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Big Data Analysis in Supply Chain Management in Portuguese SMEs "Leader Excellence"

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ABSTRACT

With the market becoming increasingly competitive, companies are looking for ways to differentiate themselves from competitors, thereby increasing the interest of organizations in analysing large data and their potential benefits to supply chain management. The objective of this study is to understand the involvement of the Portuguese SMEs "Leader Excellence" with the Big Data theme and their analysis as a function of the Supply Chain Management, as well as to understand if these companies are in the same line as the companies of worldwide reference, in what concerns to the topic in question. For this study, a survey was carried out with 18 questions and applied to 80 SMEs distinguished as "SMEs Leader Excellence" certified by IAPMEI. With this random sample, from the analysis of the results, it was possible to verify that the Portuguese SMEs are not yet at the level of the big world companies with respect to the use of Big Data in the management of the supply chain. Although the Big Data theme is often explored by the scientific community, since they are relatively recent concepts, when the focus is on SMEs, the number of available studies is scarce, hence this work is a further contribution to broadening the body knowledge in this area.

Keywords: big data analysis, logistics, supply chain management, SMEs

INTRODUCTION

Market competitiveness and increasingly demanding and well-informed customers, force companies to seek new ways of distinguishing themselves from competition and providing better and better services. The maximum efficiency in Supply Chain Management (SCM) has become one of the ways in which organizations can stand out in a business world increasingly competitive (Pozo, 2000; Quayle, 2003). With the technology increasingly developed and with companies "loaded" of data of sales, of purchases, of customers, began to appear references and publications to the analysis of this data, as well as its advantages for the SCM. In order not to lose competitiveness, companies were forced to invest in Big Data analysis software (Waller and Fawcett, 2013). In this context, it is intended with this research to understand the involvement of SMEs Portuguese Excellence with the theme Big Data and its analysis as a function of Supply Chain Management, as well as to see if these SMEs invest in associated Big Data analysis systems to SCM as the world's leading companies do.

SUPPLY CHAIN MANAGEMENT

Supply Chain Management (SCM) is a term associated with logistics, as defined by the Council of Supply Chain Management Professionals, logistics refers to the "part of the supply chain that efficiently and effectively plans, implements and controls the direct flows and the reverse flows, as well as the stopping points of these flows, whether they are goods or services or related information, from the points of origin to the points of consumption, and this management is expected to increase the quality of customer service (Carvalho and Ramos, 2009). Supply chain management is more comprehensive than logistics, going beyond the boundaries of organizations, as it involves relationships and partnerships between companies thus distinguish logistics management and supply chain management, since SCM involves a larger set of processes and functions (Cooper et al., 1997).

Meeting the expectations of the final consumer and, if possible, overcoming it is one of SCM's main objectives, always aiming at reducing costs. It is the end consumer who has the power in the economy through their buying decisions. When a good or service is requested, the whole supply chain comes into action with the aim of providing the best possible service. While all actions in a supply chain aim to satisfy its own direct consumer, SCM's primary objective is to ensure that all actions have a full appreciation of how to satisfy the end consumer (Pozo, 2000). Taking these considerations into account, it is safe to say that this new organizational strategy is one way for companies to stand out from the competition, giving them a new vision of competition in the market focused on customer satisfaction and cost reduction (Castro Melo et al., 2012; Pozo, 2000; Stevens, 1989). However, some authors go even further arguing that SCM is the last means for companies to stand out from the competition and that competition is no longer between organizations, but rather between supply chains (Christopher, 2011).

Pragmatically SCM is a set of approaches to effectively and efficiently interconnect the various suppliers, manufacturers and warehouses, so that the product is produced and distributed in quantity right, at the right time, to reduce costs and achieve the best level of service possible (Kaminsky et al., 2003).

BIG DATA

The term Big Data has become synonymous with competitive advantage to the world's largest organizations (Manyika et al., 2011). Aware of its importance to achieve competitive advantage, well-known names such as Walmart, Amazon, Netflix, DHL among others, have invested in Big Data analysis programs to generate valuable knowledge for new ideas, new forms of value. The innovation, process transparency and operational optimization are some of the reasons that drive companies into this world of great data (Halaweh and Massry, 2015; Loshin, 2013). In a study conducted by IBM Global Business Services, even show that operational optimization, risk management, new business creation, and improvement in human resources are the major goals of companies with the implementation of Big Data analysis systems (Turner et al., 2013).

Some authors argue that Big Data is a subject at the forefront of business, society, and the world at large, and has become, for information technology, the latest frontier of innovation (Porter and Heppelmann, 2014).

