

Big Data Analytics in the arts and cultural industries: implication for cultural economics, policy and management

Massimiliano Nuccio¹ and Enrico Bertacchini²

ABSTRACT

The big data revolution is dramatically affecting the way we approach consumption and prompt innovation in design, production and distribution of goods and services. There are many ways a big data approach can be used to create value across sectors of the global economy, but its main contribution to individuals and organizations is to better inform their decision-making. Nevertheless, the creation of strong data driven ecosystems seems slow and different barriers limit their outbreak in business, public administrations and, even more, in the cultural and creative industries.

The aim of this paper is to explore and discuss how big data analytics affect innovation and value creation in cultural organizations and shape consumer behaviour in cultural heritage, arts and cultural industries. From a cultural economics, management and policy perspective we identify three main implications. First, ICT and mobility have exponentially increased opportunities of customer engagement and empowerment, creating new landscapes for cultural consumption. Second, the combination of gamification, loyalty programmes, augmented reality, and analytical techniques (social media and web analytics, semantic analysis, predictive analytics) allows organization to match more effectively patterns of consumption and eventually to create value from harvesting and processing information. Cultural organizations are encouraged to review their traditional business models and reconsider pricing and fundraising strategies as well as customers loyalty schemes. Finally, big data analytics set relevant challenges to policy makers as to the way to design cultural policies and to deal with privacy issues.

Keywords: big data analytics, cultural economics, cultural management, innovation

¹ massimiliano.nuccio@unito.it Department of Economics and Statistics and Despina Big Data Lab, Università degli Studi di Torino

² enrico.bertacchini@unito.it Department of Economics and Statistics Università degli Studi di Torino and EBLA Research Centre

Introduction

Since a few years the notion of Big Data has become central to explain the dramatic impact of the digital revolution on economies and societies at the global level.

Giving the recent increasing popularity of data-driven decision-making and considering the fact that technological tools will only get better and user-friendlier over the years, big data can be considered an important tool for cities, cultural organizations and museums in their constant quest for transformation and growth.

This relatively new approach has proven to be effective in both the private and public sector; organizations from Google and Netflix to Target and the 2008 Obama re-election campaign have collected and analyzed countless terabytes of data about consumer or constituent behavior to make better decisions about what movies to recommend, what products to market, or what email subject-line to use to entice their targets to contribute. Yet, the arts and culture sector seems to have stayed behind both in application and theoretical elaboration.

As discussed more in depth in the next paragraph, “big data” is not simply about the opportunity to access and exploit a larger quantity of information, but implies a disruptive change in the mindset of organization towards a data-driven economy and society.

Despite the technological dimension is only one aspect of big data, we adapted Bakhshi and Throsby’s (2012) conceptual framework on new technologies in not-for-profit arts organizations to analyse the innovative potential of a data-driven approach in cultural and creative industries (CCI).

This paper aims at closing a huge gap in the academic literature showing the contribution of a big data approach in cultural economics, policy and management both from a theoretical and practice-based perspective.

The paper is organised as follow. First, we define big data according to the relatively scarce literature and best practices and we present its allegedly revolutionary impact. Second, we present the innovative potential of big data in CCI by adopting the four categories introduced by Bakhshi and Throsby’s (2012), namely innovation in audience relationship, innovation in business models, innovation in product development and innovation in value creation. Some best practices are presented

for each of the four categories. Third we underline the possible limitations and risks of such an approach. Eventually we suggest a roadmap to implement an effective big data strategy in CCI both at the micro and macro level.

1. What's new with Big Data?

The definition of Big Data is still in evolution and controversial since it is the result of different disciplinary contributions.

This term started circulating freely in the early 2000s (Chen, et al., 2012), making its first appearance in articles and publications in 2008, though the very first signs of its usage can be traced back to the 1970s (Ularu et al., 2012). At the beginning of e-commerce Laney (2001) had proposed three challenges for data management , which have since been co-opted as a key definition based on the celebrated “three V’s”: Volume, Velocity, and Variety.

Volume refers to the quantity of data a company or institution manages to gather (Ularu et al., 2012): in particular we talk about great agglomerations of data, too big and far too complex to be used in their raw form. It's clear that, as the standard methods are not enough, it becomes necessary to make further improvements in the management and the deciphering process of these humongous sets of data, even in terms of software innovation and capacity building (Lilley and Moore, 2013; Chen et al., 2012).

Variety relates to the multiple types of data that are stored in the archives and that make up big data in general (Ularu et al., 2012). This concept can be read from two different perspectives: on the one hand, it seems incredibly difficult, if not impossible, to predict the infinitely different potential interactions between such big dataset, as well as all the possible combinations of data within those same dataset.

Velocity is about how fast data can be collected and then processed (Ularu et al., 2012): the speed at which data are gathered is continuously increasing (Bughin et al., 2010), often too much for analysts to be able to keep up, which at the end of the day could mean that the major part of the information collected will be wasted for lack of processing time or capabilities (LaValle al., 2011). However it has to be noted that the process of technology and software innovation (Schmarzo B., 2013),

as well as personnel formation, is also picking up speed, while costs for accessing the IT support needed to analyse data are steadily dropping; this means that the whole decoding process is gaining both speed and accuracy, and the risk of throwing away valuable resources is consistently getting lower.

In some views a fourth key characteristic of big data can be added, that is veracity (Ularu et al., 2012). It essentially refers to the “trustworthiness” of data, the level of accuracy and truthfulness with which the data reflect reality. Regardless of it being a key characteristic or not, it is extremely important that the data gathered are as complete and as close to the truth as possible (Kwon et al., 2014), for it will make it easier for business analysts and managers to use the information to implement successful policies.

Given the intensive use of technology, software vendors play a relevant role also in shaping the paradigm. Oracle (2013), for example, avoids employing any V’s in offering a definition, and, instead, contends that big data is the derivation of value from traditional relational database driven business decision-making, augmented with new sources of unstructured data. Such new sources include blogs, social media, sensor networks, image data and other forms of data that vary in size, structure, format and other factors.

The existence of multiple, ambiguous and often contradictory descriptions of the term led Ward and Barker (2013) to search for a concrete definition in order to eliminate ambiguity and to further research goals. They found three points of similarity among the various definitions of big data: (a) size: the volume of the datasets is a critical factor; (b) complexity: the structure, behavior and permutations of the datasets is a critical factor and; (c) technologies: the tools and techniques which are used to process a sizable or complex dataset is a critical factor.

Building on this perspective, we claim two major dimensions which make a big data approach fruitful in applied research and particularly useful also to advance knowledge in the CCI. First, it is expressly conceived to deal with complex systems and describe different and conflicting aspects of human behaviour. It has been often remarked that CCI are quite distinctive for creating and combining values from at

least three sources which can be social, economic and cultural (Throsby, 1999; Klamer, 2004; Hutter, 2008).

Second, and strictly connected to this, big data is not merely a set of advanced techniques to analyse quantