business intelligence and analytics; and according to Gartner the prediction that BI and analytics market is in the final stages of a multiyear shift from IT-led, system-of-record reporting to business-led, self-service analytics. This is a crucial shift.

The share of global BD market revenues is split amongst professional services (40 percent of all revenues in 2015), hardware (31 percent) and software (29 percent) where it is predicted that a significant growth in all four sub-segments of BD software through 2026: Data management (14% The compound annual growth rate (CAGR)), core technologies such as Hadoop, Spark

and streaming analytics (24% CAGR), databases (18% CAGR) and BD applications, analytics and tools (23% CAGR) ([Wheatley, 2016](#))

THE STRATEGIC ADVANTAGE OF BDA

[IDC \(2012\)](#) projects that by 2020 the digital universe will reach 40 zettabytes (ZB), which is 40 trillion GB of data and that the amount of B2C and B2B transactions will be 450 billion per day. The challenge here is that will we be able to deal with such amount of data as existing technologies in place are still handles terabyte to PB data only. This development in data has led to the growth of BD repositories, BD analytics/mining (BDA), and business intelligence (BI) which is driven mostly by the need of enterprises to be more competitive in: becoming more customer-centric, entering new markets and creating new business models and improving operational performance ([Columbus, 2016](#)) including improving decision making ([Janssen et al., 2017](#)). BDA is the process of uncovering actionable knowledge patterns from BD (in [Habib ur Rehman et al., 2016](#)). From now onwards BD and BDA are used interchangeably here to refer to big data.

[Côte-Real et al. \(2017\)](#) found that BD can provide value at several stages: knowledge, dynamic capability (organizational agility), business process, and competitive performance. [Habib ur Rehman et al. \(2016\)](#) found the literature praising BD in that it could help enterprises maximize their profits by optimizing business process models and improving internal business processes. They also found that the convergence of IoT with BD and CC has taken enterprises to the next level for value creation. BD is seen as a way to enhance organizational agility and to survive in competitive markets in areas of production and operations or product and service enhancement ([Côte-Real et al., 2017](#)). [Frizzo-Barker et al. \(2016\)](#) contributed the hype surrounding BD to the fact that data has become cheaper to store and analyze and easier to collect through web clicks, RFID tags, sensors, loyalty cards and barcodes. They highlighted the following benefits of BD: availability, visibility, and transparency of information and in helping businesses market products and services in a new way, optimizing operations and processes, measure and manage predictive-ity by finding new patterns and connections. However, they found most of the BD research is concentrated in large in the USA followed by Europe and Asia respectively and in large organizations only.

[Frizzo-Barker et al. \(2016\)](#) found that many researchers continue to define BD in different ways, throughout time, which further confirms the lack of agreement on defining BD. It is obvious that BD resembles massive and complex datasets that are hard to capture, collect, analyze, control and manipulate by traditional IT and software/hardware tools in an acceptable time. This includes structured data and unstructured data as well including text, audio, video, posts, log files etc. However, it seems there is an inclination to define BD in terms of its three features volume, variety and velocity (3Vs) ([Frizzo-Barker et al., 2016](#)) as explained later in this research. [Habib ur Rehman et al. \(2016\)](#) confirmed the same and pointed to inbound and outbound data sources where inbound handle data generated from internal business operations, such as manufacturing, supply chain management, marketing, and human resource management, etc. Outbound data sources handle customer-generated data which are acquired directly or indirectly from customers, market analysis, surveys, product reviews, and transactional histories.

BDA tools, technologies and infrastructure including social media, mobile devices, automatic identification technologies enabling IoT, and CC platforms enabled firms' operations to achieve and sustain competitive advantage, innovation, and productivity ([Fosso et al., 2016](#)). The same researchers emphasized the operational and strategic importance of BD in justifying information systems investment decisions and the improvement of business efficiency and effectiveness ([Fosso et al., 2016](#)).

[Wheatley \(2016\)](#) indicated that the demand-side will drive the rapid adoption of BD in addition to other drivers like maturing data lakes, evolving intelligent systems of engagement and emerging intelligent self-tuning systems. He further highlighted that the supply-side such as CC and increasing administrator and developer productivity as well as adjacent technology such as the IoT and rich media represent a significant opportunity in healthcare, entertainment and surveillance industries. To initiate the value creation process enterprises must invest in an effective BDA program and use BDA knowledge to develop capabilities that will help to maintain competitive advantages ([Côte-Real et al., 2017](#)).