Evolution of Big Data

Although it is a recent issue, Big Data was first approached in 1997 by Cox and Ellsworth, NASA scientists, to refer to the challenge for computer systems to view "large" data sets (Assunção et al., 2015). Since then the subject has been approached, however in a rather timid way.

With the development of technology and the broad growth of the internet, some authors have begun to focus attention on information produced by computers. In 1998, John R. Mashey made a publication where he refers to Big Data (Big Data … and the Next Wave of InfraStress). It is the first publication on the subject in question, however, the following year came a study of Bryson, Kenwright, Cox, Ellsworth and Haimes, named "Visually exploring gigabyte data sets in real time" with Big Data as the main theme (Bryson et al., 1999). This article has strengthened interest in the study of the subject and since then several new publications and approaches have emerged, and Douglas (2001) refers to the three dimensions of Big Data, namely volume, variety and velocity (Douglas, 2001). Already Inderpal Bhandar in 2013, made a call for people to beware and add new 3V`s to Big Data dimensions, being: validity, volatility and veracity (Normandeau and Beyond, 2013).

There is no consensus regarding the definition of Big Data, however, several authors share their concepts based on the quantity, velocity and variety of data. Dumbill (2012) defined Big Data as a large amount of data that appears at a great speed in which traditional databases do not have the capacity to take maximum advantage (Dumbill, 2012). Davenport (2014) follows the same line in its definition referring to Big Data as a common concept for all data, which because of their volume can't be contained in a single repository, unstructured enough to fit an organized database of conventional way and fast enough to be stored in a static database (Davenport, 2014). Microsoft published in April 2013 skips some of the 3V's - based definitions by setting Big Data as: "A term increasingly used to describe the application of true computing-the latest in artificial intelligence-to severely large

Table 1. Data sources that influence demand, operations, transportation and supply – adapted from (KPMG, 2014)

Search	Warehouse operations	Transportation	Supply
News and Blogs	Bar code systems	Call records	Complaints data
Competitor's price	CRM data	ERP data	Delivery and collection records
Customer location	Customer questionnaires	Delivery times	Demand forecast
Purchase Orders	Email Registers	Equipment Data	Facebook status
GPS	Intelligent Transport System	Internet of things	Inventory in transit
Inventory Costs	Inventory Data	Local and Global Events	Local and Global Events
Loyalty programs	Machine data	Mobile location	Availability on the shelf
Source and destination data	Price range data	Product reviews	Product monitoring system
Public assessments	Public information available	Assessments and reputation (by third parties)	Raw material price volatility
Sales history	Supplier and customer capacity	Supplier financial information	Traffic density
Transport costs	Tweets	Warehouse costs	Meteorological data

and complex sets of information" (Howie, 2013). In this definition, Microsoft refers to advanced technology as essential for working data, a reference that is "forgotten" by other authors and essential for the analysis of large data.

The 5 V's of Big Data

Data have always existed and have always been analyzed in a complex way. The big difference between data and large data lies in five words: Velocity, Volume, Value, Variety, and Veracity. These five aspects make the great data unique and, thanks to the technological advances, the reach of anyone. Unsurprisingly, with the emergence of the internet, the volume of data available has increased (and continues to increase) in an uncontrolled way. Virtually everything that the individual does is recorded in some way, whether it is in shopping, car trips, phone calls or simple access to social networks (Fosso et al., 2015; Wu et al., 2014).

If we can find correlations with great volume of data that can generate valuable insights, with the speed at which we have access to the data we can have information in real time or very close to it. This speed of data collection generates privileged information for a company, making it more agile. An example of this is transport and logistics companies such as DHL or UPS, among others, which use real-time route optimization systems to reduce delivery time and costs (DHL, 2016). Variety, as the name implies, represents an abundance of data diversification.

Practically everything we do is registered in a certain way and the tendency is to increase, since the interest and bet on IoT (Internet of Things) is growing. Signals of mobile phone GPS, sensor readings, behavior in social networks and images of security cameras are just a few examples of sources of wide variety of data, whether structured or unstructured data (Ashton, 2009).

BIG DATA IN SUPPLY CHAIN MANAGEMENT

Decision-making based on data analysis is not new in companies, in fact, had its peak of popularity in the mid-1980s (Chen, 2012). However, with the market becoming increasingly dynamic and volatile, and with increasing consumer demand and the increase in electronic commerce, companies were forced to follow development by investing in Big Data analysis software to improve the decision, not only strategically but also operational (Akter el al., 2016; KPMG, 2014). With this, a new organizational paradigm was created, where less experience, expertise, and management practices are attributed, and more value to managers' ability to analyze data.

