BIG DATA ANALYTICS AS A STRATEGIC CAPABILITY: A SYSTEMATIC REVIEW

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ABSTRACT

Big data analytics gained the attention of both practitioners and researches. In terms of trends, it appears to be the next big thing, together with automation, machine learning and artificial intelligence. However, compared to the others, big data analytics, threatens to jeopardize the way managers themselves work. This is because they are the expected users of data in the decisional-making process. This means that, on one side, they have to be sponsors of the big data analytics change, and on the other side, they have to lead by example by entrusting their decisions on insights generated by data.

The purpose of our study is to run a systematic review of the articles published on topic of big data analytics and organizational performance in the field of strategic management.

As a methodology, we searched the articles indexed on ISI Web of Knowledge during period January 2005 - July 2019. Our first selection included 377 articles, which we further filtered based on our inclusion criteria: (1) field of strategic management; (2) empirical study; (3) based on a framework from management (4) relationship between big data analytics firm performance.

The findings suggest that firms need to develop a big data analytics capability, which will have a positive impact upon financial performance, competitive advantage and operational performance which are the most used constructs within the analyzed articles.

KEYWORDS: *big data analytics, strategic management, systematic review.*

1. INTRODUCTION

Big data analytics gained popularity within the jargon of business people in the last years. Business executives try to position themselves, and their organizations alike, as first movers when it comes to the big data trend. One thing is clear, it tends to gain them popularity points. However, as any environmental change, it comes with a set of risks and uncertainties. The biggest of all being, whether all the efforts with this significant change are worth or not. We would argue, that more than just a technological change, the big data revolution is aiming to change the domain of management itself.

Representative for this situation is the story told by Bock (2015) about Jim Berksdale, the former CEO of Netscape, where he would challenge his executives, demanding them to provide facts, because if they just come up with opinions, he would rather use his. This attitude is found in the literature as HIPPO, meaning *"highest paid person's opinion"*, and it describes how decisions are made by managers. According to this approach, they would rather rely on their experience or gut feeling, when taking decisions.

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Because of this, Davenport (2006) and McAfee and Brynjolfsson (2012) argue that the big challenge for companies is not a technological one, but rather in changing the organizational culture, obtaining leadership sponsorship, aligning the organization on the path of a big data initiative, recruiting the employees with the appropriate set of skills and ultimately, changing the decision-making style. All this represent strategic concerns.
In the first part of our study we intended to review the articles which fit our inclusion criteria, while in the second part, we classified the articles based on a systematic review approach.

2. LITERATURE REVIEW

As we stated in the beginning of this study, our aim is to identify within the published articles the relationship between big data analytics and performance in organizations. So the first step is to assess how these two parts of the equation are treated by researchers. We believe that because our study has been conducted on articles from the domain of management, this had an impact on the approaches towards big data analytics and performance.
As we will present later in our systematic review, the largest share of the articles treated this initiative in terms of a big data analytics capability (Akter et al., 2016; Anwar et al., 2018, Côrte-Real et al., 2019; Dubey et al., 2018; Gupta and George, 2016; Mandal, 2018, Nam et al., 2019; Shan et al., 2019). This approach sends the idea that big data analytics is not the responsibility of a function or a department within an organization, but rather has strategic importance and has to be coordinated and integrated at organizational level. Other authors explore this topic from the perspective of a data driven environment which supports the decision-making process (Cao et al., 2015). This is sometimes focused on a specific function, the most common one being the supply chain management (Chavez et al., 2017; Yu et al., 2018). Another interesting approach is the impact produced by the announcement of investments in this domain. Huang et al. (2018) proved that such news has a positive impact upon the market valuation of a firm. Other researchers make distinction between ad hoc use of big data analytics (Hosoya and Kamioka, 2018) and routine use of business intelligence systems (Gunasekaran et al., 2019; Popovič et al., 2019).
Moving forward to the other side of the equation, the approach towards organizational performance can be clustered as well. As expected, there is a tendency towards financial performance in order to measure the efficiency of an organization (Akter et al., 2016; Ferraris et al., 2018; Müller et al., 2018; Popovič et al., 2019; Tang et al., 2018; Torres et al.,2018; Wamba et al., 2017). Next, on the top as the most approach embodiment of performance is that of the competitive advantage, again a measurement linked with the domain of strategic management (Anwar et al., 2018; Côrte-Real et al., 2017; Fink et al., 2017; Shan et al., 2019). Operational performance is encountered in a considerable number of articles as well (Gunasekaran et al., 2017; Gupta and George, 2016; Gupta et al., 2018; Raman et al., 2018). As it would be usual in a strategic analysis, all the stakeholders are included, so the customers' side is not neglected, therefore we have authors which study performance from the perspective of customer satisfaction (Nam et al., 2019; Raguseo and Vitari, 2018; Wamba et al., 2018). As data is being used in the decision-making process, an assessment of performance is that of the decision's effectiveness (Cao et al., 2015; Ghasemaghaei et al., 2017; Wang and Byrd, 2017).
In terms of findings, we mention that on overall, the results of the articles are favorable towards encouraging organizations about the big data analytics' impact upon performance. We have to mention that it is beyond the scope of this article to empirically measure the overall impact of big data analytics upon performance. This can be, however, a direction for future researches.

