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Vision: A Missing Key Dimension in the 5V Big Data Framework

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ABSTRACT

If Big Data is to deliver on its big promises, a well-articulated vision must be developed in a collaborative way and effectively communicated to all key stakeholders. Without a guiding technology vision, the promise and benefits of Big Data will become elusive and lost to many organizations. The literature on Big Data frequently refers to the 5Vs of Big Data (Volume, Variety, Velocity, Veracity and Value). Based on a strategic framework, this paper adds another dimension to this important and widely used framework, namely Vision, and elaborates on the critical role of vision and its relationship and impact on the remaining Vs. Research shows that vision has a positive impact on organizational performance. Organizations that link vision with strategic information systems, such as Big Data applications, ga5in a sustainable competitive advantage in the marketplace. The importance of carefully defining, establishing and communicating the vision of Big Data to the entire organization and to key stakeholders in order to leverage Big Data for growth, profits, and sustainable competitive advantage is discussed.

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1. Introduction

Today the biggest challenge facing organizations is not a lack of data as much as it is being awash in data (Edmunds & Morris, 2000). Significant advances in technology have delivered the ability to efficiently store vast amounts of data that was once unimaginable. Today, thanks to the extraordinary and highly affordable computing power at one's fingertips, data storage, information processing, and knowledge management have become affordable and within the reach for more organizations than at any other time in human history. A specific category of information systems and applications that can leverage the advances in computing power and sophisticated analytical software to help organizations achieve a competitive edge in the marketplace is Big Data (McGuire, Manyika, & Chui, 2012)

With the increasing prominence and push for "Big Data" as a must-have competitive tool (Bell, 2013) (Datskovsky, 2013) (Bhadani & Kotkar, 2015) (Davenport, 2014) (E. Prescott, 2014) it becomes essential for the entire organization and its associated business units to examine, analyze, and determine the role of Big Data in achieving competitive advantage. Big Data holds the potential to "transform the entire business process" (Wamba, Akter, Edwards, & Chopin, 2015) by changing the way companies innovate, compete, sell, grow, and survive. The effective and timely application of Big Data holds the power to alter and enhance "corporate ecosystems" (Maniyka, 2011), solve complex problems that hitherto may have been beyond reach (Yadav & Kumar, 2015), and deliver exponential value and growth (Brown, Court, & Willmott, 2013). In other words, what is evident from the emerging strengths of Big Data as a competitive weapon is that no business, regardless of its size, location or industry, can any longer afford to ignore Big Data. This is not to say that existing technology resources are no longer of value and must be replaced with Big Data technologies and techniques. Quite to the contrary, the greatest bang for Big Data may come from aligning Big Data technologies effectively with existing technologies and then carefully identifying where the valuable "stretch" opportunities may be hidden. In short, Big Data should not be viewed as a panacea for all problems, but instead as an opportunity to strengthen and expand existing resources and effectively leverage new resources to achieve powerful insights in order to solve problems that hitherto defied solutions. (Weng & Lin, 2014)

In order for Big Data to deliver on the big promises that have come to be associated with it, a well-articulated vision is critical.

In fact, the vision for Big Data within an organization may be the driving force for its success. This paper focuses on the critical role of organizational vision and derived project vision and its relationship to the other Vs (Volume, Velocity, Variety, Veracity and Value) that have been defined as the core elements of Big Data. The importance of carefully defining, establishing and communicating the vision of Big Data to the entire organization and to key stakeholders in order to leverage Big Data for monetization and competitive advantage and sustainability is discussed.

2. What Is Big Data?

Although "Big Data" has become a prominent part of the business and technology vocabulary in a short span of time, the term itself was coined nearly fifteen years ago (Press, 2013). True to the dynamic nature of an ever-expanding sea of data and its associated processes and derived value, the definition of Big Data itself continues to undergo refinements that are tailored to delivering value to the organization. The definition of Big Data can be approached from several dimensions (Agrawal et al., 2015) (Beulke, 2011), (Camacho, Macia-Fernandez, Diaz-Verdejo, & Garcia-Teodoro, 2014), (Gandomi & Haider, 2015):

1. Variety of data: Big Data refers to the ability to capture and integrate structured and unstructured data from multiple sources into a comprehensive and readily accessible resource, whether it is text, images, voice, videos, streaming data, signals or other types of data. In particular, semi-structured and unstructured data that defies conventional relational database systems is an integral part of the definition of Big Data.