The supply chain is surely one of the largest data receivers in organizations. The operations carried out generate a huge flow of goods and information that allow to record immense data. These data are valuable and, when well analyzed, generate insights that lead to competitive advantage (Rowe and Pournader, 2017). **Table 1** presents some aspects associated to the data sources that influence demand, operations, transportation and supply.

The applications of insights from the Big Data analysis lie along the supply chain from purchase to the end consumer. Whether in the marketing area, with a view to better market intelligence, or in the logistics to optimize its operations, or in the sourcing itself (process to find the sources to meet the needs of the business), with the objective of segmenting suppliers and measuring the risk, all sectors gain advantages with Big Data, taking into account maximum efficiency and the best customer experience, and in the coming years there will be a large growth of Big Data applications in sourcing (Stamford, 2013).

Companies working on the large data seek to measure supplier risk and the best options, predict demand for products or services, optimize inventory, observe capacity constraints, analyze workforce, optimize distribution across routes and schedules, alternative transportation, vehicle maintenance, analyze customer behavior, avoid unnecessary financial risks, among many other purposes. Among all previous applications, demand forecasting is of major interest to researchers (Jun et al., 2014; Sagaert et al., 2016). When a company can predict the exact

demand, it manages the perfect management of warehouse, transport, optimizing and satisfying the needs of the final consumer, get loyalty.

SMEs LEADER AND EXCELLENCE - IAPMEI – PORTUGAL

Portuguese SMEs have a large impact on the economy, representing 99.9% of the Portuguese business companies (INE, 2018). The definition and quantification of the companies is based on two capital factors, the number of employees and the turnover. The name of micro is associated to companies that employ less than 10 employees and whose total volume of business does not exceed two million euros. For a company to get the designation small, the number of employees should be less than 50 and the total turnover should be less than or equal to 10 million. Still in the SME category, a medium-sized company must have a total turnover not exceeding 50 million and the number of employees is less than 250 (Decree Law 372/2007) (DRE, 2007).

The leader SME status, awarded by the Institute for Support to Small and Medium Enterprises and Innovation (IAPMEI), in partnership with Turismo de Portugal, Mutual Guarantee Societies and Banks Partners is a reputable brand that aims to distinguish the Portuguese SMEs superior performance and with better economic and financial indicators. Among the list of companies that have achieved SME Leader certification, the ones with the best performance obtain SME Excellence certification (IAPMEI, 2018).

SCIENTIFIC WORK METHODOLOGY

To carry out the present research on the involvement of Portuguese SMEs Leader with the theme Big Data and their analysis in relation to Supply Chain Management, a quantitative exploratory methodology was adopted in which the non-documentary data collection technique was used, made by inquiry, not direct, presenting clear, direct and objective questions in a written form, with the main objective of obtaining information. This technique was based on a questionnaire, where questions were presented in a closed, dichotomic and multiple response, range and evaluation or estimation, with several alternative responses, to answer the research questions formulated. The methodological strategy adopted allows a faster and more economical analysis of the results, given its uniformity, simplifies the analysis of the responses, facilitates and streamlines the response to respondents (Hill, 2005).

Research Questions

According the main objective of the research, the following research questions were formulated:

1. Is the size of the company related to the adoption, or not adoption, of Big Data analysis systems?
2. Is Big Data analysis a differentiating factor for the successful supply chain of SMEs?
3. Are the sector of activity and the territorial scope of SMEs related to the adoption or non-adoption of Big Data analysis systems?
4. Does the size of the company influence the choice between analyzing the large data internally or entrusting this action to third parties?
5. Are large organizational restructurings necessary to take advantage of the Big Data analysis?
6. What drives SMEs to adopt or not to adopt Big Data analysis systems?
7. Do SMEs recognize the benefits of the Big Data analysis for their Supply Chain Management?

Sample Characterization

The focus of this research is Portuguese SMEs awarded the "SME 2017 Leader" status by IAPMEI, however, as in 2017 the number of companies recognized under this statute was 7 200, it was necessary to restrict the present investigation to a part of this universe. The companies that stood out from this list were chosen, with the attribution of the "Excellence SME 2017" status, also recognized by IAPMEI, in its total 1 948 companies (IAPMEI, 2018). Of these 1 948 companies, 500 were randomly selected to participate in this investigation.

