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Abstract

Purpose – The purpose of this paper is to shed light on how big data deployment transforms organizational practices, thereby generating potential benefits, in a specific industry: retail.

Design/methodology/approach – To achieve the paper's goal, the authors have conducted several semi-structured interviews with marketing managers of four retailers in Italy, and researched secondary data to get a broader picture of big data deployment in the organizations.

Findings – Data analysis helped identify specific aspects related to big data deployment, data gathering methods, required competences and data sharing approaches.

Originality/value – Despite the growing interest in big data in various fields of research, there are still few empirical studies on big data deployment in organizations in the management field, and even fewer on specific sectors. This research provides evidence of specific areas of analysis concerning big data in the retail industry.

Keywords Big data, Retail industry, Data and knowledge

Paper type Case study

Introduction

The competition in certain industries corroborates the need for firms to develop new processes to achieve success and sustainability. Businesses in the new century have been permeated by an increased digitalization of processes, and firms not following this phenomenon often lose competitive advantages (Nambisan *et al.*, 2017). This digitalization has focused attention upon the importance of data and knowledge within organizations (Dennis *et al.*, 2001), suggesting that leveraging high-quality large data and talent analytics throughout value chains are necessary to develop business strategies and increase performance (Gaur *et al.*, 2011; Gaur *et al.*, 2014; Scuotto, Santoro, Bresciani and Del Giudice, 2017). However, to accomplish the task of being a digital organization, firms need to change the decision-making culture and cultivate abilities, skills and competences within the organization (Brynjolfsson and McAfee, 2012; Sivarajah *et al.*, 2017). Big data is considered to be the "next big thing in innovation" (Gobble, 2013), as it has potential for business value creation. Big data can create actionable ideas for delivering sustained value by providing smart data and establishing competitive advantages (Wamba *et al.*, 2015) as it allows for the enhancement of data-driven decision making and the processes of organizing, learning and innovating at various levels (Wamba *et al.*, 2017). Despite the growing interest in the adoption of digital technologies as well as Internet of Things (IoT) systems in several fields of research ranging from engineering and informatics to general management (Del Giudice, 2016; Del Giudice *et al.*, 2016; Santoro, Vrontis, Thrassou, and Dezi, 2018), a clear picture of the dynamics of application and benefits of big data deployment is missing in the literature, especially in the business and management field. In particular, empirical studies on this topic are scarce. Research in this field mostly consists of recently published conceptual studies (Wamba *et al.*, 2015; Wamba and Mishra, 2017). A few exceptions exist but

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mostly regarding manufacturing firms (Merchant and Gaur, 2008; Acharya *et al.*, 2018), the health industry (Wang, Kung and Byrd, 2018; Wang, Kung, Wang and Cegielski, 2018) and the food industry (O'Connor and Kelly, 2017). Consequently, more and more service firms struggle to understand how to deploy big data analytics and how to extract value from raw data.

As a result, this research aims to explore how big data deployment transforms organizational practices, thereby generating benefits, in a specific industry: retail. To really understand the benefits of big data, it is necessary to examine the managerial, economic and strategic impacts of big data analytics and explore the effective path of how big data analytics can be leveraged to deliver business value. It was decided to focus on a specific industry because big data deployment should be considered and analyzed according to an industry's peculiarities to fully get the benefits and dynamics of the competitive and strategic environment. This is a major contribution of this study, and the hope is that future studies address the issue on the same level, in other industries.

To reach the paper's goal, an empirical qualitative analysis through multiple case studies has been developed. Specifically, several semi-structured interviews were conducted with marketing managers of four retailers in Italy. The findings of this research highlight some advantages and managerial challenges of big data deployment to further the knowledge on this topic and to provide implications for managers. The retail industry was chosen as the context of analysis for its peculiarities and high level of competitiveness and, in particular, because data are considered essential in this industry (www.forbes.com/forbes/welcome/? toURL=https://www.forbes.com/sites/bernardmarr/2015/11/10/big-data-a-game-changer-in-the-retail-sector/&refURL=https://www.google.it/&referrer=https://www.google.it/).

The paper is structured as follows: the next section provides a theoretical background on the key hallmarks of big data deployment. Then, the empirical study is described, explaining the research method and presenting the findings drawn from the semi-structured interviews with marketing managers. The final section provides conclusions and discusses the implications and limitations of the research.

Theoretical background

Technological development in the past decades significantly increased the volume of available data for organizations, having an impact on management decisions (Ciampi, 2008; Ciampi, 2017a, b; Kane *et al.*, 2015). As a consequence, scholars have placed attention on how firms implement new ICTs to create value (Davenport, 1993; Lopez-Nicolas and Soto-Acosta, 2010; Bresciani *et al.*, 2017; Scuotto, Santoro, Papa and Carayannis, 2017). This is due to the increasing importance of data, information and knowledge for a firm's competitiveness (Boisot and Canals, 2004; Del Giudice and Straub, 2011; Del Giudice and Della Peruta, 2016; Sumbal *et al.*, 2017). In particular, big data has achieved increasing attention. Big data consists of data sets whose size is beyond the capacity of typical database software tools to capture, store, manage and analyze (Ohlhorst, 2012; Weinberg *et al.*, 2013). Big data is capable of both changing competition by "transforming processes, altering corporate ecosystems, and facilitating innovation" (Brown *et al.*, 2011, p. 2) and unlocking organization business value by unleashing new organizational capabilities and value (Davenport *et al.*, 2012), and by facilitating firms to tackle their key business challenges (Kiron *et al.*, 2014).

