

The role of big data analytics in museums: balancing between contradictions and praxis

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1. Introduction

“Customer satisfaction by museums visitors increased by 2.6% in the months of January-May, compared with the same data in the previous year. Visitors are more satisfied than the previous year with reference to activities and events; accessibility, café and ticket prices are areas of improvement”

(Social media and web reporting on Italian State Museum, 2016)

Big data analytics provide new opportunities to integrate traditional reporting in the public sector with real time and user generated data. A number of papers claim this opening towards big data and analytics in public sector, entailing great improvement in completeness of information (Desouza and Jacob, 2014; Lavertu, 2016; Agostino and Arnaboldi, 2017; Matheus et al., 2018), timeliness of information and, finally, the value for decision makers (Arnaboldi et al., 2017; Janssen et al., 2017; Panagiotopoulos et al., 2017). However, empirical evidence is still limited. Many studies discuss in theory the potentialities of big data analytics (McAfee, A. and Brynjolfsson, 2012; Gandomi A and Haider, 2015; Azzone, 2018). Few studies have instead analysed the real implementation and use of big data within the public sector and the **connected management accounting change**. Available studies tend to focus on technical and analytical issues (see Sivarajah et al, 2017 for a recent review) leaving in the background a key feature for management accounting: information become knowledge only in the hands of users (Bhimani and Willcocks, 2014). This is not new to big data but it has worsened due to the increasing role of analysts and the obscure areas created by the complexity of the big data chain (Quattrone, 2016).

This paper endorses a different approach, putting users and their context as central in understanding the role of big data analytics in organizational processes. More specifically, we involved and observed top managers in the development of a novel integrated reporting based on traditional and big data. Empirically the research is based on action research with three Italian State Museum that participated in the design and experimentation of an integrated reporting. The three museums were chosen among the 30 Italian museums that received financial and organizational autonomy in a recent reform about museums, addressed as “Franceschini Reform”, upon the name of the Culture Minister that promoted it. The reform and these museums were put in the limelight by the government. In particular, for the first time, an international bid was put in place to enrol directors all over the world to lead the new age of these museums. Digital technologies, big data and analytics were put as an important pillar of the reform and one of the first tool provided by government was a social media monitoring tool aimed at providing real time data about the online reputation of each museum. The three museums we

investigated shared a similar context: they are in medium size cities, outside the major attractive touristic cities. Furthermore, they were not in the “top” ranking list of museums in term of visitors, sharing hence the challenge to increase their attractiveness. Within this context, this study explores i) the extent to which the normative claim towards a digital museum reflects reporting change in practice and ii) the nature of reporting change as an institutionally constructed process.

The study is informed by institutional theory that provides a precious lens for interpreting the results granting attention to the particular setting of the three museums. They are indeed shocked by two pressures relevant to see the contradiction of the digital age. On the one hand, they are pressured to put at the centre the service and the experience of users (Osborne, 2017), after decades where the key mission was the heritage preservation and visitors were often seen even “dangerous” for the museum. On the other hand, they are pressed to “go digital” and use digital information, in a setting where some “traditional” information, such as costs or heritage catalogue, are still not available in databases. Within institutional theory, we followed the theoretical stimulus of *contradictions* and *praxis* introduced by Seo and Creed (2002). According to these authors, *contradictions* within and between social systems create the conditions for embedded agents (individuals or groups) to recognise the potentialities of change. In particular, four types of contradictions (legitimacy, adaptation, intrainstitutional conformity, isomorphism) are identified as determinants for institutional change. These contradictions provide a fertile ground for individuals, to act on *praxis* and translate ideas into practices creating the conditions for change to occur: “praxis is the free and creative reconstruction of social patterns on the basis of a reasoned analysis of both the limits and the potentials of present social forms” (Seo and Creed, 2002, p. 225). The incorporation of the role of agents into institutional theory grants attention to both the external pressure but also to the internal dynamics, an aspect mainly neglected by traditional institutional theory (Lounsbury, 2008).

This theoretical perspective is coherent with the purpose of the paper to address the internal organizational response to an external normative pressure towards the novel and digital museum. Through this theoretical lens, this paper aims to move forward the notion that normative pressure creates the condition for decoupled management accounting systems. On the contrary, this study explores contradictions between different social systems generated by normative pressures and the nature and effects of reporting change as institutionally constructed process. *Contradictions* are here generated by the collapse between three main social worlds that characterize museums: bureaucrats, professionals and the newly appointed managerial roles (i.e. directors). These institutional contradictions stimulated reflections by internal actors who acted on *praxis* to introduce the integrated reporting, although crashing into novel contradictions about timing and competences.

The two-year interactions with the directors and personnel of the museums allowed to understand the complex set of relationships and activities that these museums are facing, changing the reporting and data, and interpreting their perceived utility. Two major findings emerge from the study. A first result is linked to the process of construction of the new reporting systems based on big data analytics, where three social worlds contradicted, while, at the same time, they provided a stimulus for change, shaping the new integrated report. A second result is the integrated report itself, where big data analytics are presented but considered as a minor area by directors given the emergence of two further contradictions: timing and competences. The former refers to the gap between the need for a real time activity and flexibility requested by analytics and the long administrative timing that characterize public administration. The latter refers to a gap in the required competences for managing analytics and reports. These resulted fragmented into a variety of roles making it difficult to realize an effective transformational practices.

These insights are unfolded throughout the paper that is structured as follows. First, available literature on big data and analytics in public sector accounting is presented. Then, the theoretical ideas of contradictions and praxis are discussed within the boundaries of institutional theory. Section four details the action research methodology, while section five shows the empirical evidence. Finally, some discussion and conclusions are elaborated.

