The Impact of Big Data on Board Level Decision Making

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Abstract

This paper investigates how board members perceive the reliability of Big Data (BD) as a new source of information for their decision making. To understand the dilemma "*real time and effective vs reliable and compliant information*", we analyse a real case, addressing this problem to reflect on the decision making of a board of directors. In detail, within the context of a digital bank, we explore how the board assessed the quality of BD, gathered from social media and processed in the form of indicators, to define worthwhile measures for monitoring the bank reputational risk.

Our data reveal interesting findings in two areas. First, there is evidence of a shortfall in cognitive capabilities concerning BD. Second, we show how BD impacts responsibility/control within the board context. This study points to areas for development at three levels of our analysis: individual directors' cognitive capabilities in relation to BD, the board as a collective intelligent decision maker and at the organisational level, supporting a broader view of the big data flows in and out the firm's boundaries.

Keywords – Big Data**,** Social Media, Board Decision Making, Reputational Risk
Paper type – Academic Research Paper

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1. Introduction

This paper investigates how Board members perceive the reliability of Big Data (BD) as a new source of information for their decision making. As a matter of fact, BD has the potential to 'disrupt' the senior management of organisations, prompting directors to make decisions more rapidly and to shape their capabilities to address environmental changes (Merendino et al., 2018).

In the era of BD produced thanks to technologies that have allowed the collection and storage of an increasing quantity of granular information, as well as the processing and extracting the information, even in the field of managerial reporting, expectations for new opportunities have emerged.

In particular, expectations concern the possibility of overcoming two limits of traditional reporting for decision making, that is:

a) Big data may enable real-time reporting (Serafeim, 2014),

b) Big data, thanks to the possible views they offer, allow us to extract valuable information that supports achieving corporate performance (LaValle et al., 2011; Lycett, 2013).

Hence, a board of directors may benefit from a wide range of data that offers insightful information for their decision making rather than financial transactions alone (Moffit and Vasarhelyi, 2013).

However, at the same time, there are many limitations to this kind of data concerning their reliability. Indeed, some authors have talked about big data mythology, which relates to the common belief that a vast pool of data provides true, objective and accurate knowledge (Boyd and Crawford, 2012). In practice, so far, chief financial accountants serve as gatekeepers of accounting-based information provided to the Board, which prevents reporting based on big data from leading to misrepresentation and unfair decision-making (Al-Htaybat and von Alberti-Alhtaybat, 2017).

To understand the dilemma, it can be summarised as:

"*real time and effective vs reliable and compliant information*",

therefore, we have analysed a real case addressing this problem to reflect on the decision making of a board of directors. In detail, within the context of a digital bank, we will explore how the board assessed the quality of BD, gathered from social media and processed in the form of indicators, to define worthwhile measures for monitoring the bank reputational risk.

Indeed, the literature on BD information quality for corporate decision making finds supporters and detractors who develop their analysis within the frameworks developed in their own disciplines (mainly information systems and accounting). Furthermore, in most cases, it does not offer case studies or surveys on how the quality of data is perceived within the company, with only some exceptions (Merendino et al., 2018). For these reasons, we believe that this preliminary paper could shed light on an issue that deserves greater attention and that it will be increasingly important in the future.

This paper is structured as follows: section 2 illustrates the debate on the quality of big data for decision making; the methodology is presented in section 3. Section 4 draws on empirical evidence and provides the main findings of our inquiry, while section 5 highlights the implications for research and practitioners.

2. The debate on Big Data for corporate decision making

The analysis of the benefits and shortcomings of BD can be approached from two different perspectives, namely that of the accountant and the BD expert. Therefore, we have proposed a parallel analysis which is summarised in table 1.

