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Manjul Gupta

*Iowa State University*, [manjulg@iastate.edu](mailto:manjulg@iastate.edu)

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# Organizational Culture and the Three V's of Big Data

**Manjul Gupta**  
Iowa State University  
manjulg@iastate.edu

## ABSTRACT

Much of the existing research on Big Data has largely concentrated on the technical challenges related with gathering and analysis of Big Data. These studies have seldom discussed the role of organizational culture in Big Data initiatives. Thus, relatively little is known about how organizational culture may impede or enhance an organization's ability to gain advantage from these data. Given that the notion of Big Data has been defined in terms of three key (or V's) attributes (i.e., volume, variety, and velocity), it is important to examine how organizational culture influences Big Data attributes. Therefore, to establish a clear understanding between culture and Big Data attributes, this study presents a framework that links organizational culture to the three V's of Big Data. This study argues that not all organizations, due to their varying cultural orientation, emphasize the importance of data volume, data variety, and data velocity. Further, the proposed framework suggests that organizations with a flexible structure and an external focus are likely to have a positive impact on the three V's of Big Data thereby increasing their chances of deriving maximum benefits from Big Data projects.

## Keywords

Big Data, organizational culture, volume, variety, velocity, competing values framework.

## INTRODUCTION

The Big Data<sup>1</sup> wave is sweeping today's competitive markets in which organizations in almost every industry are collecting and analyzing hordes of data. While the research into the economic benefits of Big Data remains in an embryonic state, organizations are increasingly experimenting with unprecedented volumes of data (Boyd and Crawford 2011). According to Gartner's (2013) survey of 720 firms worldwide, 64% of organizations (an increase of 8% over the previous year) have already invested in or plan to make investments in Big Data. However, investing in Big Data alone does not guarantee a competitive advantage, because of the challenges pertaining to their volume (i.e., quantification of the data), variety (i.e., disparate data formats), and velocity (i.e., speed at which data are generated and acted upon) (Chen, Chiang, and Storey 2012; Laney 2001; Russom 2011). These three V's (volume, variety, and velocity) collectively represent the three key attributes of Big Data (Laney 2001).

There is a widely-held perception that Big Data projects fail because most organizations do not have the right technical tools to harness the potential of Big Data; however, scholars have recently started to raise doubts about this popular opinion (McAfee and Brynjolfsson 2012). For instance, Lavalle and colleagues indicate that the reasons why Big Data projects are often unsuccessful relate to organizational culture rather than to the data attributes and technology (LaValle, Lesser, Shockley, Hopkins, and Kruschwitz 2014). Similarly, Ross, Beath, and Quaadgras (2013) assert that culture can impede (or enhance) an organization's ability to benefit from these data. Organizations that rely on Big Data need to continuously evaluate and change their business processes in response to emerging insights (Ross et al. 2013). To do so, organizations must have a culture that not only encourages collecting voluminous, diverse, and real-time data, but also allows them to make quick decisions as soon as new insights are extracted (McAfee and Brynjolfsson 2012). Stated simply, if culture is not right, likelihood of gaining business advantage from Big Data is low (Ross et al. 2013).

While these studies indicate that organizational culture is critical for the success of Big Data initiatives, nothing substantial can be concluded about how culture would influence the extent to which an organization focusses on data volume, data variety, and data velocity. Since culture tends to vary significantly across organizations (Hofstede 1993), it would be reasonable to suggest that organizations with different cultures will focus on the three V's of Big Data differently. Given that there are cultural differences across organizations, and given that we know little about the relationship between organizational culture and the data volume, variety, and velocity, this study examines the following research question: How does culture emphasize the management of data volume, data variety, and data velocity in organizations? Drawing upon

Quinn and Rohrbaugh's (1983) competing values framework of organizational culture and recent literature on Big Data, we develop a framework that links organizational culture to the three V's of Big Data.

## LITERATURE

### Big Data

The term Big Data is often used to describe gigantic, complex, and real-time data that can only be probed via cutting-edge management, analytical, and processing techniques (Beyer and Laney 2012). Posts on Facebook and Twitter, images on Pinterest, reviews on Yelp, search queries on Google, videos on YouTube, data generated via online purchases on Amazon, electronic clinical data, users' online browsing history, customer service data, and in-car sensors data about fuel consumption and CO2 emissions are all examples of Big Data. In comparison with traditional (structured) data, these data are "high-volume, high-variety, and high-velocity information assets," which can only be decoded via sophisticated data analytics tools (Beyer and Laney 2012).