2. Big Data analytics and the digital turn in the Public sector

2.1 Defining big data and analytics

“Personal Data is the new oil of the internet and the new currency of the digital world”. This sentence was pronounced by the European Consumer Commissioner, Meglena Kuneva, during the World Economic Forum in 2011 to underline the opportunities connected to the new asset of the so called big data. If during the industrial revolution oil was considered the key assets, nowadays the availability of big data and the computational capacity and competences (analytics) to analyse these data is considered as a driver for competitive advantage and social growth (La Valle et al., 2010).

Big data and analytics are the results of two phenomenon that have taken place almost simultaneously: data availability, and computational capacity and storage capacity to analyse these data. The explosion of web 2.0 has prompted the diffusion of novel technologies based on semantic web. Social media, sensors, internet of things and connected objects have favoured a real time generation of huge amount of data by users, hence prompting the creation of databases external to the traditional organizational boundaries. This has facilitated the diffusion of big data. Although a widely agreed definition about big data is still missing, they are usually defined with reference to their distinctive

characteristics: volume, velocity, variety, veracity, value and variability (Gandomi and Haider, 2015). Unlike traditional data, they are generated, not only from internal and proprietary organizational databases, but they are also generated by external sources, such as social media, sensors or open administrative databases. This heterogeneity of sources give rise to data variety, since data come in the format of number, text, videos, hyperlinks or photos; data velocity since they are continuously generated; data volume since the quantity of these data is incomparable with the past. In their original raw dataset, big data are noisy and unstructured, and with limited added value (Al-Htaybat and Alhtaybat, 2017).

Big data assumes value when they are analysed and the enormous data set is transformed into a final number usable to inform decision-making. This is referred to as “big data analytics” or simply analytics. As Chen et al. (2012) underlined, analytics refer to “analytical techniques in applications that are so large (from terabytes to exabytes) and complex (from sensor to social media data) that they require advanced and unique data storage, management, analysis, and visualization technologies” (p. 1166). Nowadays, analytics play a crucial role to value big data with software vendors such as Google, Amazon, IBM or Microsoft that are investing money to provide always more powerful software to retrieve, store and analyse big data. Big data have limited value if they are not associated with the computational capacity of transforming a dataset into usable information for decision-making (LaValle, Hopkins, Lesser, Shockley, & Kruschwitz, 2010).

2.1 Big data analytics in accounting and public sector literature

Big data and analytics have raised the interest of management and accounting scholars although their position is divided between supporters and more sceptical. On the one hand, proponents of big data and analytics have underlined the potentialities for accounting derived from the usage of these data. Potentialities range from timeliness, completeness and reliability of information. One of the former contributions on big data in accounting is that of Bhimani and Willcocks (2014), who underlined how big data favoured the development of different types on knowledge inside organizations and emphasises the big data potentialities for providers of accounting information. Following this wave, the opportunities offered by big data analytics to develop a better, faster and more complete knowledge of the environment have been theoretically discussed (Cao et al., 2015; Sneider et al., 2015; Warren et al., 2015). The paper by Al-Htaybat and Alhtaybat (2017) is one of the few empirical studies addressing reporting. The authors found timing (i.e. real time reporting), accuracy and the prospective nature of reporting (i.e. predictive analytics) as the main benefits of corporate reporting based on big data analytics. With a specific focus on financial accounting, some other scholars acknowledged the benefits for financial accounting for more transparent information (Teoh, 2018) or

for a deeper understanding of the strategies and practices of high-frequency trading in financial markets (Seddon and Currie, 2017),

At the same time, some other scholars have endorsed a more cautious and sceptical position. In this respect, Quattrone (2016) questioned the capacity of big data to inform better decision making. His study underlined the risk connected with a data driven society with accountants being fascinated by the dream of perfect information rather than posing questioning and being critical. Through an empirical investigation, Agostino and Sidorova (2017) emphasised instead the risk connected with the organizations being acted upon by customers and a control cycle in the hand of users.

If literature on big data in private sector accounting is flourishing, public sector accounting, although at a slow pace, has not been immune to this shift. Extant studies acknowledged the potentialities of big data for providing better insights for customized public policies (Azzone, 2018), more precise analytics for efficiency measurement of public services (Rogge et al., 2017), a more complete picture about service users perception (Agostino and Arnaboldi, 2017) or predictive values about individual users (Gamage, 2016). Also risks and threats have been underlined such as challenges for accountant professionals (Guthrie and Parker, 2016) or the difficulties of incorporating analytics in public affairs curricula (Hu, 2018).

This literature on big data analytics in public sector accounting provides us vision on the future of accounting for public institutions leveraging on a real time access to a complete set of information that are then transparently reported externally. Yet, the majority of these studies are conceptual and theoretically discuss potentialities or risks of big data analytics for public institutions. We have to date limited evidence on empirical implementations, adoption and uses of analytics in public institutions. This has favoured the emergence of a gap between the premise of big data and reality (Desouza and Jacob, 2017). This paper contributes to fill this gap by empirically investigating public institutions in charge of developing big data analytics, with a specific reference of an integrated reporting that joined traditional data with big data analytics. More specifically, we addressed a particular context of public administration, public museums, with an external imposed normative to adopt digital approaches of management. Within this field, we investigated the extent to which the normative claim towards a digital museum reflects reporting change in practice and ii) the nature of reporting change as an institutionally constructed process. These aspects are informed by institutional theory.

3. Theoretical framework

This study is informed by institutional theory with particular reference to the concepts of *contradictions* and *praxis* (Seo and Creed, 2002), which support a view of reporting change as a process that encompasses both institutional embeddedness and transformational agency.