Table 1. Benefits and shortcomings of Big Data for decision making

	Accountant	Big Data expert
Benefits	Real time information useful when decisions need to be timely within a setting of limited rationality	Extension of the decision maker's ability to make sense of the present and anticipate future trends
Shortcomings	Possible lack of reliability compared to accounting models and existing regulations	Risk of over-perceiving the value of meaningless patterns found among large quantities of data

2.1. The BD expert perspective

BD has been recognised as a potential driver of disruption in the way firms operate as it enables managers to make decisions based on evidence rather than intuition (McAfee and Brynjolfsson, 2012). Usage of BD, especially when coupled with Artificial Intelligence

techniques, is capable of equipping decision makers with both an extended understanding of the present circumstance through a deeper understanding of the market, consumer and competitors, and the anticipation of forthcoming events in the future. Insights and predictions can give firms a competitive advantage as they support an increase in productivity and an improvement in the speed and quality of decision making (Agrawal et al., 2018). At the same time, decision makers who are not fully equipped with knowledge about BD methods might make some wrong decisions as they fail to consider the level of confidence behind findings (Seely-Gant and Frehill, 2015). For example, a frequent limitation of BD models is overfitting which can lead decision makers to see non-existing patterns simply because large quantities of data can offer connections that apparently radiate in all directions, as noticed by Boyd and Crawford (2012). Until organisations obtain a minimal level of fluency in BD methods, data scientists and business analysts will have the additional responsibility to coach others on best practices, emphasising both the value and the possible shortcomings of analytics projects (Davenport, 2020).

2.2. The accountant perspective

In the field of corporate reporting, the contrast emerges because data scientists process information in an abductive way (Arnaboldi et al. 2017), while accountants ensure the quality of the data with respect to consistency with a determined accounting model (Demartini, 1999). Hence, accountants serve as gatekeepers of accounting-based knowledge, which prevents reporting based on big data from leading to misrepresentation, and unfair decision making (Al-Htaybat and von Alberti-Alhtaybat, 2017), which could be even considered as non-compliant with the existing legal or regulatory norms.

Namely, the biggest problem for an accountant is precisely to understand the “quality” of the data. This is mainly due to the fact that they need to use information that is certified by third parties and that complies with the characteristics required by legal and compulsory regulatory norms. In this sense, the traditional distinction between the quality required for financial data and making well-informed business decisions is fading. This is even more true in contexts regulated by law such as banking.

2.3. The impact of BD on Board-level decision making

To inquire about how the quality of big data is perceived, analysed and discussed by the Board, it is appropriate to recall its functions briefly. In a nutshell, the Board of a company is responsible for the strategic supervision and monitoring of the firm's activities. To effectively perform these functions, both individual directors and the Board, considered as a collective intelligent system (Leimeister, 2010), must have adequate knowledge, competence and skill. For our purposes, it is also important to consider that required knowledge changes over time in light of new challenges businesses. So, it is also important to reflect on the dynamic capability (Teece et al. 1997) and knowledge (Spender, 1996) of the Board. This attitude should be considered at several levels:

- at an individual level, to avoid the negative effects of cognitive biases (Amit & Schoemaker, 1993), such as anchoring (i.e., the old way of thinking) and cognitive dissonance (i.e., holding conflicting beliefs or ideas) (Brennan & Conroy, 2013). The lack of cognitive capabilities of the Board of directors can also cause boardroom or organisational inertia (Tripsas & Gavetti, 2000);

- at the Board level, which acts as a collective intelligent decision maker (Leimeister, 2010);

- at the organisational level, by defining how to manage knowledge flows inside and outside the boundaries of the firm from a cognitive view (Cress & Kimmerle, 2008; Secundo et al., 2016).

3. Methodology

In the following section, we will analyse a real case, addressing the issues mentioned above, to reflect on the decision making of a Board of directors.

The choice of a digital bank stems from the fact that, as we said, the banking sector, on the one hand, has always made great use of new technologies to manage a large amount of data and, on the other, is subjected to strict compliance requirements established by law and numerous national and supranational supervisory bodies. In detail, the choice of a digital bank defines the context of reference even more analytically as we assume that the corporate culture is based on transversal skills with reference to the new communication technologies and that it is accompanied by a certain openness towards the search for

innovative solutions, also concerning company reporting. Furthermore, it is expected that members with specific skills in digitalisation will also be present on the Board.

Therefore, we have conducted semi-structured interviews with the Board members of a digital bank to provide a discussion on a specific concrete situation concerning how and whether to use big data for high-level strategic decision making. The concrete situation concerns the design of a framework aimed at monitoring the bank's reputational risk, which will be briefly described in the following section.

3.1. The context of the decision making

The design of a reputational risk framework

The deterioration of stakeholder confidence exposes banks to reputational risk and effects their ability to maintain viability conditions over time. For this reason, and also on the basis of the indications of the supervisory bodies, many banks have adopted a framework for monitoring reputational risks.

