

Accounting, Accountability, Social Media and Big Data: Revolution or Hype?

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Abstract:

Purpose – This paper contributes to set an agenda for researching the intertwined relationship between technology enabled networks – such as Social Media and Big Data - and the accounting function and practice. In doing so, it links the contents of an unfolding area research with the papers published in this *Accounting, Auditing and Accountability Journal* special issue.

Design/methodology – The paper surveys the existing literature, which is still in its infancy, and proposes few dimensions to frame the early research attempts and future patterns of investigations. The intention is not to offer a comprehensive review, rather to stimulate and open-up the conversations in the field.

Findings – After having reviewed some of the existing studies exploring technology enabled networks, and highlighted some of the key aspects featuring Social Media and Big Data, the paper offers a classification of the existing research efforts, as well opportunities, based on their focus. Three different areas of investigation are identified: new performance indicators based on social media and Big Data indicators; governance of social media and Big Data information resources; and, finally, social media and Big Data's alteration of information and decision-making processes.

Originality/value – If many commentators are to be believed, we are currently experiencing a technological revolution that will fundamentally change the way in which organizations, as well as individuals, operate and take decisions. It is claimed that many knowledge-based jobs are being automated, as well as other transformed with, for example, data scientists ready to replace even the most qualified accountants. But of course, similar claims have been made before and therefore, as academics, we are called upon to explore the impact of these technology enabled networks – such as social media and Big Data – further, and separate the hype from reality. This paper contributes kicking-off a debate in the literature, and speculate on the possible research agenda ahead.

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1. Introduction

The use of new Social Media, such as Facebook, Twitter, Youtube and blogs has exploded in the last few years, with most of the population (especially under 30 years old) using one or more technology enabled networks in their day-to-day life, at home, on the go, or in the workplace. The importance of these such technology enabled networks, as well as of the data they generate, is visible also at the financial level, with the entrance of social media owners in the share market, sometime with impressive results, such as the case of Facebook whose market cap rose \$40 billion to \$340 billion during the first quarter of 2016.

The key characteristic of social media technology is the possibility to connect with other users worldwide and to access, post and share information on a regular and continuous basis. Millions of users are now connected locally and globally thanks to the rapid spread of these technologies and their ease of use. One effect of the explosion in the take up of social media technologies has been the growth of the so-called “Big Data” corpora where it is now possible for companies and others to collect, collate and analyze the mass of information that is posted by people on their blogs, social networking sites, etc. Such corpora has become widely presented as a new panacea for potentially improving business performance across a wide range of corporate functions (ranging from marketing, innovation, personnel search through to risk management, etc.). Recently, for example, both Accenture and Mckinsey have published the results of surveys among practitioners emphasizing the need to invest in Big Data and the results already achieved:

“Big Data is taking off. Users that have completed at least one project are very satisfied with their initial forays into Big Data. The vast majority who have completed their projects report that they are satisfied with business outcomes and that their Big Data initiative is meeting their needs.[...] Big Data is definitely disruptive, potentially transformational. The consensus is clear: Big Data brings disruption that can revolutionize business” (Accenture, 2016, p.2).

It would be easy to be carried away with the hyperbole that surrounds social media and Big Data, but to ignore its effects would also be remiss. It is expected that social media technologies will afford possibilities not only for users to exchange information but also for others to collect and analyze the data generated by these users online. New information and control possibilities are created as more customer, employee and stakeholder interactions happen digitally. However, this also creates complications for organizations and decision-makers in terms of identifying which information to use, what data can be relied upon and how to reshape business processes to take into account these new ‘digital interactions’. Hence, social media and Big Data can have wide-reaching organizational effects not only in relation to the way in which decisions are taken, but also in terms of related processes and competences, as well as the relative power of actors both within and outside enterprise boundaries.

Accounting professionals, rather belatedly are turning their attention to the potential of social media and Big Data. Empirical investigation of both social media and Big Data phenomena for accounting is still in its infancy (Jeacle and Carter, 2011; Scott and Orlikowski, 2012). These reveal doubts about the reliability of the information gathered, the methodologies for processing it, the risks from using it, the organizational fit, the reputational risk management and, finally, the value of the information to be extracted. Yet, anecdotal evidence and case studies reveal that social media and Big Data have already been changing accounting and accountability in several companies although this change is often introduced and promulgated outside accounting functions (commonly through marketing departments). It seems timely therefore to consider how, as accounting scholars, we might embark on a research journey that investigates and illustrates the way in which accounting practices engage with social media and Big Data.

Following from the above, the purpose of this paper is to stimulate and promote an agenda for researching the intertwined relationship between such technology enabled networks and the accounting functions and practices. For conceptual clarity purposes, we first review the term Big Data and outline some overarching implications for accounting. We then discuss

different perspectives from which we can interpret the relationship between accounting functions/practices and the social media and Big Data phenomena as a means of shedding light on some of the possible research questions that might guide future inquiry and studies. Next, we introduce the papers in this *Accounting, Auditing and Accountability Journal* special issue. Finally, we summarize the contents of this paper and outline the opportunities for further research.