Institutional theory emphasises the management accounting change as a process being shaped by external pressures for conformity and legitimacy (DiMaggio and Powell, 1983; Meyer and Rowan, 1977). Following this view, organizations adopt isomorphic behaviours to conform to external coercive, normative or mimicry pressures. In turns, accounting practices are often decoupled between formal practices ritually used inside organization to conform to the external environment and actual day-to-days routines and activities (Meyer and Rowan, 1977). Although the widely adoption of institutional theory in accounting studies on management accounting change, institutional theory has long being criticized for its main focus on the external environment, while underemphasising internal organizational dynamics (Burns and Scapens, 2000; Seo and Creed, 2002; Lounsbury, 2008). In this respect, Lounsbury (2008) opened for new directions in accounting studies informed by institutional theory by complementing the analysis of conformity and legitimacy with a more deep understanding of internal organizational practices:

“While not eschewing the structural insights of institutional analysis, this new emphasis on rationality and organizational decision-making entails a much more penetrating examination of actors and practices. Given a more intent focus on actors, one important new direction for institutional analysis is the study of organizational heterogeneity and practice variation” (p. 351)

This main limitation of institutional theory has prompted some scholars to integrate other theoretical perspectives centred on internal organizational dynamics into the main lens of institutional theory (e.g. Burns and Scapens, 2000; Burns and Baldvinsdottir, 2005; Ozdil and Hoque, 2017). In this study, we rely particularly on one of these perspectives: the theoretical concepts of *contradictions* and *praxis* proposed by Seo and Creed (2002). These authors provide a distinctive perspective on institutional theory by incorporating the role of transformational agents into institutional theory, enhancing an integrated view between external pressures and internal agency. According to Seo and Creed (2002): “institutional change is understood as an outcome of the dynamic interactions between two institutional by-products: institutional contradictions and human praxis” (p. 222). In particular, the process of institutionalization generate four main *contradictions*, which, in turn prompt a voluntary action for change by internal actors called *praxis*.

Contradictions “refers to these various ruptures and inconsistencies both among and within the established social arrangements” (p. 225). They arise when social relationships become

institutionalized over a long period. Four main *contradictions* have been conceptualized: legitimacy, adaptation, intrainstitutional conformity, and isomorphism. Legitimacy refers to the inefficiency generated by a decoupling between formal practices adopted to externally conform and everyday activities. This difference, over the long run, increase a technical inefficiency contradiction.

Adaptation is a contradiction generated when internal practices are so embedded and locked in, which are unresponsive to changes in the external environment. “This unresponsiveness creates a space where contradictions between those institutions and their external environment develop and accumulated over time” (Seo and Creed, 2002; pag. 228). Intrainstitutional conformity instead arises when different internal local contexts autonomously reproduce social interactions giving rise to interinstitutional incompatibilities between the different internal institutional realms. Finally, isomorphism occurs when the reproduction of institutional arrangements is not able to satisfy interests of all participants with their divergent interests and unequal power, generating tensions.

These *contradictions* are highly interconnected and can arise simultaneously or separately. The reaction by internal actors to contradictions is represented by *praxis*. This is the point where institutional theory is complemented with internal agency: the manifestation of contradictions stimulate internal actors to act and react to tensions of the institutionalised environment. Following Seo and Creed (2002):

“The development of social contradiction is a necessary driving force for praxis because contradictions enable a shift in partially autonomous social actors’ collective consciousness from a unreflective and passive mode to a reflective and active on” (p. 231)

Praxis encompasses three main features: actors’ self-awareness, actors’ mobilization and actors’ multilateral or collective action. The more actors experience tensions deriving from contradictions, the higher the likelihood that praxis increases.

In this study, we interpret the process of creating an integrated reporting in three Italian museums by relying on the notions of *contradictions* and *practices*. The main reason behind this choice lies in the possibility to investigate contradictions generated by a normative imposition and internal reactions by actors, hence entering the micro-dynamics of how and why embedded actors shaped by institutional structures are motivated and promote change in their organizations.

Unlike previous studies endorsing the notion of *contradictions* and *praxis* (e.g. Pace and Santos, 2010; Stoltzfus et al., 2011), this investigation is distinctive in linking the normative external pressure to conformity and legitimacy with the attempts and efforts by internal actors to promote change inside public museums. In this study, we pose the attention on one specific contradiction: intrainstitutional conformity, which favours a focus on the different institutional worlds that coexists inside museums:

professionals, bureaucrats and managers. As recently underlined (Abdullah et al., 2017) a particular feature of museums is the heterogeneity of objectives and involved actors. This is coherent with the investigation of contradictions generated by the different institutional worlds when an external pressure for management accounting change is put forward. Not only contradictions between the different institutional worlds are explored, but we also tackled the praxis by internal actors in addressing these contradictions, and effects on the development process of integrated reporting.

4. Research approach and setting

This study adopts an action research approach carried out between February 2016 and March 2018 in three Italian state museums. The choice of the action research lies in the possibilities to investigate a practical concern on the field acting with the studied organization (Eden and Huxham, 1996). This is particularly suitable to explore interinstitutional incompatibilities and praxis adopted by internal actors in their process towards the development of integrated reporting.

The action research methodology provides the main benefits of acting on a practical concern while at the same time addressing a theoretical problem (Avison et al., 2001). The practical problem addressed was represented by the development and experimentation of an integrated reporting based on analytics in three Italian museums following a normative pressure. The theoretical problem instead refers to the extent to which the normative claim towards a digital museum reflects reporting change in practice and the nature of reporting change as an institutionally constructed process.

