



Contents lists available at ScienceDirect

Journal of Business Research



Big Data consumer analytics and the transformation of marketing

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ARTICLE INFO

Article history:

Received 31 March 2014

Received in revised form 2 July 2015

Accepted 4 July 2015

Available online xxxx

Keywords:

Big Data

Consumer analytics

Consumer insights

Resource-based theory

Induction

Ignorance

ABSTRACT

Consumer analytics is at the epicenter of a Big Data revolution. Technology helps capture rich and plentiful data on consumer phenomena in real time. Thus, unprecedented volume, velocity, and variety of primary data, Big Data, are available from individual consumers. To better understand the impact of Big Data on various marketing activities, enabling firms to better exploit its benefits, a conceptual framework that builds on resource-based theory is proposed. Three resources—physical, human, and organizational capital—moderate the following: (1) the process of collecting and storing evidence of consumer activity as Big Data, (2) the process of extracting consumer insight from Big Data, and (3) the process of utilizing consumer insight to enhance dynamic/adaptive capabilities. Furthermore, unique resource requirements for firms to benefit from Big Data are discussed.

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1. Introduction

“It’s not what you look at that matters, it’s what you see” Henry David Thoreau

The study of consumer analytics lies at the junction of Big Data and consumer behavior. Data provide behavioral insights about consumers; marketers translate those insights into market advantage. *Analytics* generally refers to tools that help find hidden patterns in data. For the past few decades, businesses generate more data than they are able to use or know how to use (Fayyad, Piatetsky-Shapiro, & Smyth, 1996; Friedrich, Stoler, Moritz, & Nash, 1983).

What is different today is the unprecedented volume, velocity, and variety of *primary* data available from *individual* consumers, resulting in the so-called Big Data revolution; potentially, a revolution that will lead to entirely new ways of understanding consumer behavior and formulating marketing strategy. In this paper, *Big Data consumer analytics* is defined as the *extraction* of hidden insight about consumer behavior from Big Data and the *exploitation* of that insight through advantageous interpretation. Although Big Data is considered a new form of capital in

today’s marketplace (Mayer-Schönberger & Cukier, 2013; Satell, 2014), many firms fail to exploit its benefits (Mithas, Lee, Earley, & Murugesan, 2013). To profit from this new form of capital, firms must allocate appropriate physical, human, and organizational capital resources to Big Data.

As data become larger, more complex, and more inexplicable, the limited mental capacities of humans pose difficulties in deciphering and interpreting an unknown environment (Sammur & Sartawi, 2012). A major shift, turning the scientific method around, from fitting data to preconceived theories of the marketplace, to using data to frame theories has been occurring (Firestein, 2012). Technological and methodological advances enable researchers to identify patterns in Big Data without forming hypotheses (Lycett, 2013). Such scientific inquiry requires less reliance on existing knowledge and more focus on what is unknown (Sammur & Sartawi 2012). Focusing on the unknown reflects a realization that “knowledge alone is not adequate to run the world” (Vitek & Jackson, 2008, p. 7) and requires a transition from a knowledge-based view into an ignorance-based view (Sammur & Sartawi, 2012).

Failure to benefit from Big Data (Mithas et al., 2013) often derives from its unique resource requirements. To stimulate more discussion of Big Data among marketing scholars, a conceptual framework is introduced to illustrate the impact of Big Data on various marketing activities. Using this framework, the following two research questions are explored: (1) *When and how* does Big Data enable firms to better create value and gain a sustainable competitive advantage? (2) What are the specific resource requirements for firms to take advantage of Big Data to gain a sustainable competitive advantage?

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2. Defining consumer Big Data

Today, technology has turned the average consumer into an incessant generator of both traditional, structured, transactional data as well as more contemporary, unstructured, behavioral data. The *magnitude* of the data generated, the *relentless rapidity* at which data are constantly generated, and the *diverse richness* of the data are transforming marketing decision making. These three dimensions help define Big Data, commonly referred to as the three Vs: volume, velocity, and variety (IBM, 2012; Lycett, 2013; Oracle, 2012).

2.1. Volume

The volume of Big Data is currently measured in petabytes, exabytes, or zettabytes. One petabyte is equivalent to 20 million traditional filing cabinets of text; Walmart is estimated to create 2.5 petabytes of consumer data every hour (McAfee & Brynjolfsson, 2012). Today's measurement tags will be inadequate as data sets continue to surge in size. The size of the digital universe in 2013 was estimated at 4.4 zettabytes (1 zettabyte is equivalent to 250 billion DVDs (Cisco, 2014); by 2020, the digital universe is expected to reach 44 zettabytes (IDC, 2014). As a result of firms' efforts to rein in the challenge of ever-increasing Big Data volume, the global market for software, hardware, and services for storing and analyzing Big Data is estimated to double in size every 2 years (IDC, 2014). Contributing significantly to the explosive growth in volume is the Internet of Things (IOT), whereby computerization is incorporated into cars, toys, appliances, turbines, and dog collars. Thirty-two billion objects are expected to be connected online by 2020 (IDC, 2014). Although volume is a primary distinguishing characteristic of Big Data, some firms possess massive data sets that lack the other characteristics of Big Data (velocity and variety).