Researchers found that big data analytics positively impacts competitive advantage (Côrte-Real et al., 2017; Shan et al., 2019), as well as it enables organizations to obtain sustained value (Côrte-Real et al., 2019, Ghasemaghaei, 2019), operational business value and strategic business value (Fink et al., 2017), decision effectiveness (Ghasemaghaei et al., 2017), market performance and operational performance (Gupta and George, 2016; Gupta et al., 2018), and customer satisfaction (Raguseo and Vitari, 2018). Other studies proved that big data analytics has a significant positive effect towards organizations' agility making it possible to quickly adapt to market changes (Hosoya and Kamioka, 2018) and it increases tendency to innovate (Niebel et al., 2019).
Although most of the published articles identified a positive link between the two constructs, there were some which could not prove a significant relationship. Huang et al. (2018) found a positive link between big data implementations, on one side, and financial performance and market valuation on the other side, however, there was no significant relationship found between the former and productivity. Ghasemaghaei et al. (2017) tested data analytics impact upon agility and found no significant relationship as well. Dubey et al. (2018) found that big data and predictive analytics positively impact visibility and coordination, however these cannot be used in order to obtain swift trust between temporary teams which need to work together for a short period of time.

3. RESEARCH METHODOLOGY

The aim of our study is to do a systematic review of all the articles published so far within the strategic management literature. The reason for this is to identify if there is alignment between researchers which studied the topic of big data analytics from the lenses of strategic management.
In order to select as many relevant studies as possible, we did an extensive research on *ISI Web of Knowledge* database. The timeframe used for our search was starting from January 2005 until July 2019. We searched the following tags: "*big data"*, or *"data science"*, or *"business analytics"*, together with terms like *"firm performance"*, *"competitive advantage"*, or *"value"*. For the received results, we used a first filtering based on title and abstract. After the first screening, we identified 377 studies.

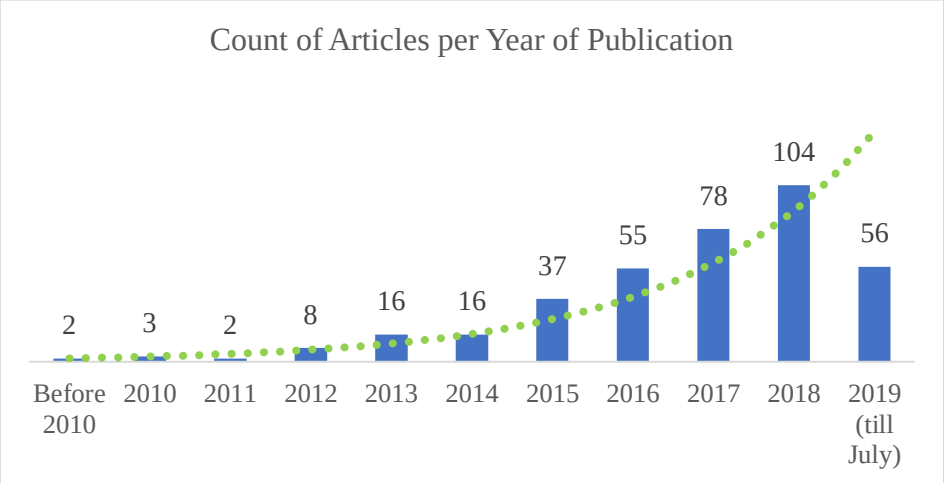

Figure 1. Count of articles per year of publication
Source: Own editing, based on the literature reviewed