The listing made available in Excel by IAPMEI, of free consultation, was used to obtain the information of the SMEs to be contacted. The 500 companies to contact were selected through the "rand between" functionality of Excel. This feature allows for a totally neutral and random draw.

Collection and Processing of Data

The questionnaire survey used is structured and divided into 18 direct and objective questions. The survey was adapted from the questionnaire used in the research "Going beyond the data: Achieving actionable insights with data and analytics" carried out by KPMG (2014).

The survey structure comprises three divisions. The first division corresponds to the characterization of the company, the second is the analysis of Big Data in the Supply Chain Management of the company and the third

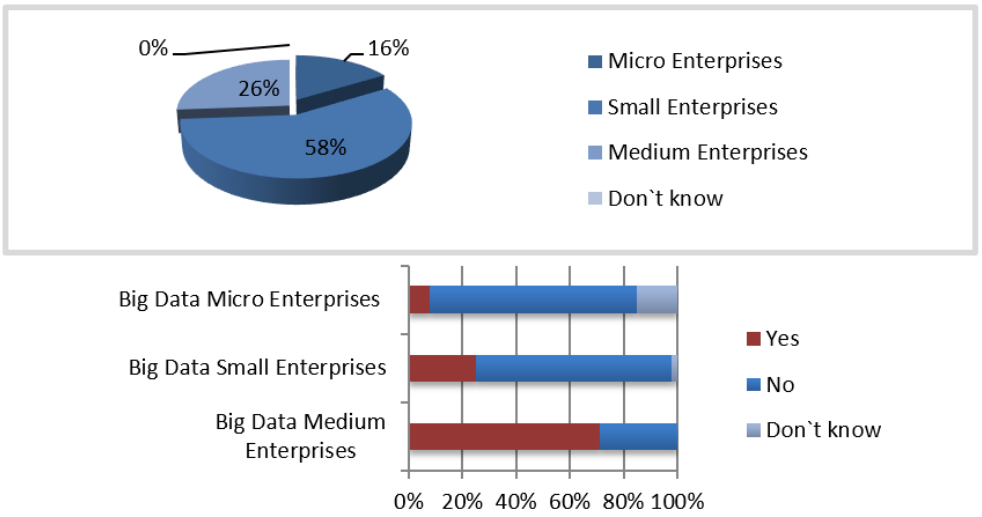


Figure 1. Size of the company by number of employees and their use of Big Data

and final division concerns the opinion of the respondent regarding the importance and benefits of this topic for the company. Two questions were also raised that should be in accordance with the criteria for awarding the SME Excellence Leader status, disregarding random answers and seeking the credibility of the questionnaire.

Before the survey was passed to the selected companies, a "test" was made with 10 organizations to test the perceptibility of the same and to miss some possible error. Once everything was in place, the data collection process began. Between April 24 and May 30, 2018, the questionnaire was passed to all 500 companies by e-mail, in some cases the delivery and collection was done in person. Some companies were also contacted via telephone to raise awareness of the questionnaire.

ANALYSIS AND DISCUSSION OF RESULTS

The results obtained through the quantitative methodology, using a questionnaire survey of 500 companies surveyed, as a data collection instrument, consists of a sample of 80 respondent SMEs, in the following points of this article, the results obtained according to the research questions are presented.

Relationship of the Size of the Company with the Use of Big Data

Considering that the first research question of this work is to understand if the size of the company is related to the adoption or not adoption of Big Data analysis systems, it is necessary to know the size of the company.

It was necessary to relate the answers to the three company statutes (micro, small and medium-sized companies), with answers that ask if companies use Big Data analysis software for the benefit of Supply Chain Management.

After analyzing the results, it was verified that only 8% of micro-enterprises use Big Data analysis software, aimed at SCM. The percentage of small businesses is considerably higher, accounting for 25%. In the case of medium-sized companies, this figure reaches 71%. These data allow us to conclude that today the size of the company is clearly related to the adoption of Big Data analysis systems - see **Figure 1**.

One explanation for these results is that larger companies have more capable and more complex organizational structures and have other arguments that facilitate the adoption of these Big Data systems, exploiting the supply chain as much as possible. Nevertheless, the costs and difficulties associated with the implementation of this type of software are outlined by outsourcing. Already in 2001, in a study by Thong, it was concluded that smaller companies, to succeed in the implementation of Information Technology, should resort to outsourcing (Thong, 2001). Today, knowing that there are numerous data analysis companies competing heavily for customer acquisition, resulting in lower prices, SMEs are more likely to enter this data world.