2. Volume of Data: Big Data refers to large volumes of data, both structured and unstructured. Since the concept of "large" is itself subjective and ever-changing (Gandomi & Haider, 2015), by large we mean volumes of data that may challenge existing hardware and software systems in terms of storage, processing, analysis, display, and evaluation in a given organization. However, as Boyd and Crawford (2012) caution, "Big Data is less about data that is big than it is about the capacity to search, aggregate, and cross-reference large data sets."

3. Sources of data: Big Data refers to the ability to collect, structure, analyze, and process data from a wide variety of sources, including social media sites, web, sensors, transaction records, hard copies, mobile phones, tablets, satellites, the human body, and other data sources. In addition, new types of data may be generated in the future that must be smoothly integrated or appended with existing data pipelines. Systems that have the ability to handle and integrate diverse sources of data are an integral part of the definition of Big Data.

4. Processing for insights: At the heart of Big Data applications lies predictive analytics (Bose, 2009; Brown et al., 2013)(Earley, 2014), a set of statistical techniques along with other sophisticated analytical tools, techniques, and algorithms that can predict the future of things, scenarios, and parameters that are of interest to the user. This includes patterns that are revealed when large data sets intersect, which in turn form the basis of deep insights that can yield rich benefits to an organization. These patterns were not easy to extract or detect prior to Big Data because the necessary hardware and software were simply not available or it was too expensive and hence out of reach to many decision-makers. But today, with cloud computing, open source software, and the Internet of Things, Big Data can deliver information, knowledge and insights that are far superior to what was available in the past (Evans, 2015; Giniat, 2011), (Jukić, Sharma, Nestorov, & Jukić, 2015). Mining and processing information and insights by comparing and diving deep into large data sets can lead to rich insights that can transform industries, deliver unparalleled value to organizations, and even solve social problems that hitherto were beyond reach. Furthermore, these benefits are now within the reach of less-resourced organizations also, thanks to declining technology costs and the concept of renting "just-in-time" technology (Hagen & Khan, 2014; Hair, 2007).

Based on the above discussion, Big Data can be defined within the broad parameters of data types, sources, volume, and processing strategies as a vehicle that can deliver insights that until now was beyond the reach of storage and database technologies and the processing abilities of software. When data sets are so large and complex and include data types and sources that traditional database technology and processing techniques cannot handle, Big Data steps in.

For purposes of this paper, we will use the following holistic definition of Big Data as offered by Boyd and Crawford (2012): Big Data is a cultural, technological, and scholarly phenomenon that rests on the interplay of:

1) Technology: maximizing computation power and algorithmic accuracy to gather, analyze, link, and compare large data sets;

2) Analysis: drawing on large data sets to identify patterns in order to make economic, social, technical, and legal claims;

3) Mythology: the widespread belief that large data sets offer a higher form of intelligence and knowledge that can generate insights that were previously impossible, with the aura of truth, objectivity, and accuracy.

3. Using "V" to Define Big Data

One popular framework or approach that has been useful to address the technical and managerial aspects of Big Data, including emerging issues, challenges, promises, and opportunities is the 5Vs framework. In the early stages of Big Data, the framework was defined using three Vs: Volume, Velocity, and Variety (Chen, Mao, Zhang, & Leung, 2014) (Tsai, Lai, Chao, & Vasilakos, 2015). Later, this model was expanded to include two more dimensions: Value and Veracity (Beulke, 2011; Chen et al., 2014) (James, 2014) (Gandomi & Haider, 2015). These 5Vs (Volume, Velocity, Variety, Value and Veracity) are frequently referred to as the 5Vs of Big Data. The 5Vs framework has been a useful approach to addressing the issues and challenges of Big Data. "We define Big Data as a holistic approach to manage, process and analyze 5Vs (i.e., volume, variety, velocity, veracity and value) in order to create

actionable insights for sustained value delivery, measuring performance and establishing competitive advantages." (Boyd & Crawford, 2012) Since Variety and Volume were discussed previously, we discuss the other dimensions of the 5Vs framework below.

Velocity: Velocity refers to the frequency of data generation and/or data delivery. This can be both an opportunity and a challenge. While there are benefits to the rapid and instant generation of structured and semi-structured data, speed of data generation has a downside as well. Data that is quickly generated, must be verified, processed, stored, distributed, gleaned for insights, monitored, updated and maintained with equal speed if it is to add value and offer a competitive advantage. This increases the pressure points on internal and external technology systems and on those who are responsible for it.