We represent in *Figure 1* the distribution per year of the articles we selected based on our first filtering. With the remark that for 2019, we used as a cut-off date the month of July. Cleary, the popularity of this topic grew in the recent years exponentially.
Further, based on the actual content of the articles, we applied a second filter where we would select only those articles which respected the following criteria: (1) studying the topic of big data analytics from the perspective of strategic management; (2) had an empirical study; (3) was based on a theory/framework from management (see. Figure 4), (4) treated the relationship between big data analytics on one side, and firm performance, on the other side. After this stage we were left with a total of 50 articles.
In order to, better review the chosen articles, we examined them based on 5 standardized outlooks: (1) industry/ sector, on which the empirical study is focusing, (2) the methodology of the study, (3) the theory or the framework based on which the elements of the study are treated, (4) the approach on big data analytics, (5) the definition of performance.

4. RESULTS AND DISCUSSIONS

We would like to remark in the beginning that, were applicable to more than just one dimension, we counted the articles multiple times. For example, if an article used both interviews and surveys, or if it was based on more than just one theory/ framework.

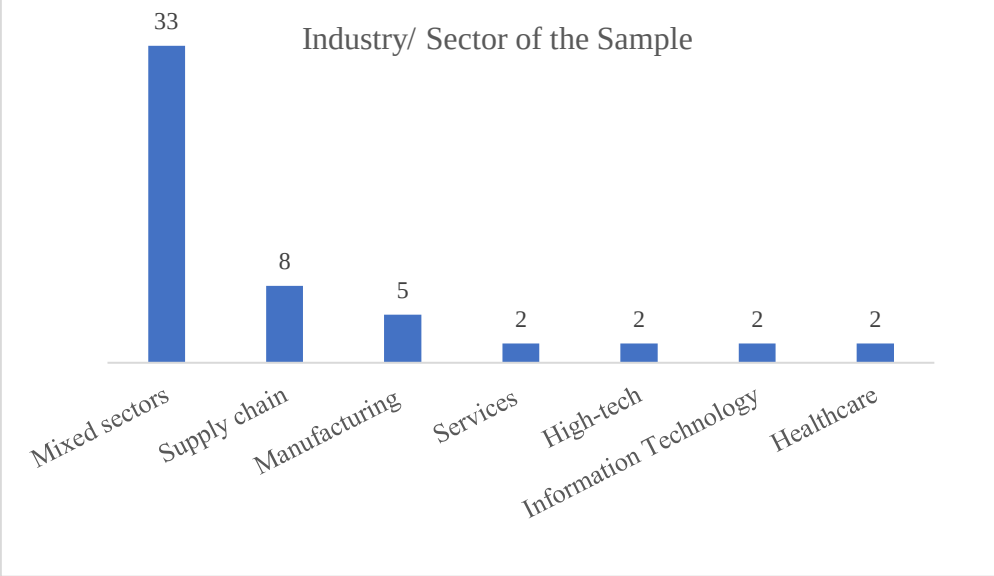

Figure 2. Industry/ sector of the sample
Source: Own editing, based on the literature reviewed

In terms of the industry or the sector on which the articles were focused, as presented in *Figure 2* we found out that most of the studies took their sample from multiple sectors (33 out of 50). There were however some articles which focused on a specific sector only: 8 articles on supply chain, 5 articles on manufacturing sector, 2 articles on services firms, 2 articles on high-tech, 2 articles within the information technology field and finally, 2 articles on healthcare.

