

Big Data Analytics and Business Intelligence in Business Marketing: A Review

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Abstract

The aim of this paper is to conduct an extensive study on big data analytics and business intelligence (BI) in marketing that is within the academic research sphere. Research gaps were identified and development for future research on the study was highlighted. A systematic review based on literature which related academic articles indexed in Web of Science and Scopus databases was used. The articles reviewed were based on certain features like theoretical and conceptual characterization; data source; research topic; type and size of data; data analysis techniques and methods used in data collection. The research outcome indicates that there is an increase in the marketing research with analytical technique applies to large quantity of data. However, this research area is limited in scope and methodologies and presents several gaps. A conceptual framework that will help in detecting important business challenges and relate the domain of big data and business intelligence to marketing is missing. This study contributes to exploring systematically the awareness of marketers working in big data and business intelligence.

Keywords: Big data, Marketing, Systematic literature review, Business intelligence

1 Introduction

The technology sphere has been on the explorative side lately as new concepts, technologies, tools are been unfolded and brought to light. The concept of big data has been talked about and is still in the loop as new trends keep evolving on a daily basis. Big Data is becoming a new solution used to solve common problems found when handling large volumes of data, these problems might be diverse and may likely be handled parallelism [1, 25, 29]. Big data are usually characterized with 5V's, which are velocity, variety, volume, value, and veracity [2, 27, 30]. Big Data comprises of large data volumes in the range of Exabyte, and beyond which exceeds online storage capacity as well as the capacity of processing systems. Big data has become advantageous in areas such as customer-centric business intelligence, real time data analytics, computer assisted innovation, industry wide decision making, among others. Despite the advantages, big data has several issues pertaining to management, storage and transport, and also processing which require quality assessment approaches [3].

Business intelligence defines a series of methods and concepts that assist decisions making in business by the application of support systems based on facts. Business intelligence offers technology and techniques for businesses to enable them collect, manage and analyze data rapidly, these data are also transformed into useful information, and then distributed throughout the company for use [4]. In most organizations, including online businesses, the art of data-driven decision-making (business intelligence) is used, it allows them take advantage of all the data available out in the open [5]. Given that marketing involves lots of data management, and management in turn supports decision making activity, then there is obviously a relationship between business intelligence and analytics and marketing [6, 20].

The notion of big data therefore revolves around laws and sub-components of change in regulations depending on the type of job performed or the type of assessment and implementation been done [7]. The concept of business intelligence on the other hand is not just about the tools or technology used for data analysis, but it entails the overall

application of the solution and can even be directed into idea management or rational thinking based on data science analysis [4].

The rest of the paper is structured as follows: Section 2 provides review of literature in the field of big data and business intelligence. In Section 3, illustration of methodology of research used in conducting the literature review systematically was covered. Section 4 gives a detailed explanation of the major findings of the review as well as a discussion on the articles critically dealing with big data and business intelligence. Finally, We then picture the major conclusions and discuss the limitations and future research areas of the review; theoretical implications, research needs, and practical implications were also highlighted in section 5.

2 Business intelligence and big data

2.1 Business intelligence

Business intelligence is one of computer science's latest scientific fields. It is a complicated job to use the understanding gathered from the unavailable and accessible dataset to get alternatives. Business Intelligence seeks to achieve executable and praiseworthy company solutions based on data analysis and processing. The most used aspect in business intelligence is the data that is collected, on the basis of the effect or nature of the data, informed choices are made. Thus, information is used to produce actionable and achievable findings at the end of the business process [7].

Business intelligence systems are used to detect the environment and connect these information points to suggest alternatives and predict outcomes accurately. Although business intelligence systems are still constructed in non-real time, there is a high demand to process, collect, visualize, and integrate in real time. Business intelligence systems are of advantage due to the variety of sensors contained in cell phones, private computers, Internet of Things, health monitoring devices intended to offer contextual, semantic voice to things that could not earlier contribute to knowledge [8].

In summary, business intelligence is beneficial as helps in understanding customers' want, competitors' actions and market trends as the data volume keeps increasing. It also ensures data brought together from various sources are helpful to aid analyses, improve business performance, makes data sharable and accessible at all times including provision of accurate and high-quality reports [9].

2.2 Big data

Big data can be defined as sufficient data volume in terms of structure and size that differs from traditional data. It can be seen as a combination of structured, unstructured and semi structured data and is within the range of exabytes [10]. Big Data is a bulky and growing dataset coming from various independent sources which could be textual content, multimedia content gotten from audio, videos, or images, social media content and even smartphones, home appliances, etc. [11]. Big data has a vital involvement in almost every field of life including engineering, biomedical, biological, science and social departments. Big Data from its name tells that it will be massive in capacity, and it is a technology of today as well as the future, because big data comes from many sources and its growth would continue evolving [8].

Due to the size of big data, it cannot be stored using conventional ways and in conventional databases, hence it employs the use of machine learning and deep learning algorithms to process the data and also some loud technology platforms like Hadoop. In simple words, big data plays the most significant role in observing patterns and behaviors of several systems over a lengthy period of time and it aids foreseeing the future of such system which is beneficial in areas where such system is been used [6].

Big data is the thing that produces data used for investigation. It is unstructured information that can't be stored directly into an organized database for investigation without earlier preparation. It implies huge amount of unstructured and mostly organized data from various sources can unveil various uniformities in arrays of data and furthermore makes anomalies in data known, given that similarity in examples exist in the data index being inspected [9]. Big data is generated from emails, personal information, economic transactions, delivery or pick-up services such as taxis, etc., access to customers marked places by updating their profile or uploading photos, video or audio files, or by using Facebook's check-in feature, which basically records and makes visible to colleagues on the platform, GPS and satellite images. Some Issues in the Big Data faced includes security, Processing, management [4] and Storage [3, 5].

2.3 *Using Business Intelligence and Big Data Connection in Marketing*

Business intelligence suggested as an approach to big data management in order to manage big data strategically and efficiently [9, 24, 28, 34]. Big data is the term instituted alongside business knowledge or information insight. The idea of enormous information rotates around a couple of guidelines and sub constituents of the standards change contingent on the sort of assignment executed or kind of investigation and application being executed. Big data challenges include not only analyses and data mining, but also data acquisition, data storage and data curation processes. With these aspects, results querying, virtualization, storage space problems, transformation, information retrieval, data access and controls, passage collaboration and most importantly, data independence and related data privacy. Big data is generally associated with the 3V concept. Recently, two additional features have been added to the same big data definitions (see Table 1) [7, 32, 36].

Table 1: Characteristics of Big Data [36]

Characteristic	Description
Volume	The sheer amount of data generated or data intensity that must be ingested, analyzed, and managed to make decisions based on complete data analysis.
Velocity	How fast data is being produced, changed and the speed with which data must be received, understood and processed.
Variety	The rise of information coming from new sources both inside and outside the walls of the enterprise or organization creates integration, management, governance, and architectural pressures in IT.
Veracity	The quality and provenance of received data.
Value	The important feature of the data which is defined by the added-value that the collected data can bring to the intended process, activity or predictive analysis/hypothesis.

Any marketing company needs to leverage its managerial and marketing strategies, tactics and tools to achieve and maintain sustained competitive advantage, this can be guarantee by the use of business intelligence technologies to manage and process the data acquired to form relevant information that is beneficial to such companies [12, 22, 31]. Most recent trend in business trend is that professionals are in effect more data mindful and they are focusing on the administration of realizing that great quality data would yield quality analysis. Professionals are likewise starting to be information mindful to the point of looking for the tools they can work with inside their organization. That is, data analytics is winding up some space in what organization see as a core personalized task and taking active [9, 23, 26, 33].