Value: The key reason why Big Data has garnered so much interest around the world is the potential it holds to deliver value (Gandomi & Haider, 2015; Giniat, 2011; Hagen & Khan, 2014; Honavar, 2014). In this case, we are referring to value that without Big Data would simply not be possible. We recognize that value is subjective and time-dependent in some cases, if not in all cases. In other words, the value of a piece of data changes with time. In addition, it is a function of the preferences and shifting needs of users as well. As is widely known, data, in and of itself, is often of limited value. But when data leads to insights that hitherto were unavailable or inaccessible, it becomes a value differentiator which can provide a significant competitive advantage.

Verification/Veracity: It is fair to say that sometimes bad data is worse than no data (Hoffman & Podgurski, 2013; Jacsó, 2010). In fact, data can easily become a burden or a liability if it is corrupt, unreliable, untimely and prone to weak analysis and misinterpretation. Further, excessive data that is hard to locate can also result in wasted time and effort and lead to frustration and delays in decision-making. The consequences of bad data can be far-reaching, resulting in poor decision-making or even loss of life in the case of critical, life-monitoring applications.

Many experts cite the 1:10:100 rule, which states that the cost of preventing a data problem increases by an order of magnitude as the record progresses through a process of correcting the failure (ten times the cost of prevention) and if this is not done, incurring the cost of failure (one hundred times the cost of prevention). Others estimate that bad data costs a typical business around 15% of net revenue ("Data Validation: An Incremental Approach to Big ROI," n.d.) According to Gartner.com, organizations on an average, may lose $8.2 million dollars annually due to poor data quality. In addition, 55% of CRM projects that failed to meet customer expectations was because of poor data. As Alice Zheng summarizes appropriately in Dataconomy, "Data is the first class citizen. Algorithms and models are just helpers."

As the types and sources of data increase and as the speed or velocity with which such data is produced increases, the challenges of verifying such data on an ongoing bases also increases. While there are many culprits for bad data in an organization, Big Data cannot fix the problems of bad data nor can it override its ill effects. In fact, sophisticated predictive analytics performed on bad data can lead to "insights" that are plain wrong and damaging as it can lead decision-makers down the wrong path (Simon, 2014). Verification refers to processes that check the accuracy of data, detect inconsistencies, and ensures completeness of data. Security, governance, compliance, metadata management and verification of data and its users are inter-related, with each influencing the overall value and quality of Big Data (Beulke, 2011) The above 5Vs namely Volume, Variety, Velocity, Value, and Verification have been widely discussed in the literature and provides a strong foundation for studying and understanding issues related to the creation, processing, and management of Big Data. In addition to the above 5Vs, two other parameters have been proposed ("Understanding Big Data: The Seven V's | Dataconomy," n.d.). These include Validity and Visibility, and are discussed below:

Validity: The integrity of the data that is being used to derive insights is at the heart of the value derived from Big Data. If the data lacks integrity and has not been a using method that is fit-for-purpose, then the insights will be rejected by users or put to wrong use. Data validation, at the very least, requires ensuring the validity of relevant data type from start to end as the data goes through various intended processes. All touch points of data must therefore be validated to ensure its integrity and accuracy. Interpreted data must be grounded in logic and/or facts.

Visibility: Many organizations are not short on data. Instead, the source of their frustration is often rooted in the fact that valuable data remains buried or hidden in storage systems and applications that are hard to reach or even decipher. Sitting on valuable data that can provide compelling competitive advantages in the marketplace but being unable to leverage it is one of the issues addressed by data visibility. Visibility refers to data that an authorized user can locate, access, process and secure in a reliable and timely manner (Gandomi & Haider, 2015; Simon, 2014; Walker et al., 2013) (Gandomi & Haider, 2015). Visibility also provides users with context. In other words, if a piece of data was "stitched together," the source, processes, timing, and other relevant details must also be made visible to an authorized user. Valuable intelligence and insights lies at the heart of visibility. Without visibility, the ability to connect, integrate, analyze, and understand data that may reside in multi-platform, multi-echelon environments is lost. Making relevant data visible to relevant users brings it to life and increases the value and utility of such data. Useful data that is invisible to the user is of little or no value. Internal and external data must be made visible at the right time, in the right way, to the right user.

While the 7 Vs identified above (Volume, Variety, Velocity, Value, Verification, Validation and Visibility) are essential components of a holistic framework to understand, assess, and manage Big Data, one essential component that ties together the remaining components is missing, namely, Vision. Lack of vision makes Big Data projects ad hoc and arbitrary, thereby depriving

the organization of long-term and sustainable benefits of Big Data. The importance of Vision and its role in the 7Vs framework is discussed in the following section.