BDA RESEARCH IMPLICATIONS

However, realizing such BD advantages is not a straightforward process. A comprehensive review of the BD literature pointed to its fragmentation and to its weak theoretical grounding, methodological diversity and empirically oriented work ([Frizzo-Barker et al., 2016](#)). In their review of the literature, [Côte-Real et al. \(2017\)](#) found that existing BDA research is focused on the adoption and use of BDA; in terms of BD value, most research is focusing on analyzing business value from a data or system perspective; from a strategic management perspective only one conceptual research explored how BDA affects several marketing activities; and the remaining research addresses industry primarily. [Frizzo-Barker et al. \(2016\)](#) noted that despite the newest of the BD field there was a clear evidence of the increasing interest on BD; BD research remains in the preliminary stages of investigating as it is dominated by conceptually-based research; BD orientation focused more toward BD tools than any other BD issues; much of the literature is more focused on the what or how type questions around integrating BD into business, but far less on whether or even if all organizations or their stakeholders will benefit from using BD; limited coverage

on critical, ethical or socio-economic aspects of BD or even the politics of BD algorithms; limitations in the literature relating to small and medium enterprises; lack of global diversity where conducting future empirical work is necessary to determine what types of data-driven best practices are most useful for diverse users; based on the growing trend of empirical studies, it is expected to see more studies in the near future with an eye toward which BD techniques work and which do not, in the context of practical application.

At the outset, Côte-Real et al. (2017) highlighted that although BDA technologies have been recognized as the "next big thing for innovation", BDA value chain remains relatively unexplored and needs further investigation. They highlighted that the literature found BDA adopters to gain an advantage over their competitors by 5% in productivity and 6% in profitability which encouraged enterprises to invest heavily in BDA technologies. On the other hand, this success is faced with scant empirical research, that needs to extend beyond post-adoption stages toward competitiveness, assessing how BD can bring business value, establishing linkages between knowledge assets, organizational agility, performance (process-level and competitive advantage) and how to use the appropriate technology and organizational resources to gain a competitive edge.

Using Gartner's hype cycle methodology, Frizzo-Barker et al. (2016) concluded that BD has moved through the initial hype and now is still in the preliminary stages of the disillusionment stage. Therefore, they blamed the complexity of the BD field to its infancy as a field and to the limited understanding of what BD is and what it means for organizations. This complexity also stems from difficulties in dealing with large data repositories (infrastructure), data itself (integrity, authenticity, validity, reliability, etc.) and data processing (analytics) to generate insights and strategic decisions concerning BD assimilation in business. In addition BD is often related to predictive analytics and hence, using different techniques to predict future insights by looking for patterns and relationships in data is not that easy process (Gandomi & Haider, 2015). Further, BD processes and data collection strategy increases operational costs and privacy threats, resulting in customer dissatisfaction (Habib ur Rehman et al., 2016).

Similarly, Shin (2016) reported that BD is one dominant strategy in a smart society and found the literature pointing to the wide enthusiasm, hype and potential importance of BD to the economy of the different countries in the world. But this literature was pointing to different implications: both public and private sectors are still not actively applying BDA; current initiatives are technologically biased and industry-specific; and most development efforts have been focused on the industrialization and commercialization of data technologies and infrastructure and ignored the social dynamics and organizational, political, and managerial decisions on BD success (i.e., privacy, security, interoperability).

Given these challenges and considering the strategic importance of BD to enterprises and their stakeholders, it is very important to understand the innate of BD and how it could be exploited to the benefit of organizations. For example, there is a considerable pre-adoption stage where enterprises should invest money and time to explore how BD can be applied in their business processes in order to develop skills and gain experience. Therefore this research depicts the following research question: *how can enterprises adopt BD successfully*. This question entails answering several sub-questions including what BD means to organizations and how such organizations adopt and implement BD by avoiding hindrances and capitalizing on accelerating factors. In the following sections, the research progresses BD features and tools followed by BD drivers and challenges. Finally the research discusses the results and ends with a conclusion.

BD FEATURES AND TOOLS

In their review of the literature, Janssen et al. (2017) found researchers employing different analytical steps involved in the BD process without specifying who executes these steps and the effects of one step on the other steps: six-model steps (data capturing, data storage, data searching, data sharing, data analysis, and data visualization); three steps (data handling, data processing, and data moving); five steps (problem definition, data searching, data transformation, data entity resolution, answer the query/solve the problem); and data collection, data storage, data management, data manipulation, data cleansing, and data transformation.