*Volume* refers to the enormous size of the data (i.e., petabytes or exabytes of data). The advances in the Internet-based technologies have enabled organizations to gather unprecedented amounts of data (Laney 2001). According to an estimate, Walmart manages over 1 million shopping transactions every hour, generating approximately 2.5 petabytes of data (Knox 2013). Additionally, since these data are considered a potential source of gaining competitive advantage, organizations are extremely wary of discarding historical data (Laney 2001). Therefore, to keep up with the pace at which new data are generated, organizations continuously purchase additional data storage. For instance, Facebook adds 350 million new images every day to its existing database of more than 240 billion images (Miller 2013). And to store these astronomical amounts of data, Facebook increases its storage space by 7 petabytes on a monthly basis (Miller 2013).

The ease with which data can be captured in today's digital age has made organizations data hoarders. However, these data come from different sources and in a *variety* of formats. Data generated from clickstreams, online transactions, government surveillance, and social networking tools are not only voluminous, but they are also highly unstructured and difficult to categorize (Russom 2011). Moreover, organizations tend to add context to the streams of these data by adding previously stored structured data, which in turn result in the creation of convoluted data sets. In simple words, Big Data unite multiple varieties of data – unstructured data (audio, video, text), semi-structured data (emails, markup languages such as XML), and historical data (spreadsheets or relational databases) (Laney 2001; Russom 2011).

The third V of Big Data describes the *velocity* or speed at which data are created. With the advent of the technologies such as RFID (Radio-frequency identification) and location-based sensors, and with the ubiquity of smartphones, organizations can tap into these data as soon as these data are created. Therefore, organizations that can quickly glean intelligence from these data have a definite advantage over others (McAfee and Brynjolfsson 2012). However, to outdo the competition, organizations must act quickly once new insights surface. Consequently, the term velocity does not only refer to how fast data are created, but also to how promptly an organization responds to the insights extracted from Big Data (Agarwal et al. 2011).

### Organizational Culture

Organizational culture is considered a complex construct, which encapsulates almost everything in an organization (Iivari and Huisman 2007). Hence, it is not surprising that there is no commonly accepted definition of culture in the organizational literature (Alavi, Kayworth, and Leidner 2006). Highlighting the need for having an agreed upon understanding of organizational culture among practitioners and academics, Schein (1990) described organizational culture at three levels: artifacts (i.e., office layout, employees' dress and appearance, and publically available documents), assumptions (i.e., taken-for-granted norms that employees intuitively follow), and values (i.e., rules that describe everyday behavior of employees) (Alavi et al. 2006).

While artifacts represent the most tangible aspects of organizational culture, they cannot be interpreted correctly without having a complete understanding of the underlying assumptions (Schein 1990). Assumptions, on the other hand, are even difficult to decipher because they are deep-rooted in the organization's history (Schein 1992). Thus, given the challenges related to the analysis of organizational culture at the artifacts-level and the underlying assumptions-level, scholars have primarily relied on the values-based perspective of organizational culture (Cameron and Quinn 2011; Hofstede 1984). Values lie between artifacts and assumptions thereby making them more visible than the underlying assumptions; however, less visible than artifacts. Further, the two widely-accepted frameworks of culture – Hofstede's (1980) national culture framework and Quinn and Rohrbaugh's (1983) competing values framework – are both based on the values perspective.

Since we are primarily interested in culture at the organizational level rather than at the national level, this study uses the competing values framework (CVF), which is based on the two pairs of competing values: (1) *internal focus versus external focus* and (2) *flexibility versus stability*.

## THEORETICAL FRAMEWORK

The first pair of competing values (i.e., internal focus and external focus) describes the extent to which an organization values the development of its employees as opposed to the development of the organization as a whole (Quinn and Rohrbaugh 1983). The major difference between these two types of organizations lies in terms of how they perceive value creation (Cameron 2006). An internally-focused organization believes in creating value by developing internal competencies, such as establishing harmony among organizational members, building a family-like workplace environment, and efficiently performing familiar tasks. Conversely, an externally-focused organization is concerned about the survival and growth of the organization itself and thus it is closely examining the activities of its competitors all the time (Cameron and Quinn 2011).