The investigation of this specific topic is beyond our inquiry, therefore, only the elements relevant to our purposes will be provided below.

It is sufficient to recall that the reputational risk framework adopted by the bank for monitoring translates into a quarterly reporting dashboard, presented to the bank's Board, containing the management indicators for each stakeholder. The latter are intended to "measure" the quality of the relationship with each stakeholder.

The decision to be made

As part of the design of the bank's reputational framework, the decision on which we have focused our analysis concerns the identification of the indicators for the mitigation of the reputational risk called "*brand capital*". The latter expresses what the bank defines as "*the synthesis of the perception of customers and non-customers in terms of engagement, competence, integrity of the exchange, reliability and loyalty*".

Specifically, we will focus on the discussion developed within the Board around two of the most significant indicators among those selected to monitor the components affecting brand capital, namely:

- Index of negative sentiment online (number of conversations with negative polarity/total conversations recorded in the Quarterly period)

- Litigation index (expressed as the number of complaints received by the bank during the Quarterly period)

The first indicator derives from an external survey conducted by a provider specialised in sentiment analysis and is based on the processing of non-structured big data present online, including web pages, online news, internet discussion groups, online reviews, web blogs and social media.

The second indicator is traditionally provided by the internal office that deals with complaints and has always been monitored by the bank.

This comparison will allow us to analyse how the Board considers the quality of information coming from sentiment analysis, compared to traditional information relating to complaints.

3.2 Data collection and analysis

Data were collected from 2019 to 2020 by one of the authors. Data used for the analysis come from different sources:

- internal reports and documents to analyse the design of the reputational risk framework (i.e., Board meetings minutes, technical reports);
- subsequently, semi-structured interviews with each director focusing on the discussion that arose within the Board on the reliability of the index of sentiment online to monitor the bank's brand capital.

Interviews were the primary source of data. A total of 7 interviews were carried out (see Table 2 for more details on informants and their theoretical and practical expertise). Conversations varied in length from one to two hours. All of them were recorded and later transcribed verbatim for further analysis.

Table 2-Interviewees' profile

No of interviews	*Role*	*Theoretical expertise*	*Practical expertise*
1	Chairman	Auditing and accounting	Professional, member of boards and supervisory board (Legislative Decree no. 231/2001)
1	Board member	Media communication	Founding partner and marketing chief of a digital company
1	Board member	Business administration	CFO/Chief risk officer in the banking sector
4	Board members	Legal and business administration skills and competence	Chief legal officer, Chief Commercial officer, HR responsible in the banking sector Professional

As suggested by Miles et al. (2014), data analysis was an ongoing process. Available data were iteratively analysed to allow a progressive elaboration of a general interpretative framework. In the first step of the data analysis, we created a detailed description of the case, putting together interviews and secondary sources. In the second step, we cycled through multiple readings of the data and, in line with the purposes of our research, in this phase, we identified the following three levels to analyse how the quality of big data is perceived for decision making: the individual director, the board as a collective decision maker, the organisation as a whole. With this purpose in mind, each author read the empirical material independently and categorised the stream of words into meaningful categories, via manual open coding. Furthermore, in our analysis, we found the use of excerpts highly worthwhile as they allow researchers to address the way the actors use language, think and make sense of big data usefulness and reliability.

4. Findings

4.1. The Individual level

At an individual level, directors need to develop the mental models and skills, or managerial cognitive capabilities, to perceive, analyse and process changes in the environment that affect decision making.

It did not surprise us that, apart from one of the directors with a specialist background, the others had not gained in-depth knowledge on big data. Nonetheless, none of the interviewees complained that they did not have adequate knowledge to be able to specifically evaluate the reliability and adequacy of the index of sentiment online for the defined purpose.