2. Big Data and Implications for Accounting

A large attention by practitioner and academics on Big Data has emerged from the diffusion of social media application, and the related possibility to observe and crawl data from public interfaces. However, the term Big Data does not refer solely to Social Media Data but to a larger, but loosely defined, corpora of data. The definition mostly used by practitioners is attributed to Gartner (2001) and describes Big Data:

“as high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making” (Gartner IT Glossary (n.d.)).

This definition recalls the so-called “3Vs” of Big Data: Volume, Velocity and Variety. *Volume*, refers to the magnitude of data and it is the concept most associated to the label Big Data. Discussion are sometime about the threshold of what is “big”, introducing terabytes or petabytes as (emotional) reference for the size of these data. The second feature is *Velocity*, which denotes the increased rate of data generation and (potential) processing. The aspiration of advocates of Big Data is a real-time monitoring, which then inform organizations’ decision making. The third “V” is *Variety*, which refers to the desired diversity in the type of data. Big Data might include structured and unstructured data, coming from different sources such as administrative data, social media contents, photos, videos. This heterogeneity is often discussed in association with the potentiality of information fusion (Chang *et al.*, 2016) to provide new knowledge, as for example in Health care (European Commission, 2014). Over time, other ‘Vs’ have been added such as ‘Value’ and Veracity’ (Wamba *et al.*, 2015).

While these attributes are often used to describe and distinguish the key features of ‘Big Data’ compared to the previous systems, we see these concerns as hardly novel for accounting. Volume has been a matter for accounting previously; examples are Enterprise Resource Planning, but even more traditional accounting and financial transactions, which are

impressively high for large and international groups. Also velocity is not a novel matter for accounting considering the need for monitoring real time finance trends, for example for commodity risk control. Additionally, variety is part of the accounting tradition, due to the presence, in the majority of accounting system, of balanced scorecard and dashboards, where there are financial and non-financial indicators coming from different sources. Finally Value and Veracity have been always a matter of accounting, which continue to search for information reliability and significance for decision making.

Aiming to understand the change and implications for accounting practice, we propose a focus that is less concerned with the attributes of 'data' themselves to offer a more comprehensive consideration of Big Data and its connections with social media. Taken together, these technology enabled networks raise interesting questions for accounting in terms of externality, abductivity, and inexhaustivity. While these are not an exhaustive set of dimensions, we see these as important characteristics for exploring, and speculating on, the accounting-relevant concerns connected to social media and Big Data.

Externality relates to the origin of information and data. Much of new sources included in Big Data comes from internet sources and physical devices (e.g. GPS on cars, cameras, phone signals), which are fed by individuals or organizations outside the company. This externality has a first major implication: contrary to data usually adopted in accounting and control, Big Data includes information that are not generated purposively for business uses (Constantiou and Kallinikos, 2015). Thinking, for instance, at images on social media, data are produced by users in one moment and then accessed by other later, searching for commonalities or patterns in response to business/research interests (Zhou *et al.*, 2014; Yanai, 2015). This post-access entail difficulties in setting the context in which images have been produced, hence in the interpretation for dealing with the original business/research question. A second consequence of externality is the lack of total ownership or control over data. This raises concerns linked to privacy, reputation, stability, scalability which might be considered daily matters of these calculative practice. Furthermore, although everyone can participate in increasing Big Data through the democratic internet, the true ownership of data and data mining is in the hands of few giants that created a sort of "oligopoly" (Sun *et al.*, 2015) that put most organization in a weak/no power position when negotiating access or policies.

The second characteristic that we highlight is *abductivity*. It is related to the deep change in the decision-making process entailed by Big Data. As noted above, traditionally information used in decision making within organization is collected on purpose and based on a deductive approach (Constantiou and Kallinikos, 2015). Differently, Big Data rely on an inductive

approach where a broad business/research question is set, data screened, gathered, modelled and then interpreted. Yet, during this process the initial question is refined in return, entailing a hybrid between deductive and inductive thinking: abductive thinking (Lukka, 2014). This circular process affect data which become more fluid than traditional data. Abductivity, rather than simply velocity or variety, emphasizes the active role of the ‘data scientist’ in shaping data as a resource and its characteristics. The desire to capture always new information may lead to greater ‘fluidity’ and revision of procedures and processes may conflict with innate desires, especially in accounting and audit, to set stable rules and structures as a “pillar” for decision makers.