3 Methodology

To evaluate the range to which business intelligence and big data feature in marketing literature, a systematic review of academic marketing articles literature was conducted and indexed in the databases of Scopus and Web of Science. In the broader social sciences, the technique of systematic literature review was mainly embraced [12], including in the domain of marketing. Therefore, to define the associated science job, this method was adopted. Analysis and clustering of refereed science papers were subsequently classified manually into two primary groups: business intelligence related, and big data related, the papers were studied in detail based on the following characteristics:

1. theoretical and conceptual characterization;
2. data source;
3. research topic;
4. type and size of data;
5. data analysis techniques and
6. methods used in data collection.

3.1 *Data*

As discussed, the current study fetched data from two kinds of large databases named Scopus and Web of Science. The main conclusion in having selected the two prior databases is that they are treated to be the highest comprehensive sources of scholarly articles and academic work [19]. More accurately, Scopus covers more than 22,000 titles from

over 5,000 international publishers; therefore, it has been noted as one of the most comprehensive repositories of the world's research output across a wide range of academic disciplines. On the other hand, Web of Science (WOS) contributes access to up to seven databases that connect cross-disciplinary research covering over 28,000 journals. To sum up, the use of these databases ensures the reliability, validity and timeliness of the articles retrieved [20, 21]. Data used for this study was collected from January to September 2019, while the search was confined to the period of 2000-2019.

We endorse several search criteria. Only full-length empirical and review/policy articles, conference papers and book chapters, were included. Subsequently, the authors conscientiously read every single selected article based on the previous criteria and, thus, determined whether the article could be included in the analysis. We used different sets of keywords to build the target populations and samples. First, we searched the keywords “Business Intelligence” and “Big Data” on both databases. Second, we narrowed down our target population to look for work related to the marketing areas by leveraging the following searches: matching “Business Intelligence” with the keywords “Marketing” and, similarly, matching “Big Data” with the keyword “Marketing”.

A process of search using the keyword “Business Intelligence” in conjunction with other keywords representing Business Intelligence components (such as “data warehouse”, “data mining”, etc.) in the titles, abstracts and keywords returned 60,324 and 31,108 papers of publication on Scopus and Web of Science, respectively, over the period of 2009-2019. Apparently, there is a wide distribution over time and a linear and relevant growth over the past 10 years for Scopus indexed works (Figure 1). The status is different for articles indexed in WOS, significantly with low numbers (less than 10 articles per year), due to the lower coverage than Scopus.

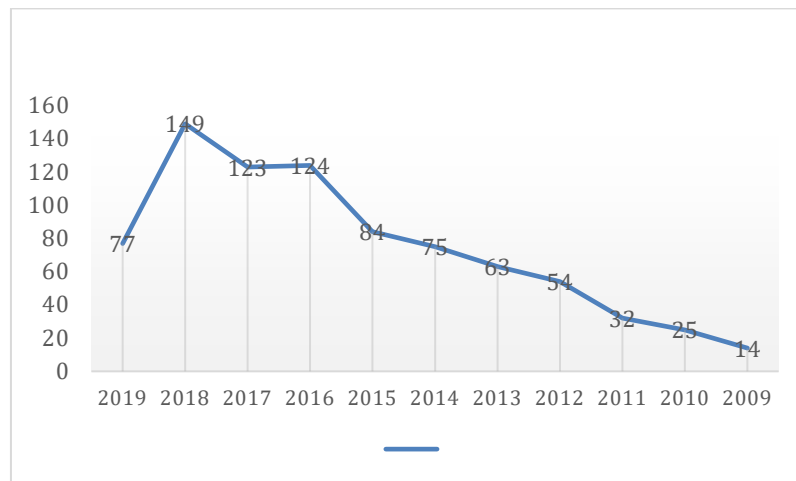


Figure 1: Cumulative time distribution of works published over the past 10 years in Scopus and Web of Science [7]

3.2 The area

Beyond any doubt, we classified our search to establish the direct relevance of the selected academic works to the wide area of marketing. We have, therefore, constrained our search on publications including “online marketing, advertising, promotion, selling or trade” in their titles, abstracts and keywords. Titles and abstracts have been manually inspected to further select work actually dealing with Business Intelligence and Big Data. The general agreement of multiple experienced researchers based in different academic institutions and countries and with different research and educational backgrounds and skills is reflection to have minimized any potential individual bias during this selection process as the last step.