Vision: Vision includes both long-term, future-oriented goals and emotional appeals embedded in a set of values (Collins, 2006; Frese, Beimel, & Schoenborn, 2003). Vision has been described and defined in many ways as summarized below: (Zaccaro & Banks, 2001)

- An idealized goal state
- A set of blueprints for the future
- A map for members to follow
- An image of what needs to be achieved It is focused on change
- Depicts a future that is credible, realistic, attractive, inspiring, and better than the status quo

The vision of an organization is its most visible and valuable roadmap for its future. Vision is more than just a statement on a website or an annual report. Instead vision clearly demarcates for key stakeholders the milestones that an organization hopes to reach in order for it to achieve the inspiring and prosperous future that it envisions. Vision is a powerful tool that helps create focus, passion, and commitment in leaders, employees, and all those who influence and impact the trajectory of a company. Vision is not the purview or the responsibility of just senior leaders, although clearly leaders set the tone. Instead, vision is "collective dreaming" and prioritization by all key stakeholders in which senior leaders play a critical and leading role that in turn, impacts the performance of individuals, teams and business units (Fallshaw, 2000; Frisina & Frisina, 2011; Li-Hua & Lu, 2013; Reid & Roberts, 2011; Wen-Cheng, Chien-Hung, & Ying-Chien, 2011). Vision, therefore, becomes the collective journey that all stakeholders in an organization must undertake in order to achieve a promising future (Davenport, 2014). After all, insights don't come cheap. A strong and consistent vision impacts profits, market power, organizational performance, sustainability, and employee motivation and commitment. Research shows that organization with a well-articulated vision can achieve sustained competitive advantage over those organizations that lack such a vision (Kantabutra 2009).

Why is vision so relevant and critical to Big Data? Because Big Data is not a short-term, use-and-discard, type of endeavor. Instead it demands long-term thinking, significant investments in infrastructure and personnel, team work, and the willingness to persist in the face of failures. In fact, a strong and meaningful organizational and technology vision increases the chances of success for Big Data projects. "… a vision which is **not** a one-time, specific goal that can be met, then discarded, increases the prospect of improvements in organizational performance, because such an abstract vision suggests a longer-lasting organization that is desirable to followers, and encourages effective group formation to carry out the vision." (Kantabutra, 2009)

Should all organizations engaged in Big Data pay close attention to vision? The answer is yes. Linkages between IT and successful strategy and competitive advantages have been proven over and over again. *"Although visions may be triggered by a variety of factors, the emergence and articulation of vision is particularly salient at three times in the life cycle of organizations: at founding, when facing periods of disruption, and when purposefully planning for the future."* (O'Connell, Hickerson, & Pillutla, 2011). At these times, information systems and technologies that are designed and implemented with the primary intent of successfully executing a specific business strategy or strategic information systems, are common. Today there is hardly a company or an industry that is not facing disruption, small or large, imminent or invisible, and hence organizations must embrace vision as a key driver for their Big Data initiatives.

4. An Integrative V-Framework for Big Data

Given the critical role that vision plays in long-term organizational performance and sustainable competitive advantage, it is imperative and highly pertinent to include Vision in any discussion of a holistic framework that addresses the assessment, management, and challenges of Big Data. This paper expands the current framework of 5Vs (or 7Vs) to include vision that stakeholders must take into account to leverage the full benefits of Big Data. Based on the above discussion, we propose an expanded framework for Big Data and outline the interactive relationship between these Vs (refer to Figure 1):

1. Vision
2. Value
3. Volume
4. Velocity
5. Variety
6. Veracity
7. Validation
8. Visibility

Vision drives and determines the meaning, nature and scope of business value within an organization, whether it be the value of technology, personnel, projects, products, services, customer acquisition, or any other dimension. A cohesive vision that is well understood throughout the orgnization, in turn, drives and determines what is of value within each funcitional area, unit, and project of the business. As project requirments, customer needs, and organizational priorities change frequently, vision becomes the steady hand that helps individuals and teams navigate through the perpetual sea of change to pursue what is of true value to the organization over the long-run. In other words, the challenge and opportunity facing businesses is to build and rely on a clear vision and value proposition even as they invest in projects with unknown requirements and an uncertain future (Velu, Madnick, & Van Alstyne, 2013).