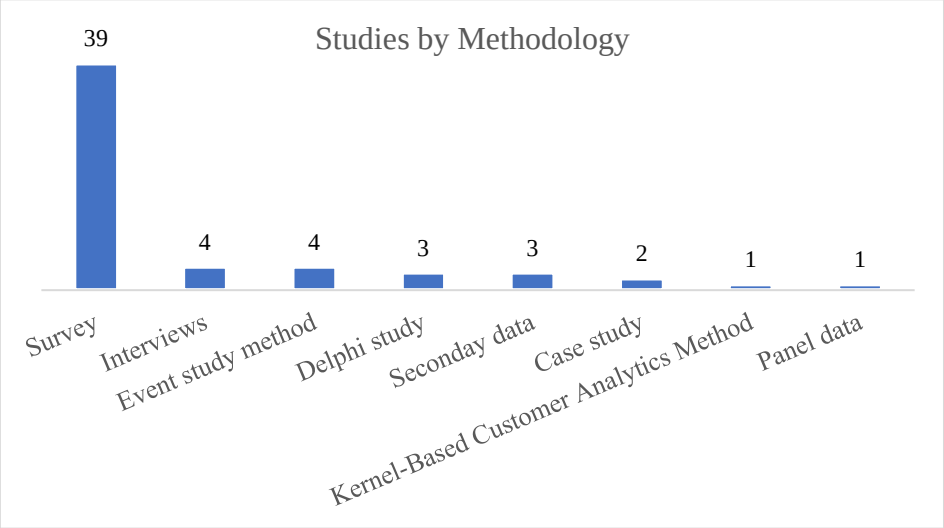

Figure 3. Studies by methodology
Source: Own editing, based on the literature reviewed

When it comes to methodology of the study (*Figure 3*), there is a shared practice as well, as 39 out of 50 articles used surveys in order to test their hypothesis. At a far distance, we have interviews and event-study method, each encountered within 4 articles. Delphi studies and studies based on secondary data share the next place, each with 3 occurrences. Lastly, one article used kernel-based customer analytics method, while another used panel data.

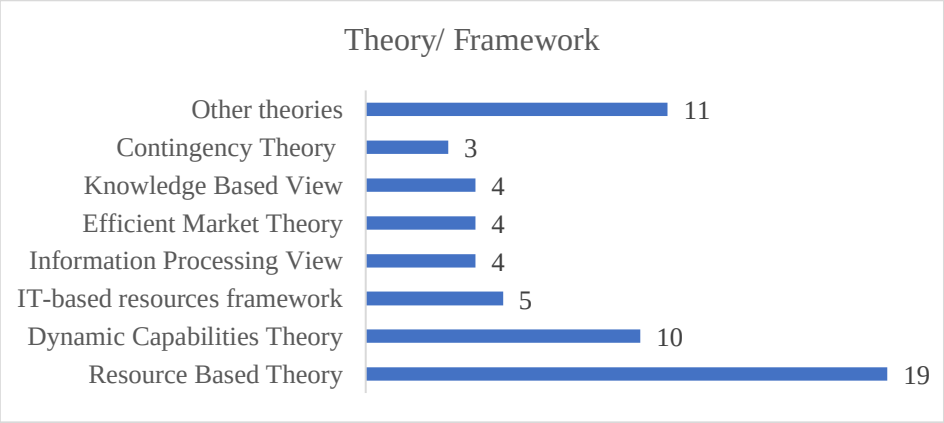

Figure 4. Theory/ framework of the studies
Source: Own editing, based on the literature reviewed

When it comes to the theory/ framework (*Figure 4*) on which the authors based their studies, there are two theories which stand out. The first is the Resource-Based Theory which occurred within 19 articles, second, with 10 appearances is the Dynamic Capabilities Theory. Other frameworks used are the following: IT-based Resources Framework (5), Information Processing View (4), Efficient Market Theory (4), Knowledge-Based View (4), Contingency Theory (3). Besides these, there were other notable theories which were tackled, but which appeared only once: Entanglement View of Socio-materialism, Signaling Theory, Technology–Organization– Environment Framework, Sensemaking-Based Model, Relationship Marketing Theory, Complexity Theory, Appraisal-Emotional Response-Coping Framework, Diffusion of Innovation Theory, Conceptualizations of Organizational Learning, Fit Perspective, Business-focused Inventory of Personality.