CC, new programming models, and scalable high-performance databases, are emerging as BD's core technologies. BD tools are categorized into (Frizzo-Barker et al., 2016):

1. programming models, e.g., MapReduce and Matlab (Matrix lab)
2. data collection, processing and storage, e.g., AaaS, Amazon Web Services
3. data extraction and monitoring, e.g., Amazon Mechanical Turk, Technorati
4. data management, modelling, and analytics, e.g., Hadoop (based on MapReduce), Apache,

Habib ur Rehman et al. (2016) found the literature splitting the BDA processes into descriptive (e.g., mean, median, mode, standard deviation, variance, and frequency) or prescriptive (cause-effect, optimize business process models based on

feedback from predictive analytic) or predictive (supervised, unsupervised, and semi-supervised learning models) analytic models. They also listed the following BDA software tools including Accenture, Alpine Data, Alteryx, Angoss, BigML, BIME, Clario, CoolaData, CoreMetrics, Data Applied, Dell, FICO, IBM, KNIME, Kognitio, Lexalytics, Microsoft, MicroStrategy, Predixion Software Prognost, RapidMiner, SAP, SAS, etc. SqlStream, Again, the same researchers highlighted different BDA methods. Initially, there is Machine Learning type which include different methods such as Supervised Learning, Unsupervised Learning, Semi-Supervised Learning and Deep Learning. Secondly, Data Mining which include the following different methods: Classification, Association Rules Mining, and Regression Analysis. Finally, the Statistical Methods including Descriptive Statistics and Inferential Statistics.

In looking at BD, volume seemed to be the most obvious attribute here. Variety describes the diversity of structured and unstructured data that can be collected. Velocity refers to how quickly data can be made available for analysis ([Frizzo-Barker et al., 2016](#)). However, such a 3Vs model is not enough to warrant companies a competitive position as such. Adding more features such as Variability, Veracity and Visualization (Gandomi and Haider, 2015) provide surrogates to the previous 3Vs in the form of enhanced decision making, further insight discovery, and process optimization. Veracity means how much of the collected data was precise and accurate. This is especially so with data collected from social media avenues and how to trust decisions that were based on such data. Variability considers if the data collected from variety source are consistent and semantics. The variability property determines the internal variability in BD with multiple information-shifts as time passes. The information shift is defined as the difference between states of knowledge in BD systems ([Habib ur Rehman et al., 2016](#)). Visualization refers to data presentation as i.e., images, statistical graphs or chemical structure to easily understand the meaning of the data. Others added value to the above six Vs to measure the usefulness of data for an intended purpose ([Frizzo-Barker et al., 2016](#)). BD's volume, velocity and variety poses new challenges for aggregating, classifying, storing, and deciphering value out of data ([Frizzo-Barker et al., 2016](#)). The challenge here is that the veracity (manipulation, noise), variety (heterogeneity of data) and velocity (constantly changing data sources) amplified by the size of BD calls for relational and contractual governance mechanisms to ensure BD quality and being able to contextualize data ([Janssen et al., 2017](#)).

BD DRIVERS AND CHALLENGES

[Frizzo-Barker et al. \(2016\)](#) attributed the success of BD to the: ease of obtaining data through e.g., web clicks, RFID tags, sensors, loyalty cards and barcodes; data has become cheaper to store and analyze; the volume capacity and performance quality of BD tools; the greater availability, visibility, and transparency of information; data analysts and data-mining techniques can find new insights; and help businesses measure and manage predictivity.

BD is considered a disruptive technology and hence, the majority of these challenges ([Frizzo-Barker et al., 2016](#)) range from organizational BD design issues and management, BD in relation to innovation, computing technologies, analytics, social media, marketing, inventory management, talent management, and customer experience. Wheatley (2016) highlighted that the skill-gap remains the number one barrier to BD followed by the lack of standards and conventions for BD programming models, administration processes and insight-delivery methods. In the same vein, Janssen et al. (2017) pointed to the BD capacity and capabilities of people involved in collecting and processing BD. Secondly, the relative immaturity of technologies which hinders BD growth, even e.g. Hadoop and data lakes are still need a lot of transformation to be simpler. Finally, BD governance, or rules for use is more complex as it transcends technology boundaries. Similarly, Frizzo-Barker et al. (2016) confirmed the same and highlighted other challenges: lack of skillsets; lack of tools required to carry out BD strategies; concerns about privacy and surveillance; various disruptions of conventional methods, labor, and legality; incorporate BD into business, challenges organizational structures themselves, as new workflows and incentives must be designed to prioritize data-driven decision-making; risk of data privacy and ethical infringements, lack of BD policy; cost versus benefit of using BD for decision-making; the validation and integrity of collected data, and the complexities of dealing with highly distributed data sources; and how to take advantage of the unprecedented scale of available data:

1. Need for BD scientists and programmers
2. Integration of new technical tools required to collect, store, analyze and use BD

[Côte-Real et al. \(2017\)](#) research indicate that although BDA technologies call for substantial investment in implementation and maintenance, European firms are aware of BDA's potential value and benefits. Let's not forget BD may incur indirect costs. For example, CC utilization costs increase because of BD analytics and value creation activities for enterprises and customers ([Habib ur Rehman et al., 2016](#)). Despite its significance, the effect of BD on decision-making quality has been given scant attention in the literature ([Janssen et al., 2017](#)). This is attributed to the complexity of creating value from BD sets that are collected from different and heterogeneous sources that have various data qualities and are processed by various organizational entities resulting in the creation of a BD chain (collecting the data from the sources and ends when data-based decisions are taken) involving a myriad of multidisciplinary players.

Therefore, it is not surprising that the majority of adopters are concentrated within real-time, large and multinational organizations but even though, such corporations are still struggling to integrate BD into their organizational cultures where

questions like what BD is, who is using it, and what benefits, opportunities, and risks does it present to organizations and firms are not yet answered in large ([Frizzo-Barker et al., 2016](#)). Those organizations spanned different industries including finance and management sectors (banking and accounting), law and governance (military, policy-making, and national security), Information technology (IT) (data analysis, technical platforms, crowdsourcing, and information systems strategy), healthcare represented (genomics, medicine, hospitals and drug administration), education (BD in higher education, research and libraries), and finally, limited participation from other industries including trade and manufacturing, agriculture, music and entertainment, insurance, media, non-governmental organizations, and the environment.

While some challenges are related to data such as acquisition and storage and the risk of the confidentiality aspect others related to management and analysis ([Janssen et al., 2017](#)). Further, they highlighted that BD is noisy, messy, constantly-changing, and comes in different formats. They found the literature highlighting that an effective BD chain requires building capabilities and capacity for data management and BD analytics (descriptive, exploratory, inferential, predictive, causal and mechanistic techniques). For that reason, various methods are employed such as natural language processing, text mining, linguistic computation, machine learning, search and sort algorithms, syntax and lexical analysis, etc. They found the following conditions important for BD and BD analytics success: contractual governance concerning making agreements and contracts (SLAs) with BD providers to ensure mutual understanding of BD; relational governance is important to establish trust among involved organizations; the ability to collaborate among BD providers, BDA analysts and decision-makers; BDA domain-based capabilities in identifying the right tools for analyzing, which techniques to use and how to visualize B; data and knowledge exchange about the data in order to facilitate BDA analysis; process integration and standardization; routinizing and standardization BD chain improves BD velocity and decision making; flexible infrastructure determines the ability and the amount of effort necessary to handle and process the data; systems integration improves the handling of BD in order to avoid tedious manual work; scarce BD and BDA expertise who could communicate and interpret results; data quality of the BD sources; and the quality of decision-maker decisions

[Côte-Real et al. \(2017\)](#) stressed on the following antecedents to realizing BDA value: initially, making sense of the way firms use the technologies available to manage internal and external knowledge (helped through training); second, by effectively using BDA, firms can acquire capabilities to innovate and rapidly adjust to external demands (building organizational agility); thirdly, these capabilities will encourage specific business areas to involve the whole organization, when an effective bottom-up strategy is followed, supported by good communication practices; and finally, a performance metric to gauge the impact of BDA.