If, on the one hand, these affirmations manifest the mental openness of the directors towards the evaluation of new data sources, on the other hand, it can also be the signal of a shortfall in cognitive capabilities in assessing the quality of BD, given that no directors, during the Board meetings, asked for specific information on how the index was calculated. Except for the one with expertise on media communication, the other directors took the data for granted, also because online sentiment analysis had long been a source of information used by the bank's communication office. Hence, the index was used to provide information about technical content, whose quality assessment is up to specialist managers. This offers valuable insights into why directors may act conservatively, clinging on to more traditional processes which have been institutionalised. Indeed, a more critical approach was only adopted by the director with greater BD expertise, who stated: *it is always advisable to know the sentiment analysis techniques used to understand the meaning of the information provided.*

4.2 The Board

In analysing the data collected, we adopted the view of the Board as a collective intelligent decision maker. The term “collective” describes a group of individuals that work together to find solutions to a given problem. The term “intelligence” refers to the ability to learn, understand and adapt to new circumstances by using knowledge.

In this perspective, it is interesting to observe how, through the dialectic and the contribution of the various actors, the Board reached the final decision through compromise decision making to include both indicators, the more traditional one of complaints and the newer one relating to online sentiment analysis.

In particular, the director with expertise in the field of risk control highlighted the potential predictive value of the information by stating that: "*the sentiment index online can provide an early warning, once the time series allows you to test the data".*

On the other hand, the chairman with experience in auditing and compliance underlined how: "*the complaints index, even if it provides information on the corporate reputation when the relationship of trust with the clientele is already damaged, offers precise indications for the implementation of remedial actions and, in particular, has always been the subject of attention by the inspectors of the supervisory bodies* ".

Overall, the analysis of the discussion within the Board shows that the combination of different skills and experiences gained by the directors offered a solution that also considered the risks and responsibilities of the Board.

1. The Organisation

The concept of an organisation as a collective cognitive system elicits that knowledge is no longer only accumulated and created within a firm but is co-created by different actors through collective intelligence.

The case examined highlights how the bank can use external BD suppliers. This specific point highlights a potential weakness of the bank, which does not process the information internally but acquires it from an external supplier. Hence it is necessary to know about the quality of the information acquired, not only because it becomes part of the company's decision-making processes but also because it must be possible to account for it when confronting the supervisory bodies

To sum up, in an organisation as a collective cognitive system, the focus shifts from the processes of internal creation of knowledge to the processes of knowledge transfer. Hence, interdependencies and knowledge flows between different stakeholders become crucial.

5. Conclusions and future research

Our data reveal interesting findings in two areas. First, we have found evidence of a shortfall in cognitive capabilities concerning BD. Second, we have shown how BD impacts responsibility/control within the board context. This study also points to areas for development at three levels of our analysis: individual directors' cognitive capabilities in relation to BD, the board as a collective intelligent decision maker and a broader view of the big data flows inside and outside the firm's boundaries.

5.1. Implications for future research and practice

With reference to the first aspect, it is necessary to increase the knowledge of the board members in the field of big data, in addition to artificial intelligence and new technologies that increasingly impact the management of companies. We no longer believe that this knowledge is held by single specialist managers. The Board has strategic oversight and control tasks and, today, failing to understand the potential of new technologies appears to be a big shortcoming.

With reference to the second aspect, the Board as an intelligent collective body, we believe that, especially with particular reference to banks, its composition cannot disregard the presence of subjects who have skills in this area. As a result, we believe that there is matter to reasoning on the content of the so-called "fit and proper" regulation, issued on 2014 by the European Central bank which regulates the composition of the boards of European banks. Board members should have the theoretical (knowledge and skills) and practical experience that are indispensable to carry out their functions, which vary according to the specific role and institution. As a minimum, members of the management body must have basic theoretical experience in banking, and additional experience may be required depending on other factors that are important to the particular institution. In detail, the latter currently provides for the presence of members who have basic experience on legal issues and risk control (ECB, 2018 p.10) but do not deal with the issue of technological knowledge functional to the strategic management of a bank.

Finally, regarding the third point, which refers to the corporate level, we believe that another aspect that should be investigated by researchers but is also relevant for practice, is revisiting the design of corporate information flows in light of the relevance of big data. It is important to understand how and who generates the algorithms for the analysis of big data and not take them for granted. We think that a large part of corporate knowledge will be produced by leveraging on big data in the future, and as usual in the rules of the business, it is important to know how to feed, transfer and share knowledge, and also protect it.

References

Cress, U., & Kimmerle, J. (2008). A systemic and cognitive view on collaborative knowledge building with wikis. *International Journal of Computer-Supported Collaborative Learning*, *3*(2), 105.