Finally, *non-exhaustiveness* concerns the ‘representativeness’ of information and data. Contained within the ‘promise’ of Big Data is the notion of exhaustivity in scope in that Big Data allows organizations to strive “to capture entire populations or systems (n =all)” (Kitchin, 2014, p.1) rather than mere samples. Yet we suggest that one of the characteristic salient of Big Data and its conceptualization for accounting scholars, is their non-exhaustive and, indeed, non-sampling nature. To explain this feature, we take Twitter, a social media at which researchers and consultancy industry have devoted attention, due to the possibility to download data through the public API (Application Programming Interface). Despite the great use of these data at the business level and the explosion of a related industry, there are doubts on their robustness in terms of representativeness of the entire population. First the population is variable in time, but most importantly Twitter does not guarantee that the amount of data downloaded are the entire population available of tweeters. Few studies have addressed this problem, and to the best of our knowledge only Morstatter *et al.* (2013) have explicitly highlighted the drawbacks of public data in term of representation.

These three characteristics affect (to varying extents) the conceptualization of the interplays between social media, Big Data and accounting. It is to this that we turn to now.

3. Researching the Connections between Social Media, Big Data and Accounting

One possible way to frame the interpretation of the role of social media and Big Data is to view them as an object (data and information) or as a process (of generating data and information). In relation to the intersections with accounting we might also consider whether we place emphasis on social media and Big Data as a medium through which accounting practice occurs or as a target of accounting practice. In the former, social media and Big Data is taken up, yet they enable also to alter accounting practice. In the latter, social media and Big

Data is itself the focal object engaging with accounting as a practice. While Figure 1 summarizes this view, we expand on each category and associated research foci in each of the sub-sections below.

		Conceptualising the relationship with accounting - social media and Big Data as...	
		a medium of accounting	a target of accounting
Conceptualising social media and Big Data as...	An object (the data)	RESEARCH FOCUS: NEW PERFORMANCE INDICATORS BASED ON SOCIAL MEDIA DATA AND BIG DATA	RESEARCH FOCUS: GOVERNANCE OF SOCIAL MEDIA AND BIG DATA INFORMATION RESOURCES
	A process (generating data and information)	RESEARCH FOCUS: INTER-RELATIONSHIPS BETWEEN SOCIAL MEDIA AND BIG DATA AND DECISION-MAKING PROCESSES	

Figure 1 – Social Media, Big Data and Accounting Intersections

3.1 New Performance Indicators Based on Social Media and Big Data Indicators

One of the feature most emphasized by practitioners is the use of Big Data to know more about, and control, other things. This use has implications for accounting considering Big Data as a resource and as a process. To discuss these implications, we take as reference an area that has been seen as potential for Big Data: Cities (see, among others, Lee, 2015; Mattern, 2015; Kitchin, 2014). Cities are indeed a hub of data of various nature: signals from things (transportation means, electric charger; car pass-through); geo-referenced social media data; mobile phone data; Wi-Fi data; traditional data and many other.

A first major challenge is that accounting practitioners tend not to see Big Data as a resource. As we will see later in the paper, some studies in this issue show that accountants are timidly observing Big Data at a distance without taking the lead as expected by accounting associations (such as CIMA, the Chartered Institute of Management Accountants, and IMA, the Institute of Management Accountants). One of the element contributing to accountant reluctance are the pressing deadlines linked to the financial close process (Janvrin and Mascha, 2014) and the abundance of data they already have to deal with. Grounded in a deductive

thinking, and having in mind variables and models to fit, accountants see Big Data, with its externality and abductivity properties, more as a burden, rather than an opportunity.

Despite this attitude displayed by accountants, Big Data is a reality in many organizations and it has already entered decision making processes as it is evident in the City case. Kitchin (2014) shows for example how several cities, such as Rio de Janeiro or New York, have build infrastructure to integrate data from different sources, with a real-time update in order to control specific activities of city management. Examples reported include routine activities such as accident management, but also exceptional event management, like the prediction and management of floods. A large stream of projects, consultancy cases, and academic studies have focused particularly on the potentiality of social media to monitor cities (Lee, 2015; Mattern, 2015). There are studies using social media such as Twitter to control urban issues, such as the temperature (Murakami *et al.*, 2016) mobility (Kostakos, Vassilis, *et al.*, 2013) land and space (Frias-Martinez *et al.*, 2014; Wessel *et al.*, 2015; Shelton *et al.*, 2015) linguistic variation (Huang *et al.*, 2015).

There is also significant interest in new indicators based on user/customer engagement, which encompasses communication, marketing, customer care and even innovation. This use goes beyond social media data, as data from owned social media are elaborated and triangulated with other data, often stimulating the exploration of further external sources. Although the interest in metrics originated in practitioner literature, there are now several papers, mostly outside accounting journals, that addressed to issue of metrics. A first stream of papers explore the metrics for measuring the effectiveness of social media in responding to client and user requests (Burton and Soboleva, 2011; Coulter and Roggeveen, 2012; Bonson and Ratkai, 2013; Rohm *et al.*, 2013). These studies usually focus on owned sources (i.e. sources owned by organizations) and paid sources (i.e. sources acquired externally by payment - Hanna *et al.*, 2011).