[Habib ur Rehman et al. \(2016\)](#) noted from the literature that data scientists spend 57.5% of their time on data preparation and hence, following a data reductionist strategy could further facilitate workload optimization, uncover the semantic relationship between data points and reduced BD streams before entering CC systems through compression and decompression techniques to reduce in-network bandwidth, sizing datasets, reduce dimensionality, remove duplicated data, minimize the financial cost of data storage services (by CC providers) and finally using datamining and machine learning methods could be used to uncover the knowledge patterns for lateral utilization instead of iterative raw data processing. They further noted that the prior knowledge of customers' behaviors could help in reducing processing the same raw data. In addition, security breaches are on the rise which should be addressed.

It is worth noting that BD capabilities is a function of management (planning, investment, coordination, control), infrastructure flexibility (connectivity, compatibility, modularity), and personnel expertise (technical knowledge, technology management knowledge, business knowledge and relational knowledge) capabilities ([Fosso et al., 2016](#))

BD ADOPTION MODELS

9S Framework

To be able to understand the impact of BD in business; firms and managers can view BD from the perspective of the 9S framework (or BD Wheel) ([Lake and Drake, 2014](#)). The 9S framework allows managers to see broadly the interplay between data and analytics from different technical and managerial strategic directions e.g., hard technologies, security and system, style, staff ([Figure 1](#)). As shown in [Figure 1](#) statistical thinking sets at the center of the BD Wheel since it is the common perspective across all others aspect of BD. Strategy and structure are tightly coupled in a way to show how organizations are structured and where the power lies which influences the way strategy is developed. Also, such strategies and their results may change the organization structure. Moreover, the type of staff employed as well as the structure and strategy of the organization are tightly coupled with the management styles.

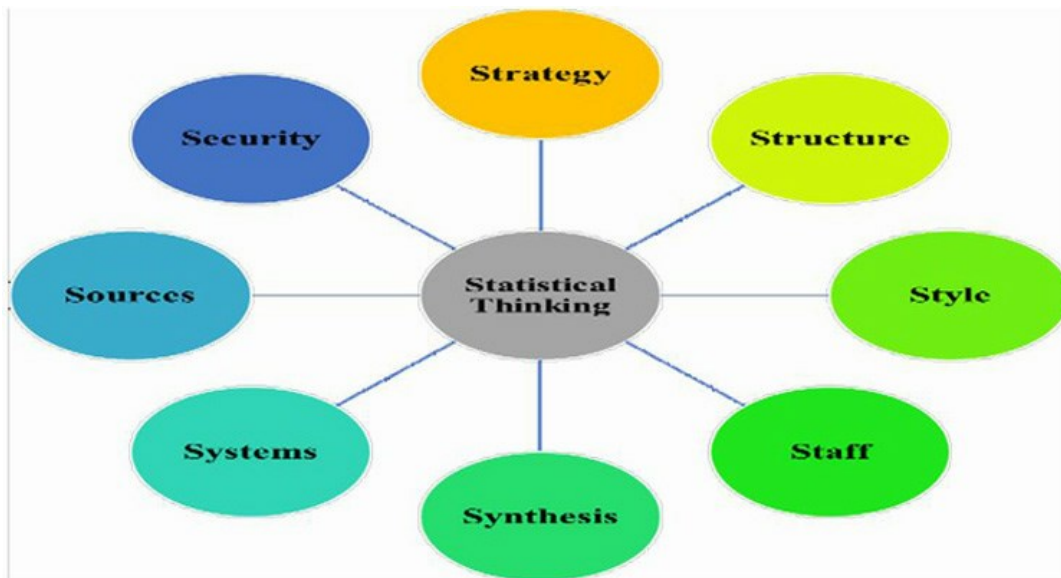


Figure 1: 9S Framework

PRACTICE FRAMEWORK

There are other frameworks which could help business to ensure a successfully BD analytics. The following framework consists of two perspectives: business perspective, technological perspective ([Singh H. 2015](#)).

Business Perspective:

1. Selecting the right strategy: Business must be able to provide clear business case on the problem they want solve analytically.
2. Connect the Stakeholders: such as active senior management support and involvement.
3. Establish Critical Success Factors CSFs: that focuses on employee usage of the resulting intelligence and key performance indicators for the processes where analytics will be used e.g., customer satisfaction, supply chain efficiency, etc.
4. Run a Pilot Project.