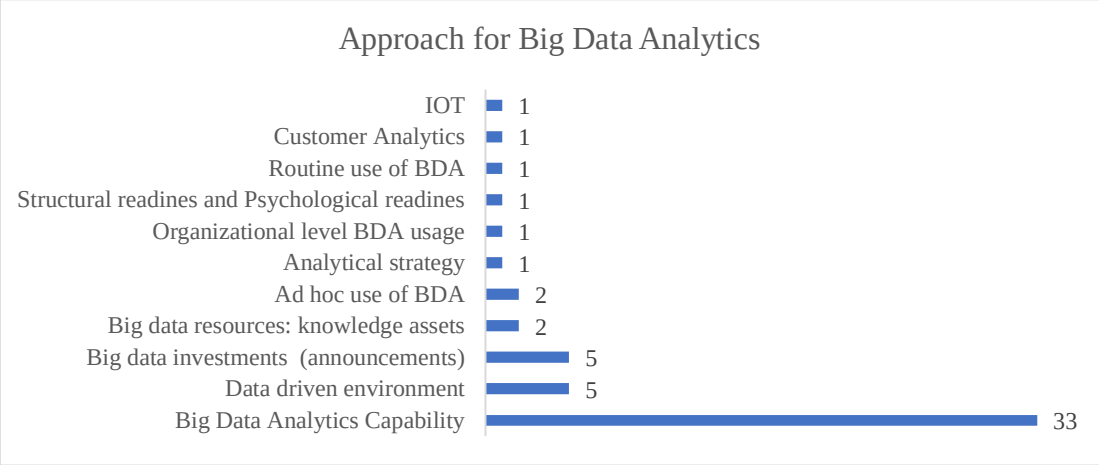

Figure 5. approach for big data analytics
Source: Own editing, based on the literature reviewed

In terms of how big data analytics (*Figure 5*) is analyzed within the included articles, we noticed that this is strongly corelated with the theories or the frameworks on which these articles are based (e.g. Resource-Based Theory and the Dynamic Capabilities Theory). Due to this, most of the studies (33) argue that in order for the organization to benefit from a big data analytics initiative, they need to develop a capability in this sense. (Gupta and George, 2016; Akter et al., 2016; Yu et al., 2018; Shan et al., 2019). Five studies assessed big data in terms of a data driven environment. The same number of articles (5) followed the impact of big data investments announcements upon the stock price. Besides these , other articles treated big data analytics in terms of big data resources (2), the ad hoc use of big data analytics (2), a clear analytical strategy (1), the organizational level of big data analytics usage (1), structural readiness and psychological readiness (1), routine use of big data analytics (1), customer analytics (1), and internet of thins (1).

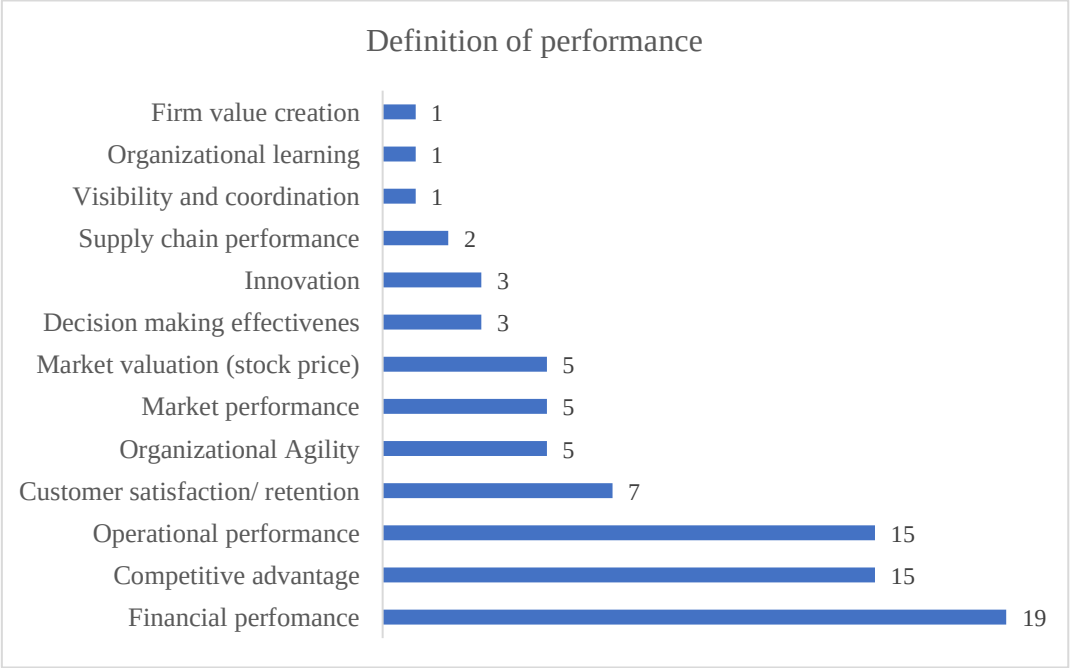

Figure 6. Definition of performance
Source: Own editing, based on the literature reviewed