A second stream of research has developed and experimented with indicators on network dynamics (user, information flows). Researchers here have developed metrics about the level and speed of diffusion of information across social networks (Kazama *et al.*, 2012; Bakshy *et al.*, 2012; Malthouse *et al.*, 2013); users' influence on company brands, products and services through web sources, for example Twitter, Facebook, blogs, fora, etc. (Bakshy *et al.*, 2011; Phang *et al.*, 2013; Flanagan and Metzger, 2013; Campo-Avila *et al.*, 2013). Despite the mounting number of contribution on specific aspects, so far there is a lack of research looking at these metrics with a holistic view, and even less addressing the use of these indicators inside organization. Few recent papers started to address the systematization of metrics with an

accounting perspective (Agostino and Sidorova, 2016; Arnaboldi *et al.*, 2016). These articles propose classifications distinguishing the source of information (paid, owned and earned) and the nature of the indicator, distinguishing between punctuated and text-derived. The first type, punctuated, refer to metrics build on numbers of specific events related to the network (transaction, access, post), while the text-derived are more challenging as they are built on the processing of text obtained from digital sources (figure 2)

	Punctuated (examples)	Text-derived (examples)
Paid sources	Number of articles Views	Rank in search engines/popularity Frequency of keywords terms
Owned sources	Number of subscribers Traffic generated (number of active actions)	Rank of features Frequency of most used terms
Earned sources	Number of users Number of comments	Number of new ideas Sentiment of discussions

Figure 2 – indicator classification (source Sidorova *et al.*, 2016 p. 143)

Agostino and Sidorova (2016) provide a more detailed classification of the type of indicators. By reviewing previous studies, their work classifies indicators in relation to the dimension controlled, articulated in Financial, Network Structure, Interactions, Social Media Conversation, User’s opinion.

Table 1 PMS metrics and methods			
Type of social media contribution	PMS metrics	Data collection	PMS methods Data analysis
Financial	<i>Financial indicators</i> Social media ROI	Traditional approaches	
Network structure	<i>Network structure indicators</i> Multiplexity Density Centrality Closeness		<i>Statistical analysis</i> Network analysis
Interactions	<i>Interactions indicators</i> Awareness Engagement Word-of-mouth Virality		Statistical analysis
Social media conversation	<i>Content indicators</i> Relevance Uniqueness	<i>Ad hoc social media data download</i> Default	<i>Natural language processing</i> Semantic web
Users' opinion	<i>Sentiment indicators</i> Subjectivity Polarity Sentiment divergence metrics	Manual Automated	<i>Supervised classification</i> Semi-supervised classification Unsupervised classification

Figure 3 – Classification of social media indicators (source Agostino and Sidorova, 2016).

These contributions offer important insights to reflect on Big Data as an object. Notwithstanding, several issues remain open. One area in need of further investigation, and with a more critical view, is predictive analytics. This is another aspect consultancy firms are currently stressing, by envisioning automatic systems capable to predict future performance and the need to move from forecasting to nowcasting. Current studies are narrowly focusing on experimentation, overlooking the organizational and decision making implication of these application.

Another important element for accounting involves the form of these new performance indicators and the communication of information. This element is a promising road for research in accounting leveraging on its tradition in visualization, and going back to the seminal contribution of the Balanced Scorecard (Kaplan and Norton, 1992). More recent studies in accounting have explored how the visual aspects of reporting have “powerful” role in data communication (Quattrone *et al.*, 2016; Busco and Quattrone, 2015; Justesen and Mouritsen, 2009; Cuganesan and Dumay, 2009).

Accounting research has examined the role of visualization and how narratives can be transformed into numbers and visualization to make the relationships between intangible resources and organisational value visible (e.g Cuganesan and Dumay, 2009). The “visualizations can have the capacity to strengthen” messages of data signals and translate them for managers in accounting, marketing design and planning (Justesen and Mouritsen, 2009: 973). Speier (2006) examines how to leverage formats of information presentation to support more effective decision-making.

More recently, Busco and Quattrone (2015) portrayed the Balanced Scorecard and its multi-dimensional set of analytics as a “rhetorical machine”, i.e. an organizing and mediating platform that help users inventing new solutions and creating new managerial knowledge. In doing so, they suggest that through rhetorical machines order and knowledge can be continuously classified and questioned, different interests can be accommodated through regular processes of interrogation and re-invention, and engagement can be sustained through participation in a series of recurrent activities. Rhetorical machines such as dashboards and scorecards have a crucial spatial connotation as they help knowledge classification and invention through the use of visual and spatially based schemas, and allow ‘re-presentations’ to be open to interpretation, appropriation and translation, beyond any stable and ultimate form of objective and univocal truth (Busco and Quattrone, 2015).

The world of Big Data have stimulated new visualization tool that sometime hide details and number in favour of a more concise view. However, there is also a dark side to this

abstraction process – the move away from the local and the particular that may be relevant for organizational action and the recognition of important heterogeneity (Cuganesan and Dumay, 2009). How communication modes of social media and Big Data information – be these visual, numerical or narrative – enables or constrains organizational actions is an important avenue for future research.

3.2 Governance of Social Media and Big Data Information Resources

Much of the existing research highlight how social media information allow capturing the fluidity and dynamics in cities with real-time possibilities. However, these studies tend to focus on the benefits of social media with an enthusiastic attitude towards the advantages offered by such technology enabled networks. They instead overlook the important issue of data quality, which is crucial when information is used in decision making. For example, few contributions highlight the problem of representativeness of social media data, which is at two level. Firstly, social media are used by only part of the population and few data are available to understand who is using a specific network. Second, and most importantly, provider of social media such as Facebook and Twitter, although they offer public interfaces to download data (named Application Public Interface – API) do not guarantee that the data accessible are the entire population available. Hence analysis made through Twitter, Facebook, Instagram data may provide weak signals of variations but cannot be used in a strict numerical vein. The issue of non-exhaustiveness is particularly relevant here.

As highlighted earlier in the paper, there is a large variety of metrics (e.g. punctuated, text-derived) and analysis (e.g. prediction, nowcasting) that need construction of processes and procedure. Regarding the measurement procedures, there are fewer managerial contributions, as management researchers seem to prefer interpreting the data collection process and analysis as a black box (Wang and Lin, 2011; Ceron *et al.*, 2013). Only few marketing scholars have addressed the problem of measurement methodologies. For example, Bell (2012) has proposed a method for analyzing unstructured data targeting specific company objectives. Bajaj and Russell (2010) developed some alternative methodologies. Further to these studies, significant research has been carried out by information technologies scholars, who analyzed Big Data information and its requirements in terms of collection and analysis (e.g. Shelton and Skalski, 2014; Balahur, 2014). Researchers underline the difficulties connected with understanding these “Big Data”, reliability, representativeness, and dissemination inside organization (Boyd and Crawford; 2012; Ferrara *et al.*, 2014; Bianchi and Andrews, 2015).

Another challenge relevant to accounting practice is the use of management controls to ensure that valuable insights from social media and Big Data information is governed appropriately, ensuring it is sufficiently assured and protected yet able to be shared with relevant partners both inside and outside the organization. Recognizing the new information possibilities posed by social media and Big Data, information systems researchers are increasingly concerned with how knowledge is governed (e.g Foss et al., 2010). These researchers are motivated by the observation that a crucial challenge for organizations is “balancing between too much and too little knowledge sharing and knowing how to protect and secure the knowledge that is being shared” (Trkman and DeSouza, 2012; 2012, p.2). However, research examining the interplay between different control types – such as action, personnel, cultural, results – and the balance between information stewardship and sharing is still emerging (Cuganesan *et al.*, 2016). Here, future research also needs to adopt a multi-level perspective, examining both organizations and individuals as inter-related units of analyses in determining how knowledge governance approaches and management control mechanisms influence the assurance, protection and subsequent use of social media and Big Data.

The presence of these benefits and problems opens space for both accounting practitioner and researchers. Accounting practitioners have a long tradition in fitting and checking data to achieve business value (Ma and Tayles, 2009), they might seize the opportunity to balance enthusiasm and rigor in using Big Data. At the academic level, several patterns are visible. There is need to have more empirical evidence on how organizations are using these data, and how they might, or eventually not, become a resource. The possibility to frame new ways for assessing Big Data as a resource is also another important opportunity ahead.

An additional area in need of further exploration concerns the way in which Big Data as an object is transforming the relations between accounting and other organizational functions. Several areas of explorations are here comprised: which functions are owning ‘Big Data’ and how they are interconnected across the organization and with accounting functions? Are there new calculative centers, which may reshape organizational power related to information management? Is there any role for accountants and finance professionals, more in general, to work with IT, data scientists and business leaders to extracts value from data more effectively? Do accountants and finance professionals play any role in leading or orchestrating the integration, interpretation, and usage of these multiple set of data? Do accountants and finance professionals require new expertise and forms of training? Recent accounting research observes the presence of professional boundaries and ‘enclosures’ that limit accounting practices (Kurunmaki and Miller, 2011) but equally accounting may be used to bring together

professional groups through enabling shared understandings of the value and potential usability of social media and Big Data resources.

3.3 Social Media and Big Data's Alteration of Information and Decision-Making Processes

The exploration of Big Data as a resource open the challenges of the impact on process related to its collection and analysis. A recent contribution by Gandomi and Haider (2015) highlights two macro-phases in the “Big Data process”. The first is *Data Management*, which is related to the acquisition of data, their cleaning, and their integration. The second macro-phase, *Analytics* is constituted by the modelling phase where algorithm are build and the interpretation stage where analysis are interpreted in relation to what is measure.

The analysis of this model suggested us to reflect on the importance of two additional macro-phases, which enable to place the decision makers at the center of the cycle. The first macro-phase is the *Exploration Setting*, where business opportunities and risks are screened to set an exploration theme, or business objectives, and where a control object is defined more specifically (see figure 4). For example, referring to the case of City monitoring, and referring to a city manager as decision maker, this phase should start from the city problems, such as pollution, traffic, immigration and then a more specific object to control is define, for example mobility of citizen during peak hours. Finally, the macro-phase *Action Observation/Interaction* is a typical element of the control cycle and it encompass the monitoring of the use of data during the action and the reporting to decision makers with all its behavioral implication.