The main attributes related to the concept of big data are volume, speed and variety (McAfee *et al.*, 2012), as organizations must be able to face large volumes of data, especially a diverse range of data and sources, quickly and effectively (Brynjolfsson and McAfee, 2012; Ohlhorst, 2012; El-Kassar and Singh, 2018).

Wamba *et al.* (2015) define big data as a holistic approach to manage, process and analyze five Vs (i.e. volume, variety, velocity, veracity and value) in order to create actionable insights for sustained value delivery, measuring performance and establishing competitive advantages. Thus, the authors add the concepts of veracity, the importance of

quality data and the level of trust in various data sources, and value, the importance of extracting economic benefits from data.

Big data deployment can be aligned with the business intelligence tools that are required to provide intelligent aid for organizational processes. The great volume of data necessary must be acquired, filtered, stored and analyzed to become heterogeneous. Because the processes of filtering and analyzing the data are very complex, it is necessary to use business intelligence strategies and tools. In detail, big data management is defined as "a collection of data and technology that accesses, integrates, and reports all available data by filtering, correlating, and reporting insights not attainable with past data technologies" (APICS, 2012) and is emerging as a strategic aspect for firms (Brynjolfsson and McAfee, 2012; Alfouzan, 2015). More specifically, the concept of big data has been used to describe data sets that are so complex they cannot be managed or analyzed using traditional data analysis software (Waller and Fawcett, 2013), making it necessary for firms to outsource big data infrastructure and hire skilled employees (Santoro and Usai, 2018). In fact, because of the abundant information that such data sets contain, big data usually consists of large, heterogeneous and unstructured data sets that cannot be explored by the usual approaches (Yin and Kaynak, 2015). Compared with traditional databases, big data includes a large amount of unstructured data that must be analyzed in real time. Big data also brings new opportunities for the discovery of new values that are temporarily hidden (Renu *et al.*, 2013).

Big data management and analytics allow managers "to measure and know radically more about their business and to directly translate that knowledge into decision making and performance" (Brynjolfsson and McAfee, 2012, p. 4). Managers may take decisions on the basis of big data analytics, which can shape decision making and business processes (Provost and Fawcett, 2013).

Acquiring and understanding data allow firms to extrapolate information that must be analyzed to develop new knowledge that can be used in management decisions (Dezi *et al.*, 2018), such as customization, pricing options and the opening of new point of sales. There are two main features of data (Azma and Mostafapour, 2012). Smart processing includes analyzing and assessing the information, providing decision support to ensure that the future performance of the organization is aligned with the planning, as well as knowledge feedback about the processes involved to be combined with pre-existing (explicit) knowledge. The organizational learning includes the discovery of new knowledge and the dissemination of this knowledge to those who need it.

Overall, it has been suggested that big data deployment can improve internal processes (Davenport, 2014), as well as enhance operational agility and flexibility (Lu and Ramamurthy, 2011; Gao, 2013; Wamba and Mishra, 2017). Moreover, acquiring and transforming raw data in smart data can actually provide firms with vital knowledge about customer behavior (Hofacker *et al.*, 2016; Motamarri *et al.*, 2017).

Empirical research on big data confirms its direct effect on firm performance (e.g. Akter *et al.*, 2016; Gupta and George, 2016; El-Kassar and Singh, 2018). However, capabilities and IT resources alone may not unequivocally foster firm performance (Melville *et al.*, 2004), therefore calling for deeper and more exploratory research methods, especially in specific sectors.

Research design
Research context: retail industry
Retailing is the group of activities performed when offering or selling products or services among consumers for their personal, family or institutional use (Kotni, 2011). Specifically, a retail firm is an organization that aims to acquire the product or service in demand to deliver it later to the consumer (Pantano, 2014). Such industry represents the foundation and health of a formal or informal economy within a region or country, giving final consumers access to products and services that otherwise would be difficult to get (Kotni, 2011).

The retail industry in Italy contributes to creating employment all over the country, and despite the economic and financial crisis which has led to the worst financial result in 2014 in this sector, the overall turnover has been increasing in the last three years, led especially by food commerce (www.dgmco.it/media/studies/pdf/gdo-report-2016-2017.pdf).

The retail industry is considered well suited for this research for its peculiarities and high level of competitiveness and, in particular, because data are considered essential in this industry. For example, gathering large amounts of data about clients is seen essential to improve the competitiveness of retail firms due to the customized product offering that data can drive and customized prices that can be applied.

It was specifically decided to focus on the retail industry (Saghir and Jönson, 2001). The last years have brought profound changes in this industry, with customers increasingly careful about what they buy and consume, about prices and so on. As clients become more aware and informed about products, prices and trends, the value chain of retailers become more complex (Peker *et al.*, 2017). Moreover, this industry is more and more threatened by low margins and fierce competition, pushing toward new digital processes to increase efficiency and adaptation. Data deployment help in managing such complexity.