Amit, R., & Schoemaker, P. J. (1993). Strategic assets and organizational rent. *Strategic management journal*, *14*(1), 33-46.

Brennan, N. M., & Conroy, J. P. (2013). Executive hubris: The case of a bank CEO. *Accounting, Auditing & Accountability Journal*.

Agrawal, A., Gans, J., & Goldfarb, A. (2018). Prediction machines: the simple economics of artificial intelligence. *Harvard Business Press*.

Al-Htaybat, K., & von Alberti-Alhtaybat, L. (2017). Big Data and corporate reporting: impacts and paradoxes. *Accounting, auditing & accountability journal*.

Arnaboldi, M., Busco, C., & Cuganesan, S. (2017). Accounting, accountability, social media and big data: revolution or hype?. *Accounting, auditing & accountability journal*, *30*(4), 762-776.

Bhimani, A., & Willcocks, L. (2014). Digitisation,'Big Data'and the transformation of accounting information. *Accounting and Business Research*, *44*(4), 469-490.

Boyd, D., & Crawford, K. (2012). Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, communication & society*, *15*(5), 662-679.

Davenport, T. H. (2020). Beyond Unicorns: Educating , Classifying , and Certifying Business Data Scientists. *Harvard Data Science Review*.De Mauro, A., Greco, M., & Grimaldi, M. (2016). A formal definition of Big Data based on its essential features. *Library Review*, *65*(3), 122-135.

De Mauro, A., M- Greco and M. Grimaldi (2019), Understanding Big Data Through a Systematic Literature Review: The ITMI Model, International Journal of Information Technology & Decision Making Vol. 18, No. 4, 1433–1461.

Demartini, P. (1999). *Globalizzazione dei mercati ed aspetti evolutivi dell'informazione economico-finanziaria delle imprese* (Vol. 1, pp. 1-285). CEDAM.

Grover V., R. H. L. Chiang, T.-P. Liang and D. Zhang (2018), Creating strategic business value from Big Data analytics: A research framework, Journal of Management Information Systems 35 (2018) 388–423.

LaValle, S., Lesser, E., Shockley, R., Hopkins, M. S., & Kruschwitz, N. (2011). Big data, analytics and the path from insights to value. *MIT sloan management review*, *52*(2), 21-32.

Leimeister, J.M. (2010), "Collective intelligence", Business & Information Systems Engineering, Vol. 2 No. 4, pp. 245-248.

Lycett, M. (2013). 'Datafication': Making sense of (big) data in a complex world.

McAfee, A., and Brynjolfsson, E. (2012). Big data: the management revolution. *Harvard Business Review*, 90(10), 1–9.

Merendino, A., Dibb, S., Meadows, M., Quinn, L., Wilson, D., Simkin, L., & Canhoto, A. (2018). Big data, big decisions: The impact of big data on board level decision-making. *Journal of Business Research*, *93*, 67-78.

Moffitt K. C. and Vasarhelyi M. A. (2013), AIS in an age of Big Data, *Journal of Information Systems*, 27(2)

Secundo, G., Del Vecchio, P., Dumay, J., & Passiante, G. (2017). Intellectual capital in the age of big data: establishing a research agenda. *Journal of Intellectual Capital*, *18*(2), 242-261.

Secundo, G., Dumay, J., Schiuma, G., & Passiante, G. (2016). Managing intellectual capital through a collective intelligence approach. *Journal of Intellectual Capital*.

Seely-Gant, K., & Frehill, L. M. (2015). Exploring Bias and Error in Big Data Research. *Journal of the Washington Academy of Sciences*, 101(3), 29. Serafeim G. (2014), Corporate Reporting in the Big Data Era.

Spender, J. C. (1996). Making knowledge the basis of a dynamic theory of the firm. *Strategic management journal*, *17*(S2), 45-62.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic management journal*, *18*(7), 509-533.

Vasarhelyi M. A., Kogan A. and Tuttle B. M. (2015), Big Data in accounting: An overview, *Accounting Horizons*, 29(2), pp. 381-396.

Tripsas, M., & Gavetti, G. (2000). Capabilities, cognition, and inertia: Evidence from digital imaging. *Strategic management journal*, *21*(10-11), 1147-1161.