Technological Perspective:

1. Evaluate data requirements
 - a. What is the structure of data sources: For example, external structured data, external unstructured data such as social media posts, internal unstructured data such as sensor data and internal structured data such as Customer Relationship Management (CRM) ([Ebner et al., 2014](#)).
 - b. Data frequency of the data being processed.
 - c. Is it on-demand, continuous feed or real-time.
 - d. What is the analysis type which should be used?
 - e. Is this batch or streaming/real-time?
 - f. What is the volume of data received.
 - g. Are these massive chunks or small and fast chunks?
 - h. How to store data or how to process it.
 - i. How to visualize results.
2. Take a structured approach: such as using an agile and iterative implementation technique that delivers quick results

addressing the business requirement instead of a considerable SDLC application development. It is recommended to start small by meeting the requirement identified in the business case and gradually expand the project while not losing sight of the bigger business strategy.

3. Pick the right tools and technology for the requirement: it is recommended to technically and financially evaluate the different tools provided by different BD commercial vendors.
4. Define data governance early: as businesses adopt BD for competitive purposes, it is as important to address security threats and issues relating to realigning organizations security, privacy and governance policies especially if data transcends countries and continents privacy laws.

There are other competing frameworks that help organizations adopt BD strategically. Most importantly is that organizations could use combined approaches, for example, combining best aspects from both the 9S and the 8 practices frameworks, to reach to a set of variables that best fit their needs.

BD Strategies

Selecting the right BD strategy can be categorized into three dimensions: strategic elements, resource, and operating environment. The first dimension refers to the strategic factors, which include the relevance of BD, sponsorship level, and urgency. The second dimension refers to the resource factors, which include the IT personnel abilities, resource availability and absorptive capacity. The last dimension is operating environment, which involves the task routineness and data privacy ([Ebner et al., 2014](#)).

DISCUSSION

At the outset, the hype surrounding BD spurred global competition in that companies are pushed to adopt BD out of fear of being left behind. With such dependency on technology, organizations are becoming increasingly more data-dependent. At this stage organizations are still driven by technology and what it can do for them. On the other hand, being a disruptive technology, it possesses a variety of challenges which challenges organizations in using BD more effectively and ethically ([Frizzo-Barker et al., 2016](#)). This will further strain top executives in considering the following options: whether to proceed with a considerable initial investment in e.g., "risky" BD endeavors or trialing with BD across their learning curves using incremental and small investments or take a wait-and-see posture until BD stabilizes and matures. All these options are difficult ones because once the BD adoption and implementation process starts it will be very difficult to reverse the process if not impossible. Preparing the organization and Building the well-integrated infrastructure and unifying all sources of data across the BD chain will already consume large amounts of resources. At this stage, such processes are still technically feasible but the following processes in dealing with the raw data, cleansing it, standardizing it and then analyzing it using the right strategic model and interpreting results are still lurking challenges both technically and cognitively in addition to the needed considerable investments on consultants, hardware and software and training. The most important part here is the needed intelligence to make sure that what the organization is looking for is in line with its strategy and how to make sense of these exorbitant data. In addition, these processes should proceed in a smooth intra- and inter-organizational manner. This will require painstakingly close cooperation and collaboration between diverse range (sometimes with conflicting views and agendas) of stakeholders and organizational silos. This is an exhausting process financially, mentally, socially, etc.

There are already large players in the game and those are learning the hard way if not the hardest, but they have no option especially companies that deal with real-time data like Facebook and Twitter. Lessons from the history of technology adoption and diffusion have always taught us that leaders will always reap most of the benefits and laggards will always be left with leftovers or nothing. Technology is evolving so rapidly that what comes soon could be something totally unprecedented. For example, blackberry have lured large numbers of Nokia's mobile users for some time with its push-email-services feature but when iPhone emerged it overtook almost all mobile phone users and set the standard for the mobile industry once and for all.

The last option of wait-and-see is no longer an option. The huge hype and drive behind BD meant that everybody large and small enterprises should jump into the speedy BD wagon. Now, the difference is that there are enterprises that are already thrusting on the different phases of the BD's lifecycle driven mostly by its strategic necessity to their existence like Facebook. They could afford integrating phases or paralleling them in order to get the job done. But other enterprises are not faced with such urgency to adopt BD. The whole issue really dictates having critical and clear vision and leadership to push BD forward.

Accordingly, BD adoption and implementation decisions should be both rationalized but at the same time should be pushed forward. This hybrid approach in "incrementally pushing" BD is highly envisaged here for organizations alongside BD's metamorphological stages. Even if BD takes a sudden change in direction, such enterprises could still be present and active in the BD game. For example, investing in building BD intelligence (internally and externally) and integrating the BD infrastructure are steps in the right direction in general. The rest of the phases could be picked up and prioritized alongside the learning curve of such enterprises. The speed on this learning curve could be steep or gentle depending on the BD's strategic

understanding and priorities of such enterprises.