Methods of analysis
The epistemological foundation of this study is based on the interpretivist approach. The multiple case study method is particularly applicable for interpretivist research. In detail, to achieve the goals of this paper, a qualitative approach was adopted through a multiple case study methodology (Eisenhardt, 1989; Gomm *et al.*, 2000), involving firms operating in the retail industry. These firms have adopted big data in business processes. This is deemed an appropriate methodology for this kind of topic because it covers a new domain and because there is limited theory and knowledge about how firms use and manage big data. In this respect, the case study is an appropriate methodology when researchers want to answer questions about the "how" and "why" of a certain topic. Moreover, multiple cases enable the building of a more generalizable and robust theory than single cases (Eisenhardt and Graebner, 2007).

Specifically, the empirical research entailed several semi-structured interviews with marketing managers of each retail firm. The marketing manager was selected as a key respondent because the marketing function is responsible for the data management in retail firms and marketing managers are in a position to understand all the strategic dynamics with the business environment. Interviews were semi-structured to let respondents talk about important aspects not strictly related to those asked (Irvine *et al.*, 2013). This allowed us to get a broader picture of the phenomenon and to discuss some of the themes highlighted with our literature review (Gaur and Kumar, 2017). Data from the interviews were integrated with secondary data from documents, such as business publications and corporate materials, as well as internet-based information. The diversity of data allowed a certain degree of triangulation to improve the reliability of the analysis and strengthened the accuracy of the findings (Jick, 1979). The language of the interviews was Italian; therefore, they have been translated. The nature of this topic required us to gather different types of information about business, strategies and functions, in order to interpret data in a proper way and provide management with useful insights about managerial decisions.

Despite some typical weaknesses of the qualitative approach, case studies have numerous strengths, such as high-conceptual validity, understanding of both the context and process and depth of the analysis (Yin, 2013).

Five organizations operating in the retail industry were selected. To avoid bias, the following steps and procedures were used. First, a convenience selection was made among the best performing organizations in this sector, in order to provide insights deriving from

high-performing benchmarks. They were then contacted to inquire about their availability for participating in interviews and their approach toward big data deployment. Five were available for interviews and were the most interested in this research and topic. Also, these were firms actually deploying big data in processes and activities (at various level). In sum, the following case selection criteria were chosen: the case is represented by a high-performing retail firm, and the case presents actual implementation of big data platforms or initiatives, to some extent. After applying these criteria, one firm was excluded as it had not deployed big data like the other ones.

The four selected firms had deployed big data in their activities at least one year before the interviews. Thus, the firms were surely aware of the mechanisms underpinning big data management and analysis, and their effects were more evident. The choice was made because these firms were active in using big data for several processes and could thus be optimal examples of best practices. The purpose was twofold. First, by using examples coming from best practices, key lessons about management decisions driven by big data could be provided. Second, real examples of big data deployment allowed for highlighting the opportunities and challenges involved with big data deployment, specifically regarding data deployment, data gathering, required competencies and data sharing.

Marketing managers were asked questions regarding general information about business performance, competition, success factors, internal and external opportunities and threats. More specific questions were asked regarding the advantages and challenges of decision-making processes driven by big data.

Data analysis began with considering the mission, vision, values and strategies of the firm, along with the overall history. These data were triangulated with data obtained from the interviews and the results were analyzed. To fill in missing details, when necessary, follow-up correspondence was conducted with the firm via e-mail and/or telephone. To analyze data, an inductive approach was used, following procedures suggested by Miles and Huberman (1994) regarding data reduction, data display and drawing and verifying conclusions. Accordingly, after gathering the data, they were reduced and displayed to identify common paths and develop consistent categories to discuss the findings, drawing and verifying conclusions.

In accordance with the firms, it was decided to provide the analysis as anonymous case studies to prevent any possible misinterpretations due to the open nature of its content (Ben Oumlil, 2013). Firms preferred to remain anonymous to avoid revealing strategic decisions and aspects, especially because of the high concentration of this industry and the limited number of well-performing players in it. Finally, anonymous cases may allow for extrapolating more real information from respondents.

Results from the case studies
Overall, it is interesting to highlight that all the four retail firms deeply and steadily use big data analytics to improve processes. All the interviewees stated that big data in the retail industry play a key role, especially in the marketing and logistics functions and that this importance will only increase. The interviews suggest that the use of big data is vital in supporting business strategies for reducing cost structure to win price wars and for differentiating offerings through the segmentation of clients. A further starting point for analysis comes from how data support human decisions. The result of the interviews shows that overall the subjects involved see an ever-increasing role for data in human decisions. If it is true, in fact, that the human element will remain indispensable, it is equally true that in many areas decisions will tend to be based less on experience and intuition, and increasingly on the objectivity of data. Obviously, this does not mean that the human component of the business will disappear, but rather that the tools to support it will be more effective.