Far from representing a comprehensive and positivistic guideline, the phases summarized in the model described above intend to highlight some of possible key challenges that practitioners and scholars in accounting may want to consider when addressing Big Data as a process. Starting from the first phase, exploration Setting, accounting has the tradition and competences for business advising but their current timid approach prevents in enlarging the scope of data that can serve business needs. In the world of Big Data what can be found is uncertainty hence competences about data and business needs have to be coupled. The way in which way this is done, or can be done in practice, is still unexplored and deserve a stream of research by itself.

As illustrated earlier in the paper, data management and analytics are instead more investigated although outside accounting. These papers are often technical without paying attention to the human and organizational dynamics that the incorporation of new competences and phases imply. Regarding the last phase of *Action Observation/Interaction* there is

abundance of studies about social media as a communication means, devoting particular attention at the individual level, while the corporate use of these technology enabled networks is still under investigated. Another area of development, transversal to the type of data, is the behavioral impact of the use of Big Data metrics. Although the use started to be investigated (Arnaboldi et al., 2016) there is a need to extend results with intensive exploration and extensive studies.

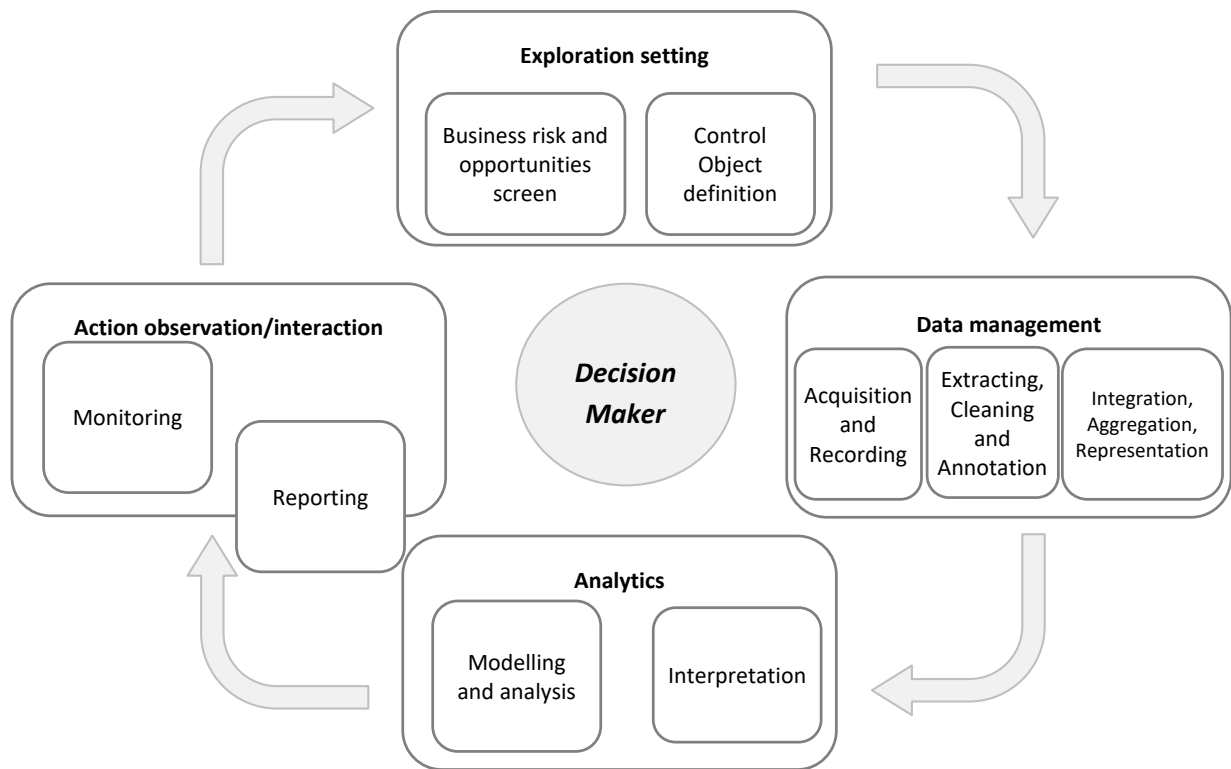


Figure 4 - Processes for extracting insights from Big Data

Here, it is important that research also takes a non-positivistic stance, investigating how Big Data, algorithms, and social media are leveraged to augment the already persuasive power of accounting numbers. One of the consequences of this process is the reduced space left to human judgment, which seems to be increasingly confined to the very last part of the relationship between the construction of knowledge and the actions that follows (Quattrone, 2015).

Accelerated and widened by the digital revolution, researching the fine line that unites the enabling power of accounting (Ahrens and Chapman, 2004) and the ambiguity and incompleteness of its representations (e.g. Dambrin and Robson, 2011) has been investigated

by accounting and organization scholars for some time. In this context, far from being treated as a mere tool for representing financial transactions, since Burchell et al. (1980) it has been clear that accounting information is often used for reasons that go well beyond a functional aid to decision making, playing multiple roles in organizations and societies (Hopwood, 1987). The literature has emphasised how accounting constructs realities (Hines, 1988), constitutes a technology of government and governmentality (Miller, 1990; Miller and Rose, 1991), and is a key element for the rationalization of organizations, societies, and whole economies (e.g., Miller and O’Leary, 1987; Suzuki, 2003a; 2003b). This is especially true when reality is complex, uncertain, and opaque, with accounting able to act as an instrument for legitimising organizational and social behaviour thanks to the apparent rationality of its calculations (Meyer, 1986; Carruthers and Espeland, 1991; Carruthers, 1995). Therefore, accounting, as much as finance, are ‘performative’: i.e., the data they produce, and engage with, are engines and not mere cameras within markets as well as organizations (McKenzie, 2006).

The performative role of accounting and Big Data creates and sustains a paradox in practice. If, on the one hand, it increases the belief into the possibility to improve rational decision making through better measurement and representation – a dream of full control where distance is cancelled, and databases and statistical models are relied upon to enhance transparency, predict individuals’ wishes and steer future actions. On the other hand, it augments uncertainty through the spurious correlations and incomplete connections that may emerge from the large amount of data that organizations are collecting, storing and confronting with (MacKenzie, 2014; Quattrone, 2015).

Drawing on studies exploring the construction of scientific knowledge ‘in action’ (e.g. Latour, 1987), a series of seminal papers (e.g. Briers and Chua, 2001; Robson, 1992) examined the fragile nature of accounting and explored their role as instruments for acting at a distance, which both enable control in large organizations and build an economic logic into management. More recent works have illustrated how accounting become a powerful system of performance measurement, not because of their supposedly representational ability, but because of their opacity (Dambrin and Robson, 2011), as well as the power relations they enact (Qu and Cooper, 2011), and also due to the organizational actions that their incompleteness generates (Busco and Quattrone, 2015). These articles contribute to the literature that emphasises the intrinsically incomplete nature of accountability (Messner, 2009; Roberts, 2009), management controls (Quattrone and Hopper, 2005), and performance measurement systems (Wouters and Wilderom, 2008).

Incompleteness of information can therefore be seen as having a positive (and not a negative) effect on managerial actions and organizational dynamics. Such incompleteness leaves room for debate over strategic courses of action due to the high uncertainty (Wouters and Wilderom, 2008), and fragility (Qu and Cooper, 2011) that surrounds accounting numbers (Meyer, 1986). Chennall et al., for example, have illustrated how the production of accounts has “the potential to provide a fertile arena for productive debate between the individual and groups who have different values” (2013, p. 269, drawing on Stark, 2009) and how it “can serve to ‘crystallize’ the compromise” among such different values providing them with transparency (Chennall et al., 2013, p. 270). These findings echo those in other works that have stressed how accounting (Davison, 2014) and other forms of visualizations, (e.g. engineering drawings, Bechky, 2003; business models, Doganova and Eyquem-Renault, 2009; power point, Kaplan, 2011), construct shared meanings and platforms of mediation to stabilise and mediate among diverse interests (Briers and Chua, 2001).

What could therefore be a possible role of Accounting and Big Data in the current digital revolution? As the etymology of the word ‘data’ reveals (from Latin datum), data are not only “given” to be used neutrally in decision-making but also “attribute” by those who produce and consume accounting data (Quattrone, 2015). In this context, politics, pressures, biases and the like all intertwine with figures, numbers, and digits moving individuals away from rational decisions. Therefore, rather than representing “answering machines” for the construction of accurate knowledge leading to rational choices, accounting and Big Data can offer and sustain platforms for achieving wise mediations among the different parties involved (Quattrone *et al*, 2016; Busco and Quattrone, 2015). Ultimately, reasonable, and not rational, choices are what institutions and organizations are after thanks to accounting and Big Data, whose digital revolution seem to offer an opportunity to question and imagine what we cannot know rather than reassuring us of what can be measured.

4. Special issue introduction

The papers included in this special issue engage with the three themes of the framework illustrated in section 3: new performance indicators based on social media and Big Data indicators; governance of social media and Big Data information resources; and, finally, social media and Big Data’s alteration of information and decision-making processes.

The first paper focuses on the governance of social media and Big Data information resource. Brivot *et al.* illustrate with a longitudinal qualitative analysis four frames of the

meanings and ideas regarding organizational control in social media namely Beyond Control, Subveillance, De-territorialization, Re-territorialization. In all cases managers, consultants or *guru*, look at social media and Big Data as an object to be (or not) controlled. The paper shows an instable situation where actors use their personal and professional thinking to frame and convince others. Although accounting is central to the notion of control, accountants are less present. They appear in the so called “Big Four” firms as consultants or in professional association claims, but they are almost absent within the organization where, instead, the field is taken by marketing and communication managers, ICT officers.