The distinctive aspect of action research is the active involvement of researchers in the studied setting (Eden and Huxham, 1996). Both the authors were actively involved in the three museums supporting them methodologically in the experimentation of the integrated reporting. The entry point in the museums was one researcher who was contacted by one museum director asking for a methodological support in the process of developing the integrated reporting in the attempt to answer to the external pressure by the government. Once the agreement on the project was achieved between the researcher and the director, then other two directors facing the same issues decided to join the activities. This ensured a high commitment by the three museums directors and their staff during the entire duration of the project.

4.1 Data collection and data analysis

Various data collection methods were used: onsite meetings, interviews, observation, documents and archives, and external information (e.g. newspaper, websites and analytics).

The primary source of data is represented by face-to-face meetings. Five plenary meetings were organized between the research group and directors of the three museums. These meetings occurred at different stages of the research project: one at the beginning of the project to plan activities, three ongoing meetings to keep track of advancements and one final meetings. Moreover, a final public presentation to journalist was held to public disclose the main results of the experimentation. These meetings were particularly useful to share ideas on the new structure of the integrated report, gain feedback on the external imposed pressure and collect insights on the heterogeneous position of the three museums directors. Interviews and additional meetings were also organized in each museum, involving also museums staff. Head of each offices in each museums were interviewed with the purpose to gain a deep understanding of the local museums reality and to provide a better support for the report development. Moreover, data about workload of each employees were collected for the purpose of the report and this further supported individual discussions with the heterogeneous actors involved. These interviews were precious in gaining the perspective of curators, administrative staff, porters and catching their views on the field.

A further data source is represented by documents and archives of the three museums. These comprise public documents such as annual reports, sustainability reports, budget plans and strategic plan. Also internal confidential analysis were collected alongside internal strategic and organizational notes. Among the confidential material, also an ad hoc online tool provided by the central government to monitor online sentiment was accessed in each museum to grasp the content and structure of already available big data analytics for museums. Finally, external sources in the form of newspapers, web and social media data were collected during the entire period of analysis. These data sources provide a rich field material to investigate institutional contradictions and praxis in place to develop the integrated report.

The process of data analysis was highly iterative, going back and forth between empirical material and theory, generating a plausible fit between theory, problems and data (Ahrens and Chapman, 2006). One of the most well-known limit of actions research is related to its distinctive feature: the active involvement of researchers that can be a source of bias (Malina and Selto, 2001). To overcome sources of bias, we constantly verify data between researchers, confront data derived from different sources and compare empirical insights with available theory.

4.2 Research setting

The investigated context is that of Italian public museums, that underwent a significant Reform in 2014 to promote autonomy and digital turn in cultural institutions. The reform is called Riforma Franceschini upon the name of the Ministry who promoted it. The main content of the reform can be

summarized into two main points. First, public museums, for the first time in Italy, gained financial, scientific and organizational autonomy. This means that museums can now have a director with a strategy and a plan to be implemented. For the first time, directors of the museums are appointed with a public bid open worldwide with the aim to have the best managers for the growth and development of the museum itself. The second distinctive aspect of the reform is that the visitor should be positioned at the centre of the museum's strategy. Museums' activities should not be carried out for the museum itself, following a custodial approach, but audience engagement and attractiveness to a wider audience should be taken into account and become a priority.

Within this reform, the digital aspects, and big data analytics in particular, played a central role as underlined several times by the Ministry and its staff in public interviews and public documents:

The Italian Ministry of cultural heritage and tourism (MIBACT) is putting at the centre communication and promotion offices of museums. The Ministry can, in this way, enhance the creation of an online network of Italian museums leveraging on web and social media campaigns, gaming and leisure activities on the web to engage a wider public on museums and cultural heritage sites" (Musei Italiani, 2014-2017)

The importance of the digital turn was also rendered visible with two main concrete actions by the central government. The first action was a strong promotion of social media usage, with the cultural direction of the central government opening social media pages on Facebook and Twitter and promoting social communication with the #museitaliani. This was intended to create an online community between the online audience and the network of Italian museums.

Second, a concrete analytical tool was developed by the central government and rendered available to each autonomous museum. The tool consisted of a digital platform that, upon registration, provided a real time and detailed view of online engagement, sentiment and content of audience of museum. Alongside the individual access by museums, also a comparative report was annually rendered available to the general public ranking museums on the basis of a synthetic index derived from a combination of the big data analytics calculated (see Figure 1).

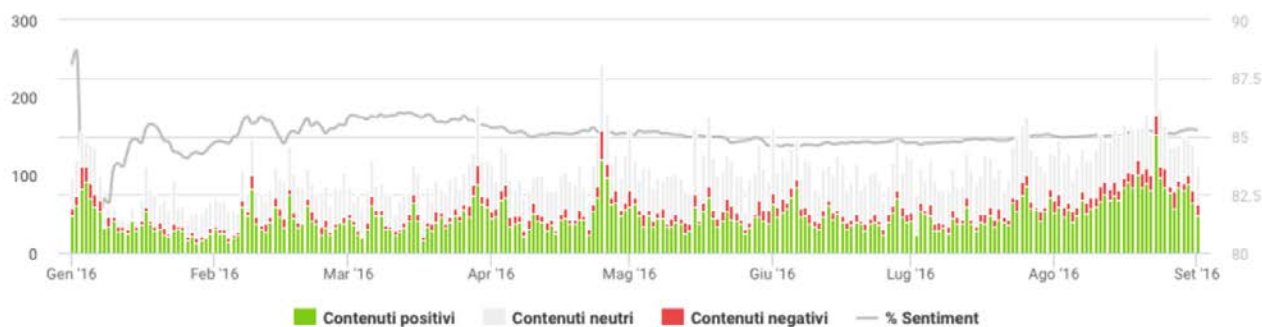


Figure 1. Example of analytics provided by the online tool by the central government

At the beginning of the Reform in 2014 museums with autonomy in Italy were 20, which became 30 in 2018. In this context, we actively engaged with three museums, supporting them in the process of developing an integrated big data analytics report in line with the external normative pressures.