Data deployment

The key aspect that emerged during the interviews about data deployment pertains to "customer targeting," that is, the ability to build and understand the customer profile through information gathered from buying approaches. This means being able to understand and analyze the dynamics of clients – their needs, preferences, attitudes – and adapting the offerings accordingly, especially with specific promotions. One response from the interviews was, "Thanks to data, we know almost everything about our regular customers. In this way we can adapt our offering and organization toward meeting their expectations."

Another application to emerged during the interviews concerns the opportunity to more effectively manage commercial channels, as well as those of marketing, improving the firm's position within the distribution chain.

Furthermore, the participants spoke of the convenience of exploiting the data collected in order to optimize firm processes (logistic and operational in general) and to reduce operating costs. It is indeed possible to improve the quality level, efficiency and accuracy of deliveries and inventory, but also to implement store efficiency, not only from the point of view of logistics. Human resource management (HRM), for example, can be optimized on the basis of expected and recorded flows within stores, as fixed costs can be monitored constantly and adapted to contingent situations, minimizing waste.

Moreover, it also emerged that the data are often stored and used in order to elaborate detailed plans and forecast budgets related to the opening of new stores, based on models able to anticipate with reasonable accuracy information such as the number of daily entrances expected for economic and financial performance.

Data gathering

With reference to the types of data that are collected and used, all firms tend to base their analyses on a mix of real-time surveys and information produced mainly in the previous year. Furthermore, it is interesting to observe that most of the organizations used not only a solid structured database, but also a considerable amount of unstructured data (from e-mails, paper documents, images, comments on social networks, blog posts, etc.). Specifically, among the main sources of value for companies, the former is always used in the analysis of data from customers. Much of this analysis tends to be based on information collected through loyalty cards and extracted from sales data. While the latter is obviously always recorded through normal daily operations, a critical issue may arise for companies that have not yet adopted a data collection strategy through loyalty cards or similar tools.

Furthermore, it is interesting to note that not all data have a practical use at the time they are collected, but they are nevertheless stored with the assumption that they will eventually create value later (so-called "secondary value"). As suggested by one manager: "We collect data for the present but especially for the future. Data accumulation can provide you valuable information useful for future strategies."

Moreover, the companies involved in this phase are in widespread agreement in considering big data an element of primary importance in order to improve knowledge of and service for customers, so much so that they can soon become the main source to draw on to understand consumers' needs.

Required competences

With reference to the necessary skills for data collection and analysis, the firms involved highlighted the desire to internally process all the information collected, to gain control over data and to store data longitudinally. For this reason, each of them has a special internal division, composed of a team with heterogeneous skills and coordinated in order to extract value from the information in its possession (only one mentioned using both an internal

division and external specialists, while the others claimed to rely solely on an internal system). All four firms, thus, have an internal division able to collect and process data by itself, while affirming that they consider it important for new figures to renew the division in the future. Apart from some issues concerning internal data management, the firms showed great confidence in the ability of their teams to effectively collect, analyze and process the data at their disposal. The trust placed in the internal structures does not mean that they are not attentive to the changes that they will have to undergo in order to prove competitive and keep up with the times. This was highlighted by all the respondents as new professional figures are destined to enter the company context. The predictions range from explicitly citing the data scientist as a new reference profile within the new competitive context to stressing the importance of the heterogeneity of skills that these figures will have to possess, with particular attention to the need for effectively combining information and business skills to provide insights to marketing managers about business decisions. It is no coincidence that respondents also mentioned the increased relevance of the "Marketing Information Manager," a figure that has existed for years but has emerged vigorously in recent years, combining commercial, IT and marketing skills. Another element that stands out is the increasing attention paid to the application of new technologies to the creation of teams and advanced customer relationship management processes, with the aim of perfecting the experience offered to the consumer and implementing his/her engagement and the related loyalty systems. In addition, many analysts are expected to be able to convert the data into strategic lines and practical applications.

However, although the efforts already made to adapt their internal procedures to the new needs of data analysis are repeatedly stressed, along with the constant attention to the latest trends and to internal and external changes to the company, the respondents revealed the difficulty of discovering and recruiting people characterized by the skills consistent with a big data analyst. Collaborations with the academic world are cited as a way to develop shared projects suitable for increasing knowledge and skills, implementing internal processes and proposing innovative solutions to daily problems, but above all for getting in close contact with the best talents from the university and integrating them into their organization. Not by chance, the only company to demonstrate general confidence in the possibility of finding people with the necessary skills for the business without too much difficulty specifies that this is the result of the close partnerships established with the universities. Moreover, securing a privileged channel with the academic world is proven to be a winning and extremely far-sighted strategy, since it is in the academic world that the skills, now scarce, will be developed, giving shape to the people suitable to successfully manage the "incessant digital flood."

Data sharing
The first noteworthy aspect of data sharing concerns the management of informational capital by companies. Three out of four organizations expressed that they follow a close policy regarding data sharing, suggesting that they prefer not to share data with competitors and partners. This decision seems to be dictated principally by two aspects: a commitment to the protection of consumer privacy (which is given much attention given the risks, reputational in the first place, related to the possible controversies on a legal level) and the desire to retain the enormous value of data. The latter aspect undoubtedly represents one of the greatest strategic dilemmas for companies in this digital era. Companies are, therefore, called upon to carry out a careful analysis of the costs and benefits of sharing data and information, in order to understand whether the benefits deriving from doing so will actually exceed the costs in terms of value dispersion. For the moment, the decision to retain data internally seems to prevail. In this regard, just one organization stated that it would be open to sharing data with competitors and partners to create shared value through relational value chains and in order to strengthen the collaboration between the different parties.