Our final classification is based upon the approach of the researchers when defining performance (*Figure 6*). There were 19 articles which took a classical approach and treated performance in financial terms. The second most common approach (15) is the performance in terms of a competitive advantage. Again, here we would like to highlight the researchers' affiliation towards theories and frameworks from the domain of strategic management. Operational performance was included in 15 articles. With 5 occurrences each, we identified the following: organizational agility, market performance, and market valuation (stock price). Decision making effectiveness and innovation appeared three times each. Supply chain performance was included in two articles. Other materializations, distinct enough to be commented, with one occurrence each were the following: visibility and coordination, organizational learning and firm value creation.

5. CONCLUSION

5.1 Contribution of the study

We aimed in our study to perform a systematic review of the articles from the strategic management field, which tackle the topic of big data analytics impact upon organizational performance. As a database for our research, we used the ISI Web of Knowledge, with a timeframe starting from January 2005 until July 2019. The first insight here is the exponential trend we identified in terms of published articles per year. Our analysis has been carried on into two steps, first a classical literature review of the included articles, followed by a systematic review, where we aimed to cluster the articles that matched our inclusion criteria. The conclusion we can draw from the first part is that there is a large share from the studied articles which prove a significant positive link between a form of big data analytics and organizational performance. However, this is not the unanimous conclusion, as there were researchers which could not prove a significant relationship between the two constructs in their studies.

In the second part of our study, we clustered the articles based on the following categories: industry/ sector on which the empirical study is applied, the methodology of the study, the theory or the framework, based on which the constructs of the study are tackled, the approach on big data analytics, the definition of performance.

As a conclusion here, we found out that the large majority of the articles included organizations from mixed sectors (60%) , although the ones which were aimed on a specific industry focused on supply chain (15%), manufacturing (9%), services (4%), healthcare(4%) , high-tech (4%) and information technology (4%) . In terms of methodology, 68% of articles used a survey for the empirical study. Other research methods included were: interviews (7%), event studies (7%), Delphi studies (5%), secondary data studies (5%), case studies (4%), Kernel-Based customer analytics method (2%) and panel data (2%). Two of the most used theories on which the studies were based are the resource-based theory (27%) and the dynamic capability theory (14%).

Considering the two sides of the equation of our analysis, big data analytics and organizational performance, we learned that 23% of the studies assessed performance in terms of financial performance, followed by competitive advantage and operational performance, both with 18%. Other studies treated performance in terms of customer satisfaction, organizational agility, market performance, market valuation, decision-making effectiveness, innovation, agility, supply chain performance, visibility and coordination, organizational learning and firm value creation. When it comes to approaches on big data analytics, most researchers view this as a strategic initiative and argue that the organizations need to develop a big data analytics capability (62%). Other articles evaluate the extent to which firms create a data driven environment (9%), announce big data

investments (9%), make use of data resources, use big data analytics on a routine based or on an ad hoc base, formulate an analytical strategy, deploy customer analytics, and the use of internet of things.

5.2 Limitations and future research

We would like to think that the limitations of our studies represent directions for future researches. First, our study included articles only from ISI Web of Knowledge database. Including articles from other sources, or even unpublished articles can generate additional insights. It is believed that articles which manage to prove a significant relationship have higher chances of being published, than those articles which do not. In this way, we keep a small dose of skepticism that our analysis might be biased by the fact that articles that confirm their hypotheses have a higher rate of success. Secondly, as our study involves the systematic review approach, we try to cluster the studies in order to generate some insights. We recommend as a next step, a meta-analysis review, which shall empirically test the relationship between big data analytics and firm performance, based on the results of all the articles included in the study.

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