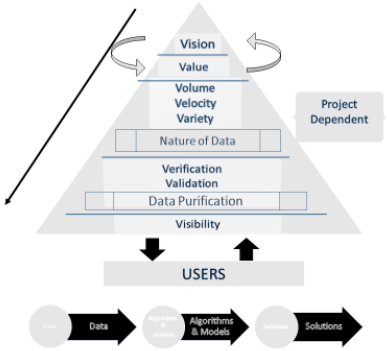

Figure 1: Big Data and the interactive relationship between these Vs

Value that is delivered collectively by different business units and projects helps organizations achieve their vision. In other words, vision is nothing but value delivered consistently over the short-term and long-term. Value, in turn, can also influence and shape vision. As organizations discover value, sometime in unexpected ways or places, in the form of new revenue, cost cutting, new market spaces, and new discoveries, it can shape and reshape the vision of an organization. Thus, vision and value are interrelated.

Volume, velocity, and variety are functions of the nature of the data set for a given problem. In other words, these three Vs will vary depending on the nature of the problem, the data behind the solution to this problem, and its intended use. In other words, volume, velocity and variety are dependent on the nature and scope of the problem and hence will vary from one problem or project to the next.

Veracity and validation are processes designed to "purify" the data for its intended use and purpose. The extent and quality to which a given data set is subjected to verification and validation depends again on the nature of the problem, user requirements, associated risks, and cost considerations, to name a few. These processes will vary depending on the nature of the data, the parameters of the problem, and the technology in use.

Finally, a number of factors, including users' needs, time sensitivity of the data, market demands, and utility value, determine visibility. Before an organization collects data, it is worthwhile to address the visibility requirements of that data, including authorized users, data format, timeliness factor, storage issues, data governance and the interactive dimensions of such data with other existing data. The larger the data set, the greater the need for sophisticated visualization tools and techniques. The more insights are deeply embedded within the data set, the greater is the need for sophisticated visualization tools that helps users move from data to information to knowledge to insights.

5. Conclusion

The objective of this paper is to emphasize the importance of vision for the long-term success of Big Data projects. This paper advocates that vision should be the driving force behind Big Data projects if organizations are to derive the much touted benefits of Big Data. The popular 5V framework of Big Data was expanded to 7Vs based on additional information and advances in the literature. Vision was then incorporated into this 7V framework, thus providing a holistic framework that will be useful to both senior executives and technology professionals. Based on research findings that organizational and technology vision drives and impacts organizational performance, competitive advantage, sustainability, and market power, the authors outlined the relationship between vision and the remaining Vs in the holistic framework. More research is needed on how to embed organizational vision into Big Data projects and how to accurately capture the value derived from Big Data projects that in turn, feed into the vision of an organization.

6. Limitations

Several limitations exist regarding this research. Retrospective data were used. However, as described above, steps were taken to mitigate potential threats to internal validity. Additionally, this approach is frequently used in the service literature (e.g. Sweeney et al., 2014; Bansal and Voyer, 2000). Also, external validity might be seen as problematic due to many of the homogeneous characteristics of the military community. Conversely, this concern could also be viewed as strength since real consumers, engaged in real-life WOM situations were used, and not student samples as is the case in much consumer-oriented academic research. Since the response rate was 64 percent, considered high for typical surveys of this nature, non-response bias was unlikely. Therefore, we have not specifically tested for this bias. Furthermore, as is common with cross-sectional surveys, this study is potentially subject to the common method bias. While we have not tried particularly for this inclination, we trust that the procedural methodologies actualized amid the review.

The Nyer (1997) study could be connected since results recommend that a relationship in the middle of feeling and WOM exists, and that feelings can "trigger" WOM, yet the greatness of impact is not known. Feeling would likely substantially affect the general WOM impact in buy choice procedures. Feeling holds potential for future investigation.

7. Conclusion

We have contributed to the service literature. By developing and testing a conceptual model with consumer-focused constructs, we have enhanced our understanding of WOM processes. A unique finding, strong support was attained for the interaction effect between product quality and service purchase decision involvement, yielding some important theoretical and managerial implications.

Based on data, we find results having product quality, service quality, word of mouth positively impact on business outcomes. In view of the writing on standards and dissemination, it is understandable that the retreat and flow look into promoting morals are centered around issues, for example, misleading publicizing, subliminal publicizing, sex, age and sexual orientation control, VIP support, industry regulation and self-

regulation, promoting to youngsters and a couple of studies on experts and publicizing partners.

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