However, as already discussed, examples of sharing information with partners could grow to such an extent that it leads to a shift in the dominant trend among organizations.

Discussion and conclusions

Despite the growing interest in the adoption of digital technologies and big data analytics, a clear picture of the dynamics of the application and benefits of big data deployment is missing in the literature, especially in specific industries, such as retail, one dimension of the service world. In particular, empirical studies on this topic are lacking. Studies in this field mostly consist of recently published conceptual research (Wamba *et al.*, 2015; Wamba and Mishra, 2017). Most of the empirical research is focused on the health industry (Wang, Kung and Byrd, 2018; Wang, Kung, Wang and Cegielski, 2018), with some in the food industry as well (O'Connor and Kelly, 2017).

Consequently, this research aimed to understand how big data deployment transforms organizational practices, thereby generating potential benefits, in the specific service industry of retail.

To fill in the relevant gaps and contribute to the literature, this paper has explored the role of big data in improving the competitive position of retail companies. In particular, an inductive approach by conducting semi-structured interviews has been used. The findings of this research (Table I) highlight the benefits of big data deployment, such as customer targeting (Hofacker *et al.*, 2016; Motamarri *et al.*, 2017) and optimized processes (Lu and Ramamurthy, 2011; Davenport, 2014) as suggested in the literature, but also reduced operating costs; improved quality, efficiency and accuracy of deliveries and inventory; optimized HRM, more detailed plans and more accurate forecast budgets. As an initial implication for theory, the findings clearly indicate the key role of big data for retail firms in achieving competitive advantage. Without big data deployment, retail firms are not able to support business strategies for cost leadership or differentiation (Barney, 1986). As indicated, the four firms included in the analysis use and manage big data in a similar way even though their business strategy is different. In fact, some focus on cost leadership while others emphasize differentiation. Nevertheless, big data management helps firms to achieve and exploit their business strategy. Another theoretical implication regards the link between big data deployment, the competencies required to deploy data analysis and data sharing. Accordingly, it has been demonstrated that big data deployment affects

Dimension	Finding	No. firms
Data deployment	Customer targeting	4/4
	Optimize processes	4/4
	Reduce operating costs	4/4
	Improve quality, efficiency and accuracy of deliveries and stocks	4/4
	Optimize HRM	4/4
	Elaborate detailed plans	4/4
	Forecast budgets	4/4
Data gathering	Mixed real-time data and stored data	4/4
	Data collected from loyalty cards and sales	4/4
	Use data for a secondary value	4/4
Competences needed	Heterogeneous skills	4/4
	Searching for new profiles as data scientist, marketing information manager	4/4
	Partnership with universities to acquire and developed the needed profiles	4/4
Data sharing	Close and tight control of data	3/4
	No data sharing	3/4

Table I.
Common findings for all the four cases

different business functions as the need for skilled human resources arises along with the need for data infrastructure, calling for a collaborative approach to leveraging external resources (Ferraris *et al.*, 2017; Scuotto, Santoro, Bresciani and Del Giudice, 2017; Santoro Bresciani, and Papa, 2018).

This paper, thanks to the case studies, also offers relevant insights and implications for managers. First, it proposes several examples of best practices and opportunities drawn from the case studies that may be useful for managers who are interested in the deployment of big data for business processes. The findings indicate that big data can be used for both internal processes and external opportunities related to customers' satisfaction and market changes. This is particularly relevant for retail companies, for which increasing competition and the emergence of new business models call for new approaches to data, information and knowledge acquisition in quick and efficient ways. From a business strategy perspective, it is well known that firms always look for ways to reduce costs and increase sales in order to optimize the gross margin contribution. Big data offers the opportunity to work instantly on prices and costs, leveraging the right business strategy and the right time. Accordingly, big data should be thought of not only in terms of analytics but more in terms developing high-level skills that allow for the use of a new generation of IT tools and architectures to collect data from various sources, and to store, organize, extract, analyze and generate valuable insights and share them with key firm stakeholders for competitive advantage.

A key point in this regard is the establishment of partnerships between heterogeneous actors to merge various skills, competences and resources (Tardivo *et al.*, 2017; Vrontis *et al.*, 2017; Del Vecchio *et al.*, 2018). A necessary resource is the human resource, which the interviewed managers suggested was essential. All firms, including those with the best performance, encountered difficulties in hiring talented human resources (Ferraris *et al.*, 2018) who are able to merge data management competences with problem-solving and decision-making skills.

Despite the implications for theory and practice, the paper has several limitations. In particular, a direct relationship between big data deployment and competitive advantage/ higher performance cannot be proved. In fact, the paper is based on qualitative evidence of the advantages and opportunities of big data. However, it is believed that the cases presented address key points about strategic exploitative and explorative business processes. Moreover, the firms involved in this research are all high performing, thus suggesting best practices and benchmarks for follower firms. However, future studies could implement quantitative research to assess the impact of big data deployment on a firm's performance. Another limitation concerns the generalizability of the results. All the firms in this research operate in the retail sector of the service industry. Future studies could focus on the exploration of big data deployment in manufacturing firms.