Externally-focused organizations, unlike internally-focused organizations, strive hard to succeed in the external competitive environment. Based on this, it is safe to suggest that these organizations will consider every byte of data (either structured or unstructured) valuable and capable of providing them an edge over the competition. Thus, these organizations are likely to emphasize gathering all sizes and types of data. Further, Russum (2011) indicates that data volume and data variety positively influence each other. In other words, when data are voluminous, it is likely that these data are diverse and have come from different sources and vice versa. Therefore, we propose:

**H1: Externally-focused organizational culture (quadrants II and III in Figure 1) will have a positive influence on data volume (+) and data variety (+).**

An internally-focused organizational culture, on the other hand, emphasizes smooth running of day-to-day organizational and is least concerned about the activities of its rivals. Additionally, these organizations tend to take decisions based on a consensus such that organizational harmony remains intact. Stated simply, an internally-focused organization is so concentrated on the efficient functioning of its internal operations that it does not pay much attention to the changes or developments taking place in its external environment. It is due to this reason that internally-focused organizations are less likely to perceive value in collecting voluminous and diverse kinds of data sets. Therefore, we suggest:

**H2: Internally-focused culture (quadrants I and IV in Figure 1) will have a negative influence on data volume (-) and data variety (-).**

The second pair of CVF describes whether an organizational culture emphasizes stability or flexibility. Stability suggests authoritative leadership style in which organizational employees are expected to adhere to the decisions taken by their superiors. These organizations are mechanistic and strive for control and predictability in their structure. Flexibility, on the other hand, implies organic structure in which members, irrespective of their ranks or titles, are free to share their views and opinions. Some research suggests that as task complexity increases, organizations tend to adopt an organic structure, which enables them to make quick decisions to cope with heightened task complexity (Lawrence and Lorsch 1967).

Agarwal and colleagues (2011) argue that the third V of Big data – velocity – does not only refer to the speed at which data are being generated, but also to the speed at which an organization acts on the intelligence extracted from these data. Ross et al. (2013) suggest that one of the primary reasons why Big Data investments fail to payoff is because organizations are often slow to make decisions either due to hierarchical barriers or rigid structures. They further assert that, to harness the full potential of Big Data, organizations need to empower their employees at all levels are allowed to make decisions based on the newly gained insights. Since flexible organizations are organic in structure in which everyone is considered equal, these organizations are more capable of making spontaneous decisions when new insights emerge from the Big Data analysis.

**H3: Flexible organizational structure (quadrants I and II in Figure 1) will have a positive influence on data velocity (+).**

Finally, an organization with a stable, controlled, and predictable organizational structure tends to be highly bureaucratic (Denison and Spreitzer 1991). The structure, which is considered a foundation for these types of organizations, slows down the process of decision making. Moreover, it is likely that, despite having interesting insights from these data, these organizations may not act upon them, especially when the intelligence gained from these data contradicts the viewpoints of people higher up in the organization (McAfee and Brynjolfsson 2012). Therefore, we propose that organizations with a stable structure are less likely to emphasize the speed at which data are created and acted upon.

**H4: Stable organizational structure (quadrants III and IV in Figure 1) will have a negative impact on data velocity (-).**