Big Data Analysis as a Differentiating Factor for the Successful SCM of SMEs

To answer the second research question, it is asked whether the adoption of Big Data analytical systems is a differentiating factor for the success of SMEs, considering the values obtained, as previously mentioned, in which only 8% and 25 % of micro and small businesses, respectively, use this type of software. Meanwhile, the number of medium-sized companies reaches 71%. Since our sample refers to successful and reference companies in Portugal, distinguished as SMEs Excellence Leader, we can conclude that, despite the 71% in medium-sized companies, having Big Data analysis systems this may not be a factor differentiation for the success of Portuguese

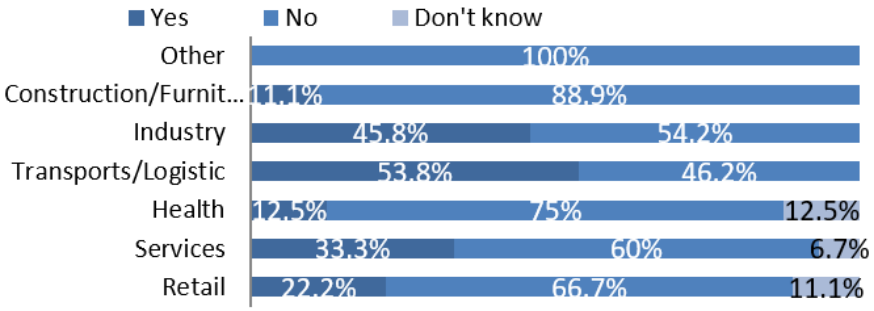


Figure 2. Percentage distribution by activity sector of SMEs using Big Data

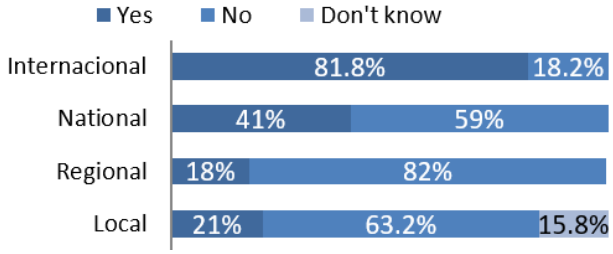


Figure 3. Percentage of SMEs that use Big Data based on geographical distribution

SMEs, however a research concluded that companies that bet on Big Data analysis presented better performance (Mcafee, 2012). The evolution of the market and the technological allows to verify that in the future a good analysis of Big Data will be a preponderant factor for the success of the SCM of the organizations (Waller and Fawcett, 2013).

Relationship between the Sector of Activity and the Territorial Scope of SMEs with the Use of Big Data

To answer the question about Relationship between the sector of activity and the territorial scope of SMEs with the use of Big Data, it was decided to divide the question into two parts, first relating the responses of the sector of activity and analysis of big data and then relating the territorial scope with the adoption of these systems of analysis of big data. As can be seen from the analysis in **Figure 2**, the companies in the transportation and logistics sector are the ones that most use Big Data analysis systems (53.8%). Industry SMEs have the second highest percentage with 45.8%, followed by the service area where 33.3% of the companies responded affirmatively to the issue. The retail, health and construction and furniture areas (22.2%, 12.5% and 11.1% respectively) are the ones that have the least companies making use of the Big Data analysis. It is important to note that no "other" SMEs sector has reported large data analysis to improve SCM.

Regarding the second part of the third research question, the results are represented in **Figure 3**. From the analysis of the data obtained, it is verified that 81.8% of SMEs with international operations have large data analysis systems. Companies operating throughout the national territory, without international market, only 41% makes analysis of Big Data. Local companies have a greater percentage (21%) than regional companies (18%) regarding the adoption of Big Data analysis software with SCM view. It should be noted that 15.8% of local businesses are unfamiliar with the issue at hand. The results presented, mainly in SMEs in the international market and national market, suggest that there is a relationship between the issue in question and the company's activity market.

According to the results obtained, it is verified that both the sector of activity and the territorial scope are related to the adoption of Big Data analysis systems. Regarding the sector of activity, the transport, logistics and industry sectors stand out clearly from the rest. This phenomenon is explained by the fact that some companies obtain more benefits than others with this analysis, as Swaminathan (2012) argues, even stating that in logistics Big Data analysis is an essential element in competitive differentiation. Of course, the construction area only accounted for 11%, since there is little data to explore compared to areas such as logistics or industry. Regarding the territorial scope, this significant difference in the results obtained is explained by the organizational structure of the company, since a company that acts internationally, needs to have more capacity to act in different markets.