The three museums are located in different areas in Italy, with different types of collections and dimensions. However, they all share some common features. First, they are not ranked as the most visited museums in Italy, posing the issue of audience engagement as a central aspect. Second, they are not located in the most famous Italian touristic cities, again posing the issue of attractiveness as crucial.

The three directors of the museums, according to the Reform, were newly appointed at the end of 2015. They had a similar background covering managerial positions in cultural institutions worldwide, while having a deep expertise in cultural heritage. This was a crucial aspect to move away museums from the traditional view of custodial approach.

The motivation behind the interest of the directors in the action research project was similar: to account externally for their managerial capability to increase audience engagement and attractiveness, but also to have some accounting tools to inform better decision making. Within this context, the development of integrated report, while addressing an external imposition, was also useful to develop accounting practices for internal management.

5. Findings

This section reports the main findings of the empirical investigation. They are divided into two main sections. First, interinstitutional contradictions emergent from the normative pressure are discussed with a focus on the organizational response to the external pressure for developing the integrated reporting. At the organizational level, different social worlds characterising museums became visible and collapsed: professional, bureaucrats and managers. The second section of results highlights the

praxis adopted by internal actors and the effect on the development on the integrated reporting are presented.

5.1 Internal institutional worlds and the emergence of intrainstitutional contradictions

The normative pressure of the Riforma Franceschini instilled a sense of urgency for the newly appointed museums directors to develop an integrated reporting based on big data analytics to account externally, but also control internally, the efficiency and effectiveness of their activities. Several joint meetings were organized between the research group and the directors as well as individual meetings in each museum with the different organizational roles in charge of identifying, collecting, organizing and interpreting the required data for the novel reporting.

The process of creation of a new integrated reporting immediately raised intraorganizational contradictions in the three museums with different social worlds that collapsed and conflicts when in charge of interacting for the development of the new report. Intraorganizational contradictions refer to the emergence of paradoxes between different social worlds presented at that time in museums: the bureaucratic worlds, the professional world and the newly managerial worlds.

The bureaucratic world is represented by the traditional “old style public administration” preoccupied for ensuring compliance to external requirements and respecting deadlines and external requests. This mainly corresponds to administrative personnel in charge of preparing and delivering documents to the central government to satisfy external requests, without questioning the content or reflecting on the collected material. These sentences provide a snapshot of the typical bureaucratic roles for museums:

“The director asked me to ask feedback to the audience at the end of their visit filling a customer satisfaction survey. But in my contract, this is not written. I cannot do this.” (Porter, PD).

The professional world is the ancient role inside museums: that of curators. They are focused on the tutorship, curatorship, maintenance and restoration of arts collection and heritage assets. Their main purpose is enhancing the value of the collection, without posing the attention on visitors or external accessibility to the collection to a wider and more generic public. They know every single detail of each art piece inside the museum and their main preoccupation is the preservation and knowledge sharing by peers. Their higher but niche expertise was visible in these quotes:

“Look at this [pointing at a book of around 1000 pages]. This is the main result of our two years activities: we have scanned our collection, inserted the pictures here and provided a very detailed technical description for each

of them. Now you can come here, purchase the book and access to each of this single details that were previously dispersed” (Curator, MRT)

The detailed and niche language used by professional is also visible in the description of operas. This is one example of sentence used to describe a painting:

“The work shows the debt to Michelangelo's mannerism in cold chromatic tones and in the complex and crowded composition, played on the overlapping of planes. The patheticism of the figures can be traced back to the climate and the new rules of the Catholic Counter-Reformation”

The managerial world is the more recent world emerging in museums, formally introduced with the Reform Franceschini and mainly visible in museums directors. This world endorsed a more business oriented approach, being preoccupied by fundraising and balancing records, attractiveness and visitors' satisfaction. The managerial style of museums' director appeared in some of their sentences:

“I've decided to rent [*Name of the museum omitted*] to obtain additional funding. I've been criticised internally by curators, but I had no choice to complement the reduced funding if I wanted to financially survive” (Director, PD)

“I decided to introduce a duck, the royal duck in my museum, as a game on Facebook, to create awareness and engagement around my activities. It might look as an activity with limited cultural value, but this is not true. It was a more accessible way to let the museum known to the wider public. Social media are widely accessed by everyone and, Facebook especially, allowed us to enter a new target of potential visitors” (Director, PRG)

“Fundraising and audience enlargement and engagement are my priorities. I'm hardly working on these issues with the establishment of open cinema in the main square of the museum during summer nights. This is a way of attracting people for a different event, but let them know that the museum has a cultural offer as well” (Director, MRT)

It is important to underline that the division between these different worlds was not sharply defined. It is here presented as the major institutional reference for the organizational actors of the museums. Since the establishment of the directors in 2014 until the beginning of the project in 2016 these worlds mainly co-existed and lived independently from each other. The need to create a new integrated reporting forced these different worlds to interact with each other in the pursuing of the new structure of the report. While reflecting on these issues, contradictions emerged. More specifically, contradictions emerged in two main phases of the process of creation of the integrated reporting: identification of indicators and data collection.

When defining the areas of the integrated report and related indicators, the three worlds conflicted with reference to the importance of the performance dimensions and their relative measurability.