Indeed, the whole BD issue is overwhelming in that the road to the full realization of the "emergent" BD field is fraught with many challenges and CEOs and CIOs will face tough decisions to make. Therefore, it is not surprising that BD became everyone's most hated buzzword in 2013 (Dattoo, 2014). What is encouraging here is that there is a general optimism around BD and its importance which will create the needed momentum to push it forward.

CONCLUSION

This research attempted to shed light into the BD field by highlighting and explaining its different components, theoretical implications, and drivers and challenges. What this research attempts to stress on here is that although BD represents a crucial strategic information systems tool for organizations, its adoption and implementation should be carefully considered and assimilated alongside different contextual levels. The earlier failure stories of enterprise information systems adoption and implementation in the past stands as painful reminders.

REFERENCES

- Columbus, L. (2016). *Roundup of Analytics, Big Data & BI Forecasts and Market Estimates, 2016, AUG 20*. Retrieved January 16, 2017 from: <http://www.forbes.com/sites/louisacolumbus/2016/08/20/roundup-of-analytics-big-data-bi-forecasts-and-market-estimates-2016/#4ea4c90849c5>
- Côrte-Real, N., Oliveira, T., & Ruivo, P. (2017). *Assessing business value of Big Data Analytics in European firms*. *Journal of Business Research*, 70, 379–390. doi:10.1016/j.jbusres.2016.08.011
- Dattoo, S. (2014). *Big data: 4 predictions for 2014*. *The Guardian*. Retrieved January 20, 2017 from: <https://www.theguardian.com/technology/datablog/2014/jan/14/big-data-4-predictions-for-2014>
- Ebner, K., Buhnen, T., & Urbach, N. (2014). *Think Big with Big Data: Identifying Suitable Big Data Strategies in Corporate Environments*. 2014 47th Hawaii International Conference on System Sciences.
- Fosso Wamba, S., Gunasekaran, A., & Akter, S. (2016). *Big data analytics and firm performance: Effects of dynamic capabilities*. *Journal of Business Research*, 70, 356–365. doi:10.1016/j.jbusres.2016.08.009
- Frizzo-Barker, J., Chow-White, P., Mozafari, M., & Ha, D. (2016). *An empirical study of the rise of big data in business Scholarship*. *International Journal of Information Management*, 36(3), 403–413. doi:10.1016/j.ijinfomgt.2016.01.006
- Gandomi, A., & Haider, M. (2015). *Beyond the hype: Big data concepts, methods, and analytics*. *International Journal of Information Management*, 35(2), 137–144. doi:10.1016/j.ijinfomgt.2014.10.007
- Habib ur Rehmana, M., Changb, V., Batoolc, A., & Wah, T. (2016). *Big data reduction framework for value creation in sustainable enterprises*. *International Journal of Information Management*, 36, 917–928.
- IDC. (2012). *Digital Universe study*. Retrieved January 1, 2017, from: <http://www.kdnuggets.com/2012/12/idc-digital-universe-2020.html>
- Janssen, M., Van der Voort, H., & Wahyudi, A. (2017). *Factors influencing big data decision-making quality*. *Journal of Business Research*, 70, 338–345. doi:10.1016/j.jbusres.2016.08.007
- Lake, P., & Drake, R. (2014). *Information systems management in the big data era*. Springer International Publishing; doi:10.1007/978-3-319-13503-8
- Shin, D. (2016). *Demystifying big data: Anatomy of big data developmental process*. *Telecommunications Policy*, 40(9), 837–854. doi:10.1016/j.telpol.2015.03.007
- Singh, H. (2015, August 24). *8 Best Practices for Executing a Successful Big Data Analytics Strategy*. Retrieved May 1, 2016, from <https://www.linkedin.com/pulse/8-best-practices-executing-successful-big-data-analytics-singh>
- Wheatley, M. (2016). *Wikibon forecasts Big Data market to hit \$92.2B by 2026*. Retrieved January 1, 2017, from: <http://siliconangle.com/blog/2016/03/30/wikibon-forecasts-big-data-market-to-hit-92-2bn-by-2026/>