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Research trends on Big Data in Marketing: A text mining and topic modeling based literature analysis

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ABSTRACT

Given the research interest on Big Data in Marketing, we present a research literature analysis based on a text mining semi-automated approach with the goal of identifying the main trends in this domain. In particular, the analysis focuses on relevant terms and topics related with five dimensions: Big Data, Marketing, Geographic location of authors' affiliation (countries and continents), Products, and Sectors. A total of 1560 articles published from 2010 to 2015 were scrutinized. The findings revealed that research is bipartite between technological and research domains, with Big Data publications not clearly aligning cutting edge techniques toward Marketing benefits. Also, few inter-continental co-authored publications were found. Moreover, findings show that research in Big Data applications to Marketing is still in an embryonic stage, thus making it essential to develop more direct efforts toward business for Big Data to thrive in the Marketing arena.

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1. Introduction

Enormous amounts of data are nowadays collected and stored by organizations, with the hope of being useful in the future. This poses the challenge of managing such loads of data and extracting from it appropriate knowledge for supporting decisions. Big Data is currently globally spread and widely accepted, representing also a synonym of vanguard in terms of information management, although this does not come without controversy (Fan & Bifet, 2013). In fact, as Chen, Chiang, and Storey (2012) argued, practitioners need to step forward “from Big Data to Big Impact” for effectively benefiting from the advantages provided by Big Data.

The support of decision making is a key issue for marketers, by providing insights to assist in answering critical questions such as: what is the most suitable product for a specific market; how to advertise such product in that market; through what communication channels; at what points in time and for what price; and supported by what kind of promotional and advertising actions.

Given these premises, it is with no surprise that Marketing has become from the start a field for experiments with Big Data approaches (Bendle & Wang, 2016). Recent sources of loads of data include social media and mobile applications: both have proven to have a huge impact on customers' decisions, directly affecting brand building (Moro, Rita, & Vala, 2016).

This paper outlines a research literature analysis on Big Data in Marketing framed in the 2010–2015 period. Considering Big Data in itself only holds value if it is harnessed aiming at extracting insightful knowledge, analytics has emerged as a pivotal trend to answer the challenges of Big Data in Marketing. In fact, marketing analytics solutions are now being disseminated throughout organizations in an attempt to benefit from Big Data solutions (Laurent, 2013), although most implementations are not yet achieved to effectively take advantage from such integrated Marketing-Big Data solutions (Chen et al., 2012). While analytics also apply to smaller volumes, emerging challenges regarding large volumes have recently risen, such as integrating a wide number of distinct sources, dealing with both structured and unstructured data, and performance issues. Therefore, analytics have also been included within this study. Nevertheless, it should be highlighted that the main focus of this study is to understand how Big Data is being managed and tackled to

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leverage Marketing challenges. Thus, by analyzing research conducted in this domain, the present study provides an overall picture of the current state of the art, contributing to a better understanding of this subject. With the aim of covering a large spectrum of the literature, a semi-automated text mining approach using topic modeling was adopted. The topics discovered provide the needed research insights on Big Data in Marketing.

2. Theory

Big Data is everywhere these days, whether in the form of structured data, such as organizations traditional databases (e.g., customer relationship management) or unstructured data, driven by new communication technologies and user editing platforms (e.g., text, images and videos) (Lansley & Longley, 2016). Social networks such as Facebook and Twitter are having a huge impact on influencing customers' decisions, leading organizations and brands to incorporate information originated in such platforms in their Marketing solutions (Moro et al., 2016). Therefore, Big Data is getting bigger.

Laney (2001) was among the first to mention the 3 Vs in Big Data management: Volume, Variety, and Velocity. Recently, two more Vs were included onto the Big Data equation: Variability, and Value. Gartner summarizes these five dimensions in its definition of Big Data in 2012 as "high volume, velocity and variety information assets cost-effective demand, innovative forms of information processing for enhanced insight and decision making" (Fan & Bifet, 2013). In order to harness Big Data, researchers have developed new techniques to capture, process, analyze and visualize large amounts of data within a limited processing timeframe. These techniques involve various disciplines: mathematics, statistics, optimization methods, signal processing, data mining and machine learning, visualization approaches and social network analysis (Chen & Zhang, 2014). The technologies and tools for exploring data can be divided in three classes: batch processing tools, streaming processing tools and interactive analysis tools. Each Big Data platform has a specific functionality and focus. For instance, some platforms are designed for batch processing, such as Apache Hadoop or Pentaho Business Analytics, while others are focused on real-time analytics, such as Apache Kafka or Storm (Chen & Zhang, 2014). In what concerns Big Data systems architecture, logical layers provide an approach to organize components that perform specific functions. Since layers are merely logical, they do not imply that the functions supporting each layer are run on separate machines or processes. A Big Data solution typically includes the four logical layers (Mysore, Khupat, & Jain, 2013): Big Data sources – different channels from which the data is generated; data messaging and store – layer responsible for acquiring and storing the data; analysis – where the data and insights are extracted; and consumption – application of the analysis layer results.

A Big Data system is only effective for business when it is set up for the extraction of useful knowledge to support business decisions (Sharda, Delen, & Turban, 2015). Predictive analytics solutions can be used on top of Big Data to facilitate that purpose, in a combined solution that can benefit from both the loads of data and advanced machine learning solutions (Hazen, Boone, Ezell, & Jones-Farmer, 2014). Predictive analytics based on Big Data drawn specifically for Marketing purposes are also called Marketing analytics solutions, aiming to provide solid ground Marketing understanding and techniques for marketers to solve real-world Marketing problems (Grigsby, 2015).

Recently, Malthouse, Haenlein, Skiera, Wege, and Zhang (2013) have identified guidelines for traditional customer relationship management (CRM) solutions to adopt for benefiting from the Big Data explosion that arose with social media. Their

recommendations include the prescription of Marketing analytics principles, in both the form of predictive models and adequate human resources with analytical skills to take the most from CRM solutions. Other studies have also identified the need to incorporate analytics solutions in CRM encompassing widely known concepts in Marketing, such as the evaluation of customer lifetime value (Moro, Cortez, & Rita, 2015b).

Marketing analytic solutions drawn on top of Big Data may benefit organizations in a wide range of problems, such as identifying customers keener to respond positively to a telemarketing campaign (Moro, Cortez, & Rita, 2014), constructing interactive reports and dashboards for managers or even unveiling interesting trends from what is being said about the brand on social media (Lacoste, 2016). Therefore, Big Data solutions may be considered the foundations for insightful systems that effectively support marketers, relieving the burden of slow-paced human analysis (Sharda et al., 2015).

By the end of 2012 a gap was predicted for the forthcoming years in terms of Marketing enabling technologies and Big Data (Feinleib, 2012). Recent studies confirmed that while some work has been done for filling such gap, the size of the gap is increasing at the velocity of the inflation of Big Data availability (e.g., Erevelles, Fukawa, & Swayne, 2016). Hence, the next years offer a relevant opportunity for research and development of Marketing solutions that explore the knowledge provided by Big Data.

3. Materials and methods

3.1. Literature selection

To select the most relevant publications for this study, the focus was set on finding the most relevant journal articles on Big Data in Marketing, within a recent timeframe including the last six years. The search was performed selecting journal articles (including reviews and articles in press) from 2010 to 2015. This timeframe was selected according to the increase of Web interest in Big Data in these years (Ozkose, Ari, & Gencer, 2015).

In order to select the relevant set of articles, the following query was executed:

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(marketing OR branding OR advertising OR "channel distribution" OR "consumer behavior") AND ("big data" OR "data analytics" OR "big dataset" OR "massive data" OR terabyte OR exabyte OR zettabyte OR petabyte)
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This query includes both Big Data and Marketing high-level concepts, considered equivalent and relevant terms for each area (e.g., Chen & Zhang, 2014 for Big Data; Grönroos, 1989 for Marketing). Since the main focus is Big Data technologies in Marketing, the query did not contain specific analytics terms. Also, considering new technologies on Big Data are emerging every day, only non-technical terms were searched through the query. Nevertheless, specialized technical articles result also in search hits as these often refer to "Big Data". The domain sciences selected in ScienceDirect were the following three: Business, Management and Accounting; Computer Science; and Economics, Econometrics and Finance. The final number of articles collected was 1560, from a total of 211 different journals, proving the diversity of interested journals on Big Data in Marketing. The large majority of studies have been published in information systems journals. Annex 1 provides a glimpse of Marketing specific journals according to SCImago categorization, by showing those with two or more articles selected for the current analysis. Such result clearly suggests that there is still room opened for research on Marketing literature for Big Data. Also, the low number of articles per journal when compared to the high

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