With respect to the importance of performance dimensions, this dialogue provided some interesting insights:

“We should include also data about why the audience does not come to my museum. In addition to the perception of our audience gained with analytics, we might think about collecting data on the reason why people prefer to go somewhere else rather than here.” (Director, PD)

“I do not think this can be feasible. If I remember correctly, we do not have this data in the requested document to fill for the ministry nor in the online tool” (Bureaucrat, MRT)

“But this is not our role, we have to enhance the value of our arts collections, develop further studies about them. Potential audience should not be our preoccupation” (Professional, MRT)

Contradictions also appeared when in charge of data collection with discussions on data availability, data usefulness and data meaning. This was a discussion during an internal meeting at museum PD with reference to data collection about engagement of visitors derived from social media data, while looking at numbers showed by the online tool and social sentiment:

“Researcher: these analytics are interesting. You can see, not only your position, but also the ranking in comparison with the other museums. How do you use these data?”

Bureaucrat: “to be honest, I just periodically enter the system and extract some data when the director has to report its activity to the journalists.

Director: “The system is interesting, but I have so many things to manage, that I have no time to enter and analyse also social media analytics”

This exchanges show a conflicting situation with the availability of data analytics, but some scepticism about its usage. Contradictions between the different social worlds emerged also with reference to data interpretation once some preliminary data from the integrated report were showed. When discussing the online network of the three museum derived from social media analytics (see Fig. 2), different reactions were visible:

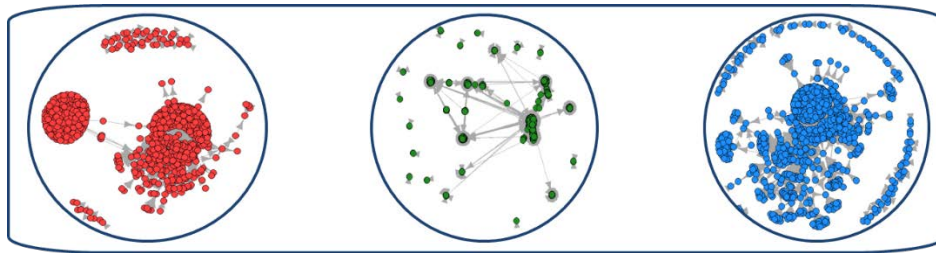


Figure 2: Insight from integrated reporting. Network of social media users of the three museums

Professional: “These analytics are nice, but we are posing the attention on analytics and the network of online audience when internally we are still struggling with the creation of online databases for our heritage assets”.

Bureaucrat: “This is true. We received this opportunities by the Ministry. We are in the limelight to become digital and modern, but every month I prepare data for central government on paper because this is the governmental format for official data communication”

Again, these quotes underlined mixed feelings between the desire to discover more insights and the worries of not being able to manage the new integrated report.

5.3 The praxis in the path towards the new integrated reporting

These contradictions, although with some nuances, were visible and present in all the three museums. As underlined by Seo and Creed (2002), contradictions did not slow down or stopped the path towards report development, but stimulated different praxis by museums directors to survive and achieve their aim of creating the report. The praxis adopted differ from one museum to another. These include overlapping, separation and substitution.

The praxis of overlapping was adopted by MRG as the response to its internal contradiction between the different social worlds. Tensions between professional bureaucrats and managers stimulated the director to overlap the three social worlds into one unique leading role: that of manager. She became the unique reference point for the development of integrated report, asking spot some “decontextualized” requests to bureacrats and professional. She was the unique role in charge of reflecting on data to be included, accessing the reports and asking others for additional data collection, but without engaging them in the larger picture of the integrated report. This resulted into a quite fast validation of data and performance dimensions to include in the report, but, in practice, a very limited access to information and insights provided by report. She was so engaged in urgencies deriving from

the central government and everyday management of the museum that the integrated report and analytics became of secondary importance. She commented:

“My primary activity is solving problems. The staff and my colleagues call me when problems arises.

And I’ve never been called for problems deriving from analytics because we sentiment on social media dropped down. Urgencies are related to the management of infrastructures, strikes by the staff, or similar stuff. These are my major concerns.” (Director, MRG)

The opposite praxis was that of separation, adopted by the director of MRT. She was instilled by internal contradictions, but praxis was stimulated by creating a rigid separation between roles and their competences in the path towards the creation of the novel reporting. This implied a fragmentation of activities between the different roles involved with bureaucrats in charge of collecting data, if in line with the external rules, managers in charge of accessing the system and looking at the data and professionals again, in charge of collecting additional data. This facilitated the diffusion of a common vision about the importance of integrated reporting, pushing towards an interest of one institutional world into the activity of one another. A joint meeting between the different roles was organized, with researchers coordinating the activity of data collection. Their field of expertise, although the separation, become fused while discussing as evidenced from this dialogue about the collection of the workload devoted to internal activities:

“We need to insert the time we spent on internal activities distinguishing between communication, administrative, services, IT management...look” (Professional)

“This is useless since we have an organizational chart with role. We have to follow that one. Why collecting this data? (Bureaucrat)

But the professional, who entered the managerial logic replied:

“There might be some differences between the formal organizational chart and your everyday activities. Moreover if we compared the time devoted to activities with results generated we can better demonstrate how much we do with a few people”

Quite surprisingly, separation favoured discussions and hybridization between the different social worlds. This resulted into a shared discussion about analytics and their insights.

Finally, the director of PD adopted the praxis of substitution without dividing roles nor overlapping them into a unique figure. On the contrary, he addressed the major problem about lack of time with the idea of substitution:

“I have your same problem: I have no time. I cannot enter the detail of everything. Every day we receive a new request by the Ministry, a new internal complaint. Moreover, we are under mediatic pressure for being ‘favoured’ in our activity. The only way to survive is to delegate some activities to competent people. I have a very good curator and a good administrative support. They help me in these activities” (Director, PD).