References

Acharya, A., Singh, S.K., Pereira, V. and Singh, P. (2018), "Big data, knowledge co-creation and decision making in fashion industry", *International Journal of Information Management*, Vol. 42, pp. 90-101.

Akter, S., Wamba, S.F., Gunasekaran, A., Dubey, R. and Childe, S.J. (2016), "How to improve firm performance using big data analytics capability and business strategy alignment?", *International Journal of Production Economics*, Vol. 182, pp. 113-131.

Alfouzan, H.I. (2015), "Big data in business", *International Journal of Scientific & Engineering Research*, Vol. 6 No. 5, pp. 1351-1352.

APICS (2012), "APICS 2012 big data insights and innovations executive summary".

Azma, F. and Mostafapour, M.A. (2012), "Business intelligence as a key strategy for development organizations", *Procedia Technology*, Vol. 1, pp. 102-106.

Barney, J.B. (1986), "Strategic factor markets: expectations, luck, and business strategy", *Management Science*, Vol. 32 No. 10, pp. 1231-1241.

Ben Oumlil, A. (2013), "Warranty implementation and evaluation: a global firm's case", *Journal of Product & Brand Management*, Vol. 22 No. 2, pp. 161-171.

Boisot, M. and Canals, A. (2004), "Data, information and knowledge: have we got it right?", *Journal of Evolutionary Economics*, Vol. 14 No. 1, pp. 43-67.

Bresciani, S., Ferraris, A. and Del Giudice, M. (2017), "The management of organizational ambidexterity through alliances in a new context of analysis: internet of Things (IoT) smart city projects", *Technological Forecasting and Social Change*, forthcoming, available at: https://doi.org/10.1016/j.techfore.2017.03.002

Brown, B., Chui, M. and Manyika, J. (2011), "Are you ready for the era of 'big data'", *McKinsey Quarterly*, Vol. 4 No. 1, pp. 24-35.

Brynjolfsson, E. and McAfee, A. (2012), "Race against the machine: how the digital revolution is accelerating innovation, driving productivity, and irreversibly transforming employment and the economy", *MIT Sloan Management*, pp. 1-8.

Ciampi, F. (2008), *The Knowledge Creation Potential of Management Consulting*, IOS Press, Amsterdam.

Ciampi, F. (2017a), "Top management diversity, ambidexterity and performance in independent small firms", *Evidence from the Italian Fashion Industry, The 21st WMSCI Conference Proceedings, Vol. 1, Orlando, 8-11 July*, pp. 9-12.

Ciampi, F. (2017b), "How management consulting creates knowledge", *The 21st WMSCI Conference Proceedings, Vol. 1, Orlando, 8-11 July*, pp. 13-15.

Davenport, T. (2014), *Big Data at Work: Dispelling the Myths, Uncovering the Opportunities*, Harvard Business Review Press, Cambridge, MA.

Davenport, T.H. (1993), *Process Innovation: Reengineering Work Through Information Technology*, Harvard Business Press, Cambridge, MA.

Davenport, T.H., Barth, P. and Bean, R. (2012), "How big data is different", *MIT Sloan Management Review*, Vol. 54 No. 1, pp. 21-25.

Del Giudice, M. (2016), "Discovering the Internet of Things (IoT): technology and business process management, inside and outside the innovative firms", *Business Process Management Journal*, Vol. 22 No. 2.

Del Giudice, M. and Della Peruta, M.R. (2016), "The impact of IT-based knowledge management systems on internal venturing and innovation: a structural equation modeling approach to corporate performance", *Journal of Knowledge Management*, Vol. 20 No. 3, pp. 484-498.

Del Giudice, M. and Straub, D. (2011), "Editor's comments: IT and entrepreneurism: an on-again, off-again love affair or a marriage?", *MIS Quarterly*, Vol. 35 No. 4, pp. iii-viii.

Del Giudice, M., Campanella, F. and Dezi, L. (2016), "The bank of things: an empirical investigation on the profitability of the financial services of the future", *Business Process Management Journal*, Vol. 22 No. 2, pp. 324-340.

Del Vecchio, P., Di Minin, A., Petruzzelli, A.M., Panniello, U. and Pirri, S. (2018), "Big data for open innovation in SMEs and large corporations: trends, opportunities, and challenges", *Creativity and Innovation Management*, Vol. 27 No. 1, pp. 6-22.

Dennis, C., Marsland, D. and Cockett, T. (2001), "Data mining for shopping centres–customer knowledge-management framework", *Journal of Knowledge Management*, Vol. 5 No. 4, pp. 368-374.

Dezi, L., Santoro, G., Gabteni, H. and Pellicelli, A.C. (2018), "The role of big data in shaping ambidextrous business process management: case studies from the service industry", *Business Process Management Journal*, Vol. 24 No. 5, pp. 1163-1175.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532-550.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: opportunities and challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25-32.

El-Kassar, A.N. and Singh, S.K. (2018), "Green innovation and organizational performance: the influence of big data and the moderating role of management commitment and HR practices", *Technological Forecasting and Social Change*, forthcoming, available at: https://doi.org/10.1016/j. techfore.2017.12.016

Ferraris, A., Santoro, G. and Bresciani, S. (2017), "Open innovation in multinational companies' subsidiaries: the role of internal and external knowledge", *European Journal of International Management*, Vol. 11 No. 4, pp. 452-468.

Ferraris, A., Santoro, G., Bresciani, S. and Carayannis, E.G. (2018), "HR practices for explorative and exploitative alliances in smart cities: evidences from smart city managers' perspective", *Management Decision*, Vol. 56 No. 6, pp. 1183-1197.

Gao, X. (2013), "Towards the next generation intelligent BPM: in the era of big data", *Business Process Management*, Springer, Berlin and Heidelberg, pp. 4-9.

Gaur, A. and Kumar, M. (2017), "A systematic approach to conducting review studies: an assessment of content analysis in 25 years of IB research", *Journal of World Business*, Vol. 53, pp. 280-289.

Gaur, A.S., Kumar, V. and Singh, D. (2014), "Institutions, resources, and internationalization of emerging economy firms", *Journal of World Business*, Vol. 49 No. 1, pp. 12-20.

Gaur, S.S., Vasudevan, H. and Gaur, A.S. (2011), "Effect of market orientation on manufacturing performance: moderating role of firm resources and environmental factors", *European Journal of Marketing*, Vol. 45 Nos 7/8, pp. 1172-1193.

Gobble, M.A. (2013), "Big data: the next big thing in innovation", *Research and Technology Management*, Vol. 56 No. 1, pp. 64-66.

Gomm, R., Hammersley, M. and Foster, P. (Eds) (2000), *Case Study Method: Key Issues, Key Texts*, Sage.

Gupta, M. and George, J.F. (2016), "Toward the development of a big data analytics capability", *Information & Management*, Vol. 53 No. 8, pp. 1049-1064.

Hofacker, C.F., Malthouse, E.C. and Sultan, F. (2016), "Big data and consumer behavior: imminent opportunities", *Journal of Consumer Marketing*, Vol. 33 No. 2, pp. 89-97.

Irvine, A., Drew, P. and Sainsbury, R. (2013), "'Am I not answering your questions properly?'Clarification, adequacy and responsiveness in semi-structured telephone and face-to-face interviews", *Qualitative Research*, Vol. 13 No. 1, pp. 87-106.

Jick, T.D. (1979), "Mixing qualitative and quantitative methods: triangulation in action", *Administrative Science Quarterly*, Vol. 24 No. 4, pp. 602-611.

Kane, G.C., Palmer, D., Phillips, A.N. and Kiron, D. (2015), "Is your business ready for a digital future?", *MIT Sloan Management Review*, Vol. 56 No. 4, p. 37.

Kiron, D., Prentice, P.K. and Ferguson, R.B. (2014), "The analytics mandate", *MIT Sloan Management Review*, Vol. 55 No. 4, pp. 1-25.

Kotni, V.D.P. (2011), "Impact of retail services on retail sales", *Journal of Business and Retail Management Research*, Vol. 6 No. 1, pp. 1-9.

Lopez-Nicolas, C. and Soto-Acosta, P. (2010), "Analyzing ICT adoption and use effects on knowledge creation: an empirical investigation in SMEs", *International Journal of Information Management*, Vol. 30 No. 6, pp. 521-528.

Lu, Y. and Ramamurthy, K. (Ram) (2011), "Understanding the link between information technology capability and organizational agility: an empirical examination", *MIS Quarterly*, Vol. 35 No. 4, pp. 931-954.

McAfee, A., Brynjolfsson, E. and Davenport, T.H. (2012), "Big data: the management revolution", *Harvard Business Review*, Vol. 90 No. 10, pp. 60-68.

Melville, N., Kraemer, K. and Gurbaxani, V. (2004), "Information technology and organizational performance: an integrative model of IT business value", *MIS Quarterly*, Vol. 28 No. 2, pp. 283-322.

Merchant, H. and Gaur, A. (2008), "Opening the 'non-manufacturing' envelope: the next big enterprise for international business research", *Management International Review*, Vol. 48 No. 4, pp. 379-396.

Miles, M.B. and Huberman, A.M. (1994), *Qualitative Data Analysis*, 2nd ed., Sage, Thousand Oaks, CA.

Motamarri, S., Akter, S. and Yanamandram, V. (2017), "Does big data analytics influence frontline employees in services marketing?", *Business Process Management Journal*, Vol. 23 No. 3, pp. 623-644.

Nambisan, S., Lyytinen, K., Majchrzak, A. and Song, M. (2017), "Digital innovation management: reinventing innovation management research in a digital world", *MIS Quarterly*, Vol. 41 No. 1, pp. 223-238.

O'Connor, C. and Kelly, S. (2017), "Facilitating knowledge management through filtered big data: SME competitiveness in an agri-food sector", *Journal of Knowledge Management*, Vol. 21 No. 1, pp. 156-179.

Ohlhorst, F.J. (2012), *Big Data Analytics: Turning Big Data into Big Money*, John Wiley & Sons.

Pantano, E. (2014), "Innovation drivers in retail industry", *International Journal of Information Management*, Vol. 34 No. 3, pp. 344-350.

Peker, S., Kocyigit, A. and Eren, P.E. (2017), "LRFMP model for customer segmentation in the grocery retail industry: a case study", *Marketing Intelligence & Planning*, Vol. 35 No. 4, pp. 544-559.

Provost, F. and Fawcett, T. (2013), "Data science and its relationship to big data and data-driven decision making", *Big Data*, Vol. 1 No. 1, pp. 51-59.

Renu, R.S., Mocko, G. and Koneru, A. (2013), "Use of big data and knowledge discovery to create data backbones for decision support systems", *Procedia Computer Science*, Vol. 20, pp. 446-453.

Saghir, M. and Jönson, G. (2001), "Packaging handling evaluation methods in the grocery retail industry", *Packaging Technology and Science*, Vol. 14 No. 1, pp. 21-29.

Santoro, G. and Usai, A. (2018), "Knowledge exploration and ICT knowledge exploitation through human resource management: a study of Italian firms", *Management Research Review*, Vol. 41 No. 6, pp. 701-715.

Santoro, G., Bresciani, S. and Papa, A. (2018), "Collaborative modes with cultural and creative industries and innovation performance: the moderating role of heterogeneous sources of knowledge and absorptive capacity", *Technovation*, available at: https://doi.org/10.1016/j.technovation.2018.06.003

Santoro, G., Vrontis, D., Thrassou, A. and Dezi, L. (2018), "The internet of things: building a knowledge management system for open innovation and knowledge management capacity", *Technological Forecasting and Social Change*, Vol. 136, pp. 347-354.

Scuotto, V., Santoro, G., Bresciani, S. and Del Giudice, M. (2017), "Shifting intra-and inter-organizational innovation processes towards digital business: an empirical analysis of SMEs", *Creativity and Innovation Management*, Vol. 26 No. 3, pp. 247-255.

Scuotto, V., Santoro, G., Papa, A. and Carayannis, E.G. (2017), "Triggering open service innovation through social media networks", *Mercati & Competitività*, pp. 21-40, doi: 10.3280/MC2017-003003.

Sivarajah, U., Kamal, M.M., Irani, Z. and Weerakkody, V. (2017), "Critical analysis of big data challenges and analytical methods", *Journal of Business Research*, Vol. 70, pp. 263-286.

Sumbal, M.S., Tsui, E. and See-to, E.W. (2017), "Interrelationship between big data and knowledge management: an exploratory study in the oil and gas sector", *Journal of Knowledge Management*, Vol. 21 No. 1, pp. 180-196.

Tardivo, G., Santoro, G. and Ferraris, A. (2017), "The role of public-private partnerships in developing open social innovation: the case of GoogleGlass4Lis", *World Review of Entrepreneurship, Management and Sustainable Development*, Vol. 13 Nos 5-6, pp. 580-592.

Vrontis, D., Thrassou, A., Santoro, G. and Papa, A. (2017), "Ambidexterity, external knowledge and performance in knowledge-intensive firms", *The Journal of Technology Transfer*, Vol. 42 No. 2, pp. 374-388.

Waller, M.A. and Fawcett, S.E. (2013), "Data science, predictive analytics, and big data: a revolution that will transform supply chain design and management", *Journal of Business Logistics*, Vol. 34 No. 2, pp. 77-84.

Wamba, S. and Mishra, D. (2017), "Big data integration with business processes: a literature review", *Business Process Management Journal*, Vol. 23 No. 3, pp. 477-492.

Wamba, S.F., Akter, S., Edwards, A., Chopin, G. and Gnanzou, D. (2015), "How 'big data' can make big impact: findings from a systematic review and a longitudinal case study", *International Journal of Production Economics*, Vol. 165, pp. 234-246.

Wamba, S.F., Gunasekaran, A., Akter, S., Ren, S.J.F., Dubey, R. and Childe, S.J. (2017), "Big data analytics and firm performance: effects of dynamic capabilities", *Journal of Business Research*, Vol. 70, pp. 356-365.

Wang, Y., Kung, L. and Byrd, T.A. (2018), "Big data analytics: understanding its capabilities and potential benefits for healthcare organizations", *Technological Forecasting and Social Change*, Vol. 126, pp. 3-13.

Wang, Y., Kung, L., Wang, W.Y.C. and Cegielski, C.G. (2018), "An integrated big data analytics-enabled transformation model: application to health care", *Information & Management*, Vol. 55 No. 1, pp. 64-79.

Weinberg, B.D., Davis, L. and Berger, P.D. (2013), "Perspectives on big data", *Journal of Marketing Analytics*, Vol. 1 No. 4, pp. 187-201.

Yin, R.K. (2013), *Case Study Research: Design and Methods*, Sage Publications.

Yin, S. and Kaynak, O. (2015), "Big data for modern industry: challenges and trends (point of view)", *Proceedings of the IEEE*, Vol. 103 No. 2, pp. 143-146.

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