The data set which is considered as the final were present in both databases (duplications) after checking for titles, includes 40 articles related to Business Intelligence and 30 articles related to Big Data. The final sample does not include duplicated articles. As stated, in the following section, the sample of articles was viewed, based on the following features: research topic; conceptual and theoretical characterization; sources of data; type of data and size; data collection methods; data analysis techniques; data reporting and visualization.

4 Result and Discussion

4.1 *A critical discussion on the articles dealing with business intelligence*

Several studies have been done in the area of business intelligence and there are lots of articles and research in the field. [9] conducted a study on business intelligence tools which are used for informed decision-making in organizations. Considering the challenges faced by various organizations with regards to manipulating the large amount of data produced from their internal business operations, business intelligence tools are proposed to be used in such firms for data processing.

The concepts of business intelligence and analytics were discussed as a means of managing large data. Case studies and applications of use like in the banking sector was provided while relevant strategies and some business intelligence tools were also highlighted. Business intelligence paradigm has been questioned by developing instances such as social media and news analytics in which information sources are not structured, suitable visual representations are not supported by mainstream instruments and evaluation metrics are not specified, [13] proposes the integration of artificial intelligence to business intelligence as a solution to enable visual analytics. [14] discussed some mythologies of business intelligence using business intelligence systems in human services organization as case study.

Four values associated with BI were perceived they include data-driven, inquisitive, shared accountability, and predictive and proactive and each of the value corresponds to a mythology of big data and BI. Design implications for better aiding data-driven decision making was suggested. [15] considers, among other areas mentioned, the technology of business intelligence, its contribution and its implementation for higher education purposes. Business intelligence application technology was classified into two instruments and methods using PRISMA as an instrument.

The range of methods was further broken down into viable system model (VSM), behavioral analytics, cloud computing, learning analytics, and data mining. While several tools that are used in business intelligence are web-based, Big Data by IBM, Gephi, and Hadoop. Business intelligence application contributions are innovation, assessment and transfer of information. Business intelligence's domain implementation is the consequence of the overall manner of applying business intelligence to multiple areas such as curriculum, research, behavioral analysis, resource management and evaluation.

4.2 *A critical discussion on the articles dealing with big data*

[16] considers big data as an efficient tool in the reduction of the costs of health care by eradicating antagonistic events and reduced hospital readmissions. The research examines the advent of big data in the U.S. healthcare industry, estimates the capacity of a hospital to use complicated information efficiently, and predicts the potential advantages that hospitals could achieve if they are effective in using big data. Challenges related to big data and its benefits were also highlighted.

[10] identifies major issues and challenges with big data even though they are beneficial. The data growing at a higher rate than computational speeds is a major problem with big data. Storage costs are getting cheaper day by day is also the result of the fact that people as well as almost all business or scientific organizations are storing more and more data. Big data is beneficial to the society and business but at the same time, it brings challenges to the scientific communities such as social activities, scientific experiments, biological explorations along with the sensor devices are great big data contributors.

The existing traditional tools, machine learning algorithms, and techniques are not capable of handling, managing, and analyzing big data, although various scalable machine learning algorithms, techniques, and tools like Hadoop and Apache Spark open-source platforms are prevalent data is developing at a higher rate than computational speed. What's more, it is the consequence of the way that capacity cost is getting less expensive step by step, so individuals just as practically all business or scientific organizations are storing an ever-increasing amount of data.

Social exercises, scientific examinations, biological investigations alongside the sensor gadgets are extraordinarily huge data givers. Big data is valuable to the general public and business and yet, it carries difficulties to scientific communities. The current conventional technique, machine learning algorithms, and systems are not equipped for taking care of, overseeing, and breaking down enormous information, albeit different adaptable machine learning algorithms, procedures, and instruments like Hadoop and Apache Spark open-source platforms are rampant.