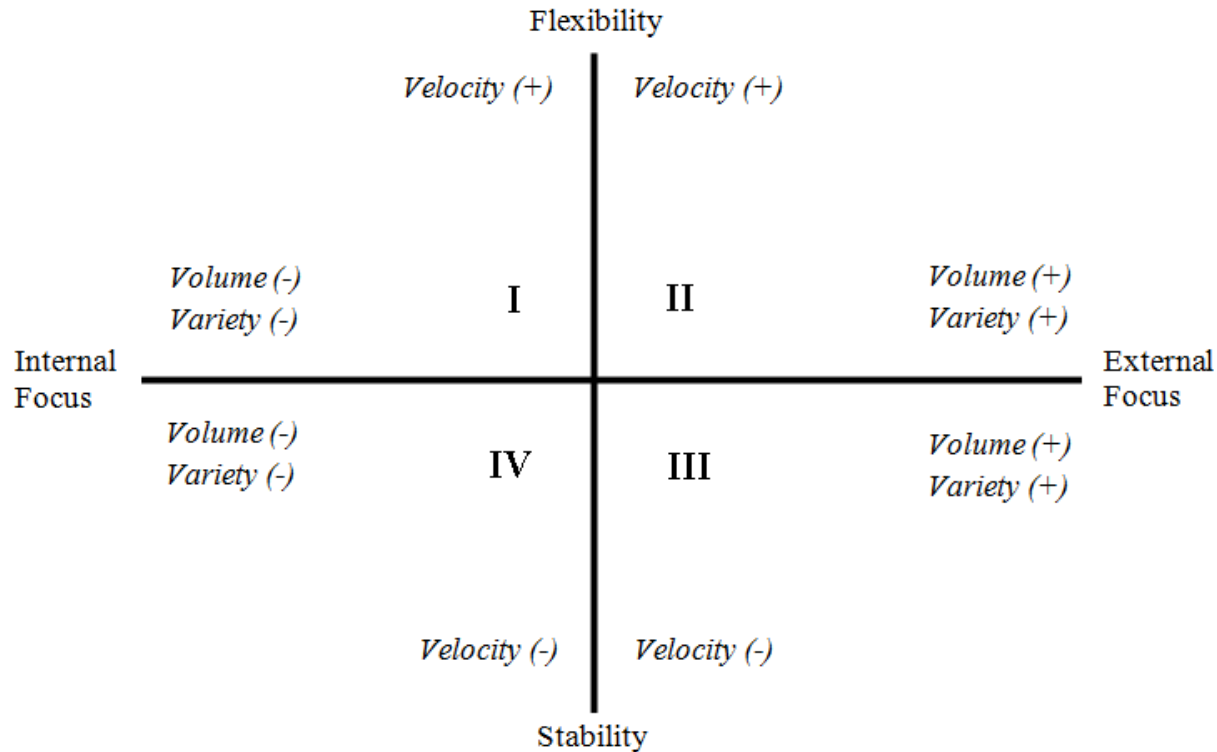


Figure 1. Organizational Culture and the Three V's of Big Data

## RESEARCH DESIGN

To test the proposed hypotheses, we will conduct a survey of chief data officers (CDO) employed in US-based companies. The unit of the analysis will be the organization. We will use a market research firm to draw an appropriate sample. Measures of organizational culture will be adapted from the scales suggested by Iivari and Huisman (2007). While the extant literature on Big Data provides clear, concise definitions of data volume, data variety, and data velocity, given the embryonic nature of the research on Big Data, there are no well-established measures of the three V's of Big Data. Therefore, we intend to develop scales to measure the extent to which organizations lay emphasis on data volume, data variety, and data velocity. To do so, we will follow the scale development procedure suggested by MacKenzie and colleagues (2011). This procedure primarily consists of five phases: conceptualization of the construct, development of measures, model specification, scale evaluation and refinement, validation, and norm development.

## DISCUSSION

We, thus far, have specifically focused on the two competing pairs (flexibility versus stability and internal focus versus external focus) of organizational culture. However, the intersection between these two pairs generates four quadrants (as shown in Figure 1). For instance, quadrant I represents internally-focused organizations with a flexible structure. While quadrant II reflects externally-focused organizations with an organic structure, quadrant III organizations are externally-focused, but tend to have a stable structure. Finally, quadrant IV denotes organizational culture that is hierarchical and internally-focused.

The advantage of viewing the proposed framework at the quadrant level allows academics and practitioners to specifically examine the relationship between different forms of organizational culture and the three V's of Big Data. Based on our framework, quadrant II organizations are expected to be successful in their Big Data initiatives because an organization with an external focus and a flexible structure will not only be interested in gathering high volume, multi-variety, and real-time data, but it can also act quickly as soon as these data yield interesting insights. On the other hand, quadrant IV organizations, due to their internal focus and controlled structure, may not benefit from Big Data at all. Quadrant III organizations will be interested in data volume and data variety; however, their top-down hierarchical structure may either slow down their decision making process or not allow them to effectively respond to new insights (Ross et al 2013). Finally, while quadrant I organizations tend to have a flexible structure, their internal focus will prevent them from perceiving potential value of Big

Data. Thus, quadrant I organizations are likely to discourage collecting of data from different sources and in different formats.

## CONCLUSION

This paper was inspired by the lack of theoretical research pertaining to the relationship between culture and an organization's emphasis on data volume, data variety, and data velocity. Drawing upon CVF of organizational culture and the existing research on Big Data, we proposed a framework that links organizational culture to the three key attributes of Big Data. The framework suggests that, to capture the full potential of Big Data, organizations need to have a flexible structure and an externally-focused cultural orientation. Additionally, the framework allows organizations, which have already invested in or plan to invest in Big Data, to assess their chances of being successful in their Big Data initiatives.