2.2. Velocity

The second key dimension of Big Data is velocity (Lycett, 2013) or the relentless rapidity of data creation. Marketing executives with access to rich, insightful, current data are able to make better decisions based on evidence at a given time, rather than on intuition or laboratory-based consumer research. To better appreciate the difference between large data sets and Big Data, consider the difference between U.S. census data and consumer data collected by a leading women's clothing retailer—whose marketing executive knows at any given time how many consumer transactions are occurring; which product, styles, and colors of merchandise are moving off store shelves as well as the retailer's website; and what consumers are posting on social networks about the retailer. Both types of data are rich, large, and provide insights. Only the latter, however, gives the marketing executive the ability to make current and evidence-based decisions that competitors without Big Data insight will be hard-pressed to match.

2.3. Variety

Many sources of Big Data provide a diverse richness that far surpasses traditional data from the past. A major difference between contemporary Big Data and traditional data is the shift from structured transactional data to unstructured behavioral data (Integreon Insight, 2012). Structured data (scanner or sensor data, records, files, and databases) have been collected by marketers for some time. Unstructured data include textual data (e.g., from blogs and text messages) and non-textual data (e.g., from videos, images, and audio recordings). Much unstructured data are captured through social media, where individuals share personal and behavioral information with friends and family. Semi-structured data incorporate various types of software that can bring order to the unstructured data. For instance, Standard Generalized Mark-up Language (SGML) software enables the viewing

of videos to determine common elements that an organization wants to capture (e.g., of the videos posted on YouTube showing people using its product, how many of them seem to be happy?).

2.4. Two additional key Vs associated with Big Data

Although the three Vs are used to define and differentiate consumer Big Data from large-scale data sets, two more Vs are important in collecting, analyzing, and extracting insights from Big Data: veracity and value (Ebner, Bühnen, & Urbach, 2014; Lycett, 2013). Veracity underscores the need to be aware of data quality (IBM, 2012). Not all Big Data about consumers is accurate. Thus, the veracity of Big Data is a major issue at a time where the volume, velocity, and variety of data are constantly increasing (IBM, 2012; Oracle, 2012).

The ever-increasing amounts of Big Data lead to the question of value. The task is to eliminate unimportant and irrelevant data, so that the remaining data are useful. Further, the remaining pertinent data need to be valuable for obtaining insight and domain-specific interpretation (Lycett, 2013). The challenge is to identify what is relevant and then rapidly extract that data for timely analysis (Oracle, 2012).

3. Theoretical framework

3.1. Resource-based theory (RBT)

3.1.1. Types of resources

RBT, utilized by numerous marketing scholars in recent years (e.g., Barney, 2014; Day, 2014; Kozlenkova, Samaha, & Palmatier, 2014; Wu, 2010), offers a valuable explanation of Big Data's impact on marketing. RBT suggests that a firm's resources, both tangible and intangible, facilitate its performance and competitive advantage when the resource is valuable, rare, imperfectly imitable, and exploitable by the organization (Barney, 1991; Lee & Grewal, 2004). A resource is *valuable* when a firm's bottom line is improved or when the resource generates something of value to customers that competitors cannot achieve. A *rare* resource is one that is not abundant, whereas an *imperfectly imitable* resource indicates that the resource cannot easily be copied. An *exploitable* resource enables a firm to take advantage of the resource in a way that others cannot.

Resources include physical capital resources, human capital resources, and organizational capital resources (Barney, 1991). In the context of Big Data, physical capital resources include software or a platform that a firm uses to collect, store, or analyze Big Data. Traditional software is simply not capable of analyzing Big Data (Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). Thus, firms need to establish a platform that is capable of storing and analyzing large amounts (volume) of data continuously flowing in real time (velocity) from many different sources (variety) (Davenport, Barth, & Bean, 2012). Second, human capital resources include the insight of data scientists and strategists who know how to capture information from consumer activities, as well as manage and extract insights from Big Data. Third, organizational capital resources include an organizational structure that enables the firm to transform insights into action. Firms may need to alter organization and business processes to act on the insights from Big Data (Viaene, 2013). As illustrated in Fig. 1, physical capital, human capital, and organizational capital resources moderate the process of transforming consumer activities into a sustainable competitive advantage at different stages.

3.1.2. Dynamic capability vs. adaptive capability

In today's hyper-competitive business environment, firms must constantly update and reconfigure resources by responding to changes in the external environment to develop a sustainable competitive advantage (e.g., Day, 2011; Kozlenkova et al., 2014; Lin & Wu, 2014; Wu, 2010). A firm's ability to respond to change (dynamic capability)

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