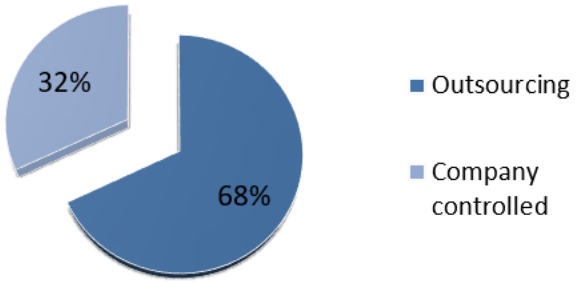
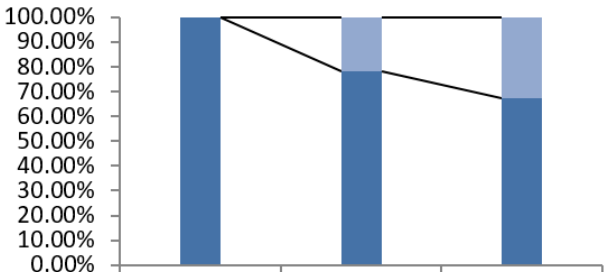


Figure 4. Analysis of Big Data internally or outsourcing in SMEs



	Micro Enterprises	Small Enterprises	Medium Enterprises
Big Data Analysis	0	16.7	40
Companies	100	60	83.3

Figure 5. Distribution of the Data Analysis Outsourcing in SMEs

The Size of the Company Influences the Choice between Analyzing the Large Data Internally or in Outsourcing

From the answers obtained to the question if the size of the company influences the choice between analyzing the large data internally or in outsourcing, it is verified that the outsourcing regime is clearly preferred by companies, representing 68% of all SMEs' respondents (see **Figure 4**). This tendency is most likely based on the need to achieve ROI more quickly and not because of the need for major structural changes in the company, as well as not hiring data analysts (Henke, 2016).

In the answers obtained, no micro-enterprise has Big Data analysis controlled by the organization itself (see **Figure 5**). It is perceived that it is very difficult and costly for a company with less than 10 employees to have a structure capable of supporting a department specialized in data analysis. In the responses of small companies, 83.3% use outsourcing. For medium-sized enterprises, this figure stands at 60%, certainly because they are companies of a different size and with other means.

From the analysis of the survey data we can conclude that the size of the company is clearly a preponderant factor in the choice between data analysis done by the company itself or in outsourcing. Restrictions on means, resources, knowledge in smaller companies explain this option by outsourcing. To the same conclusion reached Thong (2001), in his research on resource constraints and implementation of information systems. With the presented data, we can also conclude that the bigger the company, the greater the predisposition to resort to the analysis of Big Data done internally.

The Need of Organizational Restructurings to Take Advantage of the Big Data Analysis

To understand if SMEs needed to make major organizational restructurings to take advantage of the Big Data analysis (question number five research), a question was posed that obtained the following results: - The training and hiring of information technicians, of analysts and data scientists, has only 9.4% and 12.5% of responses by the companies addressed. This low percentage is since most of the companies opt for outsourcing and for the possible existence of information technology departments, and 18.8% affirm that they have updated these systems – see **Figure 6**.

About the restructuring of decision-making processes, 18.8% of companies affirm this restructuring. The training of managers to use insights in decision making (40.6%), contracting entities external to the company (53.1%) and creation and / or improvement of data collection processes (40.6%) concentrate at the top of the actions most carried out by these SMEs. These results clearly demonstrate the companies' choice of outsourcing in the Big Data analysis.