1. We used the uppercase term 'Big Data' throughout this paper to highlight that it is the notion we are discussing.

## REFERENCES

1. Alavi, M., Kayworth, T. R., and Leidner, D. E. 2006. "An Empirical Examination of the Influence of Organizational Culture on Knowledge Management Practices," *Journal of Management Information Systems* (22:3), pp. 191-224.
2. Beyer, M. A., and Laney, D. 2012. "The Importance of 'Big Data': A Definition," Stamford, CT: Gartner.
3. Boyd, D., and Crawford, K. 2011. "Six Provocations for Big Data."
4. Brynjolfsson, E., and McAfee, A. 2011. "The Big Data Boom Is the Innovation Story of Our Time," *The Atlantic*.
5. Cameron, K. S. 2006. *Competing Values Leadership: Creating Value in Organizations*. Edward Elgar Publishing.
6. Cameron, K. S., and Quinn, R. E. 2011. *Diagnosing and Changing Organizational Culture: Based on the Competing Values Framework*. Jossey-Bass.
7. Chen, H., Chiang, R. H., and Storey, V. C. 2012. "Business Intelligence and Analytics: From Big Data to Big Impact," *MIS Quarterly* (36:4).
8. Denison, D. R., and Spreitzer, G. M. 1991. "Organizational Culture and Organizational Development: A Competing Values Approach," *Research in organizational change and development* (5:1), pp. 1-21.
9. Gartner. 2013. "Gartner Survey Reveals That 64 Percent of Organizations Have Invested or Plan to Invest in Big Data in 2013." Retrieved February 22, 2014, from <http://www.gartner.com/newsroom/id/2593815>
10. Hofstede, G. 1980. *Culture's Consequences: International Differences in Work-Related Values*. Sage Publications, Incorporated.
11. Hofstede, G. 1984. *Culture's Consequences: International Differences in Work-Related Values*. sage.
12. Hofstede, G. 1993. "Cultural Constraints in Management Theories," *The Academy of Management Executive* (7:1), pp. 81-94.
13. Iivari, J., and Huisman, M. 2007. "The Relationship between Organizational Culture and the Deployment of Systems Development Methodologies," *MIS Quarterly* (31:1), pp. 35-58.
14. Knox, N. 2013. "Now Trending: Big Data at Walmart.Com." Retrieved February 22, 2014, from <http://blogs.wsj.com/cfo/2013/11/22/now-trending-big-data-at-walmart-com/>
15. Laney, D. 2001. "3d Data Management: Controlling Data Volume, Velocity and Variety," *META Group Research Note* (6).
16. LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., and Kruschwitz, N. 2014. "Big Data, Analytics and the Path from Insights to Value," *MIT Sloan Management Review* (21).
17. Lawrence, P. R., and Lorsch, J. W. 1967. "Differentiation and Integration in Complex Organizations," *Administrative science quarterly*, pp. 1-47.
18. MacKenzie, S. B., Podsakoff, P. M. and Podsakoff, N. P. (2011) Construct measurement and validation procedures in MIS and behavioral research: Integrating new and existing techniques, *MIS Quarterly*, 35(2): 293-334.
19. McAfee, A., and Brynjolfsson, E. 2012. "Big Data: The Management Revolution," *Harvard business review* (90:10), pp. 60-66.

20. Miller, R. 2013. "Facebook Builds Exabyte Data Centers for Cold Storage." Retrieved February 21, 2014, from <https://www.datacenterknowledge.com/archives/2013/01/18/facebook-builds-new-data-centers-for-cold-storage/>
21. Quinn, R. E., and Rohrbaugh, J. 1983. "A Spatial Model of Effectiveness Criteria: Towards a Competing Values Approach to Organizational Analysis," *Management science* (29:3), pp. 363-377.
22. Ross, J. W., Beath, C. M., and Quaadgras, A. 2013. "You May Not Need Big Data after All," *Harvard business review* (91:12), pp. 90-98.
23. Russom, P. 2011. "Big Data Analytics," TDWI Best Practices Report, Fourth Quarter.
24. Schein, E. H. 1990. "Organizational Culture," *American Psychologist* (45:2), p. 109.
25. Schein, E. H. 1992. *Coming to a New Awareness of Organizational Culture*. Sage.