[17] highlights risk intelligence in big data age consideration of hazards in all aspects of life implies different things for distinct individuals, while negative in particular they always cause a good deal of potential harm and inconvenience to the stakeholders of the company. Researching risk analysis instruments in today's big data age is useful to professionals as well as scholarly scientists. Some opinions on how risk-based business intelligence can be used in large-data manufacturing systems was provided.

[18] considers big data administrations dependent on versatile information and their significance, because of the way that Telecom organizations are perched on a gold mine since they possess a tremendous measure of data. When information is opened, this can create upper hands and produce new wellsprings of income. With regards to expanded intensity, quick innovative advancement and arrangement with worldwide telecoms controls, this guarantees receptiveness to other related administration categories, permitting both the inside change of the administrator by operational effectiveness or by decreasing expenses, but also externally through giving new benefits as a data provider (i.e. tourism, public services, transportation, etc.).

5 Reflections and conclusions

5.1 Conclusions

The systematic review of the literature shows that there is not much literature that applies analytical methods to big amounts of marketing information. However, big data has developed to become a disruptive technology with its effects reshaping the business intelligence domain as well as its technologies and tools, a domain that relies entirely on data analysis for better decision-making purposes, in all fields including marketing. In latest years, the broad use of internet apps has made more information easily available and accessible, data have gradually been utilized to predicting trends, analyze of consumer behaviors, detecting frauds, produce new, faster and detailed statistics, as well as elaboration of marketing strategies, hence it is required that appropriate tools should be used in the management of data.

5.2 Theoretical implications and research needs

In the field of business intelligence and big data in marketing, there are countless knowledge gaps and expansion needs. Referring to the comparative share of marketing papers in relation to business intelligence and big data when dealing with knowledge gaps, it can be concluded that marketing scholars are aware about the implication and possible effect of business intelligence and big data on business and societal domains. However, the complete number of papers accessible during the analytical era was on the brink, so future research is needed to conceptualize and execute innovative business intelligence approaches as well as critically evaluate the usefulness of these business intelligence apps and big data in marketing. A conceptual framework is also lacking to assist identify critical business problems in marketing, this is one need that should be addressed. Figure 2 gives a conceptual framework for big data and business intelligence.

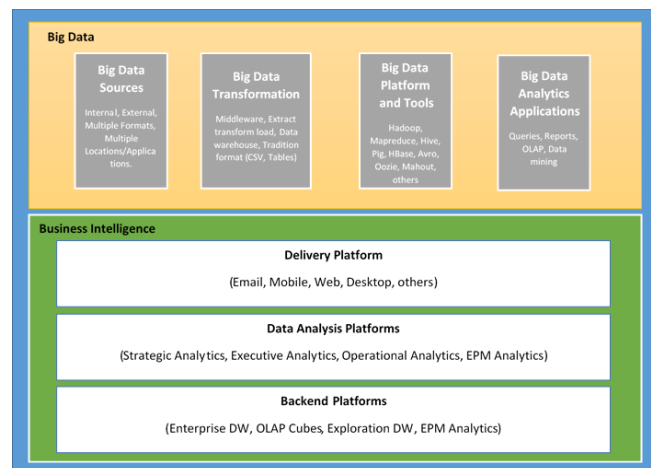


Figure 2: A conceptual framework for Big Data and Business Intelligence [35]

5.3 Practical implications

Real time data processing is an important requirement in business and marketing. Loads of real time data are produced per second and these data needs to be process efficiently and effectively in real time and output produced immediately, this trend is evolving rapidly and future advances in the broader AI field applied to data mining and predictive learning look promising to improve marketing organizations ' intelligence capacities and help them understand rapidly variable and hyper-competitive markets that can decipher ongoing company development.

Marketing executives also need to seek assistance from excellent data analysts familiar with state-of-the-art data science innovations to allow them to handle the best of the information produced or gathered.

5.4 Limitations and future research

This field of studies is rather uneven in scope and restricted in methodologies, which in turn shows several gaps. Using a conceptual framework would have helped to define critical company issues and link business intelligence and big data to marketing, but the literature review nevertheless ensured that some study gaps were highlighted that are further suggested for future studies.

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