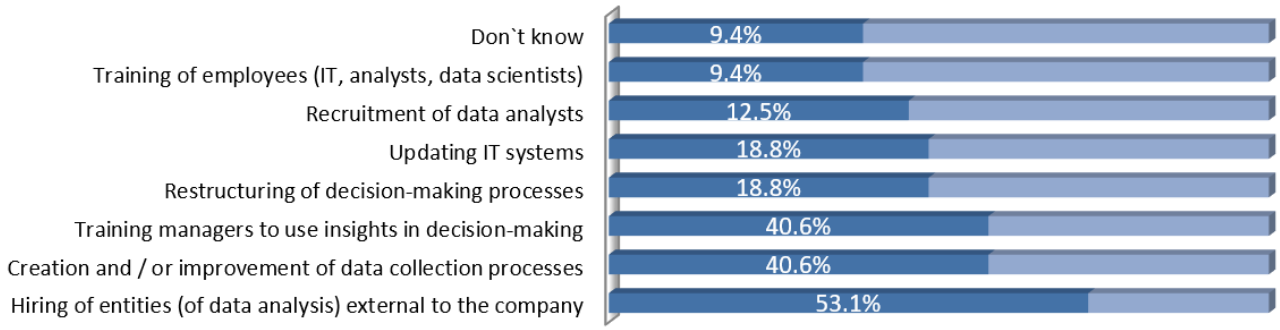


Figure 6. Executed actions in/by SME

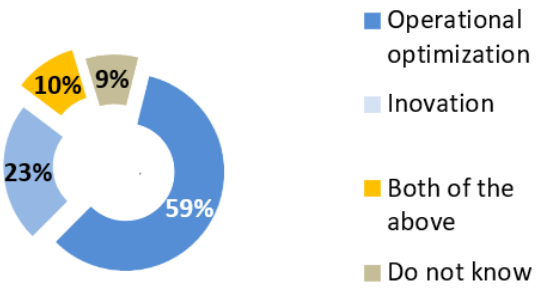


Figure 7. Purpose of the Big Data analysis

Figure 8. Operational area most targeted by companies: Percentage distribution

Responding to the fifth research question, overall, companies do not need to make major organizational restructurings, however, organizations that choose to do a Big Data analysis internally logically need to implement more change than outsourcing firms. These findings are in line with the study KPMG (2014), which states that large companies need to make restructurings to capitalize on the benefits of using Big Data.

Factors that Drives SMEs to Adopt or not to Adopt Big Data Analysis Systems

Regarding the sixth research question, which asks whether SMEs are adopting Big Data analytical systems or not, only 23% of companies replied that their main objective is innovation, with the clear majority (59%) responded to operational optimization. 10% of SMEs have put operational optimization and innovation at the same level. It should be noted that 8% answered not knowing what the main objective for the company's SCM, with the analysis of Big Data – see **Figure 7**.

Added to the previous question in the questionnaire, companies that aimed at the operational optimization of the Big Data analysis should specify this optimization. The responses concern about costs is clearly a priority for companies, accounting for 68.2% of the responses. Achieving best practices in general (36.4%) is the second most relevant item for these SMEs, while the management of the company's resources and the development of opportunities stand at 22.7%. About achieving greater transparency in the processes, companies show less interest, totaling 9.1% of the answers, as we can see in **Figure 8**.

The analysis of the findings shows what leads SMEs not to adopt this type of data processing software. The lack of knowledge on the subject in question (52.8%) is clearly the biggest barrier referenced by SMEs. The scarce information about data analysis software, as well as its advantages, may be the cause of this lack of knowledge. Data collection capacity appears to be the second largest barrier, with 37.5% of responses. Knowing which data are most relevant to collect and being able to apply the ideal solutions to interpret those same data does not seem to be the biggest obstacle for organizations, since they have only 23.6% and 22.2%, respectively, of answers – see **Figure 9**.

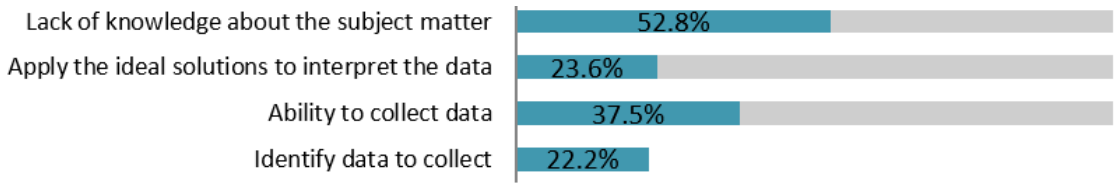


Figure 9. Barriers to Big Data analysis

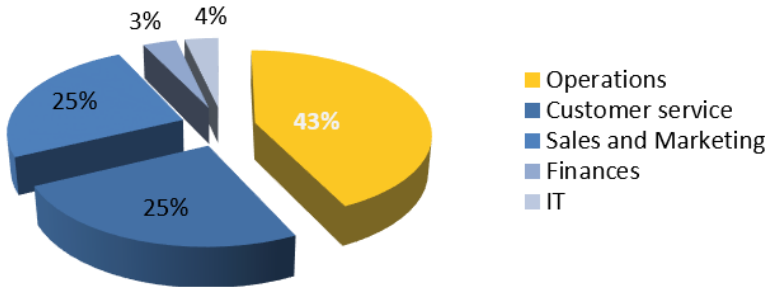


Figure 10. Part of the SCM with the greatest benefit

A question has been asked to the companies to see which part of the supply chain has benefited most from the Big Data analysis. We verified that most of the companies wanted, with the analysis of Big Data, an operational optimization. Looking to **Figure 10**, we can verify that it is in the operations that the companies most benefit (43% of answers). With this, it is safe to say that in most of these SMEs, Big Data's analysis lived up to expectations.