In practice, this translated into an interchangeable role between the director, the professional and the bureaucrat. When collecting data or discussing about indicators to collect, our reference spokesperson changed depending on the internal urgency of that moment.

5.4 The integrated reports and novel contradictions

Joint meetings with the research group, internal meetings within each museums with their internal roles resulted into a final integrated report that was officially internally presented and discussed at the end of the project. The integrated report includes both financial and non financial data as well as big data and analytics. It looks like a dashboard comprising static data about the year 2017. It is constituted by three main performance dimensions of efficiency, effectiveness and impact.

Efficiency quantifies the ratio between input and outputs following an activity based management approach. It does not contain big data analytics, but it was considered useful to quantify the employed internal resources in comparison with the output generated by the museums (i.e. exhibitions, opening hours or additional services for the audience).

Effectiveness quantifies the perception of the services provided by museums with data about the satisfaction of visitors. This includes both non financial data from customer satisfaction surveys, but also analytics from Facebook, Twitter and Instagram over the 2017 time horizon. These analytics provide a view about the sentiment of users, the content, the location of users (if provided).

Impact quantifies the social contribution of the museum measured both with non financial data about the network of relationships, but also with reference to the virtual network of relationships between museums and its followers. Analytics in this case, were obtained by Twitter, constructing the network of users, quantifying their connections and identifying the influencers.

When showing these results, reactions by directors were mixed including satisfaction and interest, but also resignation and discouragement. At a first sight, directors enthusiastically welcome the new integrated report:

“This is a really interest result. For the first time we have numbers that confirm our perceptions. They can useful for me to think about new actions and initiatives to improve my position. But I can also use these data with journalists and the public opinion who always provide distorted information. I’m really satisfied (Director PD)

“What I appreciated the most is the simultaneous presence in a unique document of different performance dimensions. We have data on our internal staff, data from customer satisfaction, but also data on our online presence and online network and engagement. We have a complete picture of ourselves” (Director MRG)

“This is a big step towards social reporting for external communicating the big effort and contribution we made to society” (Director, MRT)

After the initial enthusiasm, also some doubts and discouragement were rendered visible with particular reference to the everyday usage of the system and data interpretation. With reference to the everyday usage of the system, the main comment was about the maintenance and updating of the system.

This aspect surfaces a novel contradiction about timing with a gap between the need of the integrated report to act fast and being aligned with the real time activity of the network and the length of the administrative procedure.

“The big data analytic side of the report is fascinating and insightful, but real time data to be used need to be showed real time to take immediate action. Inside our museum, we are not ready to work real time. We are slow, administrative times are slow. The regulation is asking us to become digital, but they send us requests on paper and they ask three times in a year the same data on revenues in different format.” (Director MRG)

“You are right. I’ve autonomy, but just on some issues. I receive almost everyday a new data request by the central government. Data are open, data are already available, but still they increase the amount of data they’re asking us. The movement towards a real time reporting is too much for us in this moment. We are not ready not because we do not want, but because the central government does not give us the instruments to became fast and flexible” (Director MRT)

Also data interpretation gave rise to further reflections and led to the emergence of a *competences contradictions*, not lastly because of the impossibility for museums directors to hire personnel (who is instead nominated by the central government):

“I’m not convinced about the inclusion of social media data and online data. They are useful and provide nice insights, like the identification of influencers or the most engaging online posts. However, they are not of immediate comprehension as a financial data or a likert scale about customer satisfaction. If I ask for a financial data, almost everyone inside the organization can retrieve and interpret correctly my request and the data retrieved.

It is not the same for big data analytics. They are subject to multiple interpretation and I have not a big data expert that can mediate between the different internal roles to collect and explain these data” (Director, PD).

“My main worry is even more basic. How can I introduce this system in my organization if my internal staff in front of a pdf file, cannot use the ‘round view’ bottom to turn the picture in the right position? I need to be honest: this report is really nice, but I do not have internal people to run the system autonomously” (Director MRG)

“This is not my situation. I have a devoted staff to communication. They know social media, big data and analytics very well, but they are not in charge of report. Reports and data analysis are in charge of the administrative staff, but the national regulation assign them the functions of financial data reporting and communication to central government. This is not in their realm of competences. I need to think about who should be responsible for this; it is something in between communication and administrative office, but we do not have transversal roles” (Director, MRT)

These results highlights interinstitutional incompatibilities that create the opening for management accounting change and the praxis that support how the new integrated reporting is carved out. But, at the same time, posed the attention on new emergent contradictions: timing and competences. The next section further discusses and interpret these results.

6. Discussion and conclusions

Recent years have flourished with discussion and commentaries on the potentialities of big data and analytics for public sector reporting, highlighting an improvement in timeliness, completeness and transparency of the information alongside faster and better-informed decision-making process (Azzone, 2018; Agostino and Arnaboldi, 2017; Rogge et al., 2017). Although this enthusiasm towards challenges for public sector reporting, also more critical positions are appearing (e.g. Quattrone, 2016; Desouza and Jaboc, 2017). However, within this fast moving world of analytics, we have to date limited empirical evidence about how big data analytics are applied in practice and the usefulness of integrated reporting based on big data and analytics for public institutions. This paper addresses this gap by investigating the emergence of a new integrated reporting based on analytics in a set of three Italian museums that are facing with the challenge of digitalization. By adopting institutional theory and the concepts of interinstitutional incompatibilities and praxis (Seo and Creed, 2002), this study provides insights into reporting change as a process that encompasses both institutional embeddedness and transformational agency. This study highlights interinstitutional incompatibilities between professionals, bureaucrats and managers who, despite the normative impositions, crate the potential for change. Three main praxis are adopted by mangers, including overlapping, separation

and substitution. These praxes provide evidence on how and why reporting change is achieved in a highly institutionalized environment and the extent to which the new reporting system shaped and is embedded in an incompatible interinstitutional context.