Accountants working in organization, excluding consultancy firm, are timidly observing the phenomena. This is also shown in the paper by Arnaboldi *et al.* that focuses on the governance of social media, and the emergence of hybridized boundary objects. Through a multiple case study analysis, the authors investigate the governance of social media as opportunity for organizational actors to change their occupational boundaries. Also in this paper accountants appear to be in the background. Other actors, such as Digital Officers, marketing and communication managers enter the territory of performance measurement constructing through social media information boundary objects, which are capable to connect and engage with such technology enabled networks top manager too.

Additionally, this paper contributes to another element of our framework, i.e. the inter-relationships between social media and Big Data and decision-making processes. Through internal detailed observations Arnaboldi *et al.* illustrate how information are processed and then used by managers in the organization, reverberating the performativity function of accounting in the digital era. Social media emerge as a hybrid boundary object, condensing knowledge from different organizational areas. In the two cases illustrated the owner of social media enter new organizational spaces, entering the performance management territory, and creating new centers of calculations.

These centers of calculation are deeply investigated in the paper by Agostino and Sidorova. The authors highlight the distinctive characteristic of social media as center of calculation and their “action at a distance”. Furthermore, this research shows how the boundary between inside and outside becomes blurred. Being open, social media are a source of massive information on actual and potential customers but, at the same time, they are a window on company information, directly, through brand messages and indirectly, through users voice. Although there might be asymmetry of information, as evidenced by Brivot *et al.*, indeed this open, multi-directional channel reshape how information are processed, stored and shared.

Within both studies accountants are timidly observing the unfolding of the events. And this contributes raising the question: which is the role of accounting and accountant the world of Big Data? This question is addressed by von Alberti-Alhtaybat focusing on corporate reporting. Her research investigates the role of the accountant in this context describing impacts and paradoxes through a direct engagement with actor participating in the process. Big Data are portrayed to be an opportunity for corporate reporting in view of their timing but also accuracy of information, for example regarding inventory valuation. Von Alberti-Alhtaybat complement this positive vision, more linked to Big Data as an object, with an analysis of the emerging paradoxes linked to the process. Similarly to Agostino and Sidorova, the firmer linked between outside stakeholder and inside managers is highlighted. Although it is true that asymmetry of information remains between outside and inside, Big Data and social media force organizations to revise their way of communication and the speed of their processes.

Reflections on communication and its directionality is at the center of the last paper by Manetti *et al.*, which explores the utilization of Facebook as a tool of dialogic accounting in philanthropic foundations. Studying official Facebook pages of the 100 biggest US Philanthropic Foundations, the paper analyses in details the contents of messages as well as the way in which organizations are capable to create and engage in a dialogue, and on which issues. Findings reveal a heterogeneous situation regarding engagement, but a general positive attitude towards commenting the contents offered by social media.

5. Final remarks

If many commentators – among consultants, professionals, and academics – are to be believed, we are currently in the midst of a technological revolution that will fundamentally change the way in which organizations, as well as individuals, operate and take decisions. Among other things, it is claimed that many knowledge-based jobs are being automated, as well as other transformed with, for example, data scientists ready to replace even the most qualified accountants. But of course, similar claims have been made before. For these reasons, accounting scholars, among others, are called upon to further explore the impact of technology enabled networks, such as social media and Big Data, on the discipline and the professions also in the attempt to separate the hype from reality.

Within this context, this paper intends to contribute to the setting of an agenda for researching the intertwined relationship between technology enabled networks and the accounting function and practice. With this purpose at hand, we have first reviewed the term

Big Data, and outlined some overarching implications for accounting and accountants. We then highlighted and discussed few perspectives that can assist researchers in framing the relationship between accounting functions/practices and the social media and Big Data phenomena.

In this process, and with the intention of outlining some of the possible research questions that might guide future studies, the paper identifies and illustrates three areas of investigation: new performance indicators based on social media and Big Data indicators; governance of social media and Big Data information resources; and, finally, social media and Big Data's alteration of information and decision-making processes. While the existing literature is still in its infancy, the proposed dimensions of research have been used to frame early studies as well as speculate on future areas of investigations. Notably, our intention was not to offer a comprehensive review, but rather to stimulate and open-up the debate in the field.

What could therefore be a possible role of accounting, accountants, social media and Big Data within the current digital revolution? While we leave future research to opportunity to address this question, we do not expect technology enabled networks to “close down” or discourage participation and process of interpretations in favor of readymade solutions. Rather, we expect accounting, accountants, social media and Big Data to “open up” to further elaboration and stimulate the search for decisions to be found by humans through further engagement and conversation. In this way, accounting and Big Data shall contribute to the decision-making processes by augmenting the capacity of humans to reflect, think critically, and then take wise decisions, rather than simply automating individual and organizational responses.

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