Responding to the question of research in question, what leads Portuguese companies to invest in large data analysis software is clearly the operational optimization, evidenced with 59% of responses, against 23% who said that innovation is the big goal and 10% which he said was a combination of innovation and operational optimization. In a KPMG study (KPMG, 2014), it was concluded that most large global companies expect the Big Data analysis to bring a joint possibility of innovating and optimizing operations. Given this, the results regarding the Portuguese SME Excellence are not in agreement with the results regarding the big world companies. In relation to the companies that answered, "operational optimization", the operational costs are the main concern (68.2%), in contrast, the transparency of the processes is what matters least to the companies (9.1%). In this sense, the results of these Portuguese SMEs agree with the results presented in the same study KPMG (2014). In fact, operating costs are the major concern of organizations, as advocated by (Davenport, 2014; Leeflang, 2014; Novo and Neves, 2013; Porter and Heppelmann, 2014).

On the other hand, the reason why companies do not adopt this type of software is the lack of knowledge about the subject in question. According to Barton and Court (2012), this premise can be explained in the light of the scarcity of information, offer and news about the advantages of these great data for companies. Regarding which part of Supply Chain Management brings greater benefits, data on Portuguese Excellence SMEs are in line with those found in large world companies (KPMG, 2014), when they mention that operations and customer service are the parts of the supply chain that benefit most from Big Data's analysis.

SMEs Recognition of the Benefits of the Big Data Analysis for their SCM

With the last question addressed to companies, the intent is to understand what perception companies have concerning the benefits that Supply Chain Management can have with the Big Data analysis.

The results show that 53% of the SMEs surveyed are aware of the importance of the Big Data analysis in the SCM, since 53% of companies consider SCM to benefit greatly from data analysis and 33% reveal even if the company can benefit greatly. As we have seen in the previous results, a significant number of companies are not familiar with this topic, 9% of SMEs do not know if the SCM can benefit from data analysis and 5% believe that the company can benefit little.

RECOMMENDATIONS

The results presented in this study show that SMEs are confident that they can achieve more and better benefits for managing their supply chains using SCM big data analysis. Based on the studies carried out, it is suggested that the companies bet on a greater assertiveness in the identification of the consumer profile, enabling the creation of products more suitable to the market (Loshin, 2013) and betting on demand forecasting (INE, 2018; Stamford, 2013). The choice of outsourcing in the big data analysis, in the first phase, is the most sensible option (Thong, 2001), since the investment is low and there is little need for structural changes in the organization. It is known

that today there is no need for a major structural change in the company to work with big data, but it is important that companies are concerned with the new organizational paradigm, where less value is given to experience, expertise and practices and the greater value to individuals' ability to analyze the data they have available (Mcafee, 2012). It is also crucial that organizations care about process transparency, since it is the primary means of transmitting the security that allows the organization to use its data.

Innovation is a current theme and innovative organizations are ahead of the competition (Loshin, 2013), and it is of the utmost importance that SMEs seek to use the big data to generate innovation and not just to optimize operations (KPMG, 2014). Organizations that have data must preserve them in the best and safest possible way, demonstrating competence and honesty (Davenport, 2014).

CONCLUSIONS AND FUTURE WORK

Operational optimization is the main reason why companies use big data, and reducing operational costs is the main concern to justify their use. This study allowed us to conclude that the main reason why the number of SMEs performing the big data analysis is still low is due to a lack of knowledge about the topic. It has also been found that the part of the supply chain that achieves the greatest benefit is operations and customer service.

Concerning the recognition of the benefits of the Big Data analysis in the SCM, it is concluded that SMEs are aware of their importance, and most of them even have a strategy outlined for Big Data investment in the coming years.

Although the sample of respondents is not significant for the entire universe of Portuguese SMEs, it shows that companies still fall short of what big companies in the world do when it comes to the big data analysis, for the benefit of SCM. However, it was also possible to conclude that although they are not in the same line as these large companies, they are moving in that direction.

This study contributed to greater information on Big Data and its benefits to SMEs supply chain management, and it would be interesting to serve as a basis for future studies to compare the SMEs distinguished as Excellence Leader by IAPMEI, with the other SMEs in Portugal and with the largest Portuguese companies.

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