The intent of this study is not to test institutional theory nor the propositions by Seo and Creed (2002). On the contrary, institutional theory and the concepts of praxis and interinstitutional incompatibilities are used as a lens to interpret empirical findings.

Results show the process towards the creation of a novel integrated reporting based on big data and analytics. The integrated reporting was the result of a socially constructed process where external normative pressure interplayed with internal contradictions and incompatibilities shaping the structure and usage of the report itself. Interestingly, the integrated reporting does not result into a formal compliance with a decoupling between external requests and actual practices. On the contrary, the integrated reporting was pushed by external requests, but also reshaped by internal praxis embedded into a highly institutionalized context.

Moreover, the process towards the creation of a novel reporting facilitated the emergence of interinstitutional contradictions that, unlike obstructing the management accounting change, provide a stimulus for actions for directors. Directors unfolded different types of praxis (i.e. overlapping, separation and substitution) to foster accounting change and the movement towards this novel reporting.

Although their efforts towards the creation of the new reporting, two novel contradictions emerged: *time incompatibilities and competences incompatibilities*.

Time incompatibilities referred to the discrepancy between the need to work real time proposed by integrated big data reports and the off-line and deadline approach that characterises both museums and the external environment. Time incompatibility occurred at different levels: interinstitutionally and intrainstitutionally. Time was found crucial in catching the main benefits of big data and analytics with reference to data collection and reports in real time. By looking at data and reports real time, it is possible to take actions immediately and move towards a faster and timely decision making process. Yet, the time feature of integrated reporting was found incompatible interinstitutionally since museums activities and actions are paced by deadlines defined by external impositions and the majority of actions cannot be implemented without an authorization from the central government. In turns, interinstitutionally time incompatibility is reflected internally with administrative and professional, and also managerial roles that organize their activities on the basis of externally imposed deadlines. This reckons the old style bureaucracy that renders very difficult a real exploitation of the potentialities of real time decision-making offered by novel technologies.

Competences incompatibilities instead refer to the internal struggling for giving a meaning to novel data. If big data and analytics initially raised the attention of managers (although far less that of bureaucrats and professionals), when in charge of collecting, reading and making sense of the reported data difficulties appeared. Also managers found it difficult to grasp the methods behind data collections and the meaning associated with the reported data. This poses question on how to organize internally the accountant role in charge of the integrated reporting. Our results show that museums accountants were in charge of financial and some non-financial data, limiting their activities to those requested by normative deadlines such as expected revenues, costs, opening hours or number of visitors. They did not perceive any sense of urgency nor interest in moving their effort beyond those aspects required by the law. At the same time, also directors faced some difficulties in identifying who is responsible for monitoring and organizing these novel data: in one museum, it was the communication office, in another museum, a different roles depending on the workload of the moment, in another museum, the director herself. This empirical insights show some confusion on the correct organizational role in charge of integrated reporting, with some museums preferring a communication role and some others without having particular preference. This aspect, on the one hand, further corroborates the doubtful role of accountants in the digital turn and big data era (Guthrie, and Parker, 2016), but at the same time calls for a reflection on how to integrated different competences for big data analytics in public sector reporting.

This study contributes to existing accounting literature along three main lines.

First, it contributes to the emergent literature stream about the role of analytics in public sector accounting. While the majority of the studies on analytics and big data conceptually discusses about benefits and pitfalls of novel dataset and reporting, this study provides an empirical application of analytics in public sector accounting, by showing time and competences contradictions as major challenges for public institutions in charge of endorsing integrated reporting. This insights moves forward the debate on public sector reporting in the big data era questioning whether current public administration with their old style approaches to management are ready for the digital turn in practice. Further studies in other countries and other field can contribute in understanding the readiness of the external public environment in supporting and favouring the change towards big data and analytics. The main risk remains a gap between external pressures towards big data adoption in the public sector and the impossibility for institutions to exploit this possibility.

Second, this study contributes to institutional theory by evidencing a distinctive example of management accounting change resulting from institutional embeddedness and transformational agency. Although an external pressure for management accounting change, the organizational response moved beyond formal compliance, but, stimulating interinstitutional contradictions, praxis was

stimulated for effective change. Our theoretical perspective enlarges the literature in moving beyond the traditional view of management accounting change as an isomorphic response to external pressures (Di Maggio and Powell, 1983) towards a reflection on the implications of the interplay between internal organizational dynamics and external pressures in shaping management accounting change (Burns and Baldvinsdottir, 2005; Ozdil and Hoque, 2017). In particular, our study shows that external pressures for change stimulated internal contradictions and conflicts between different social worlds, that, in turns, provides a stimulus for praxis and action for change. In contrast, to previous institutional theory, our study found that external pressures do not necessarily result into an isomorphic behaviour, but they can provoke praxi internal change when internal contradictions are accentuated. In the empirical setting, although internal contradictions were differently managed, all the three museums arrived at a final integrated report.

Finally, this study posed the emphasis on the complexity of accounting in museums and arts institutions, by proposing some reflections on the influence of heterogeneous institutional worlds that coexist and, sometimes contradicts, inside museums on accounting practices. Some recent studies have showed a different usefulness of measures in museums depending on the influential group they serve and the risks of adopting private style performance measures in a context where not all the activities can be measured (Abdullah et al., 2018). This study enhance the debate about accounting and accountability in museums posing the emphasis on the usefulness, opportunities and problems connected with the exploitation of big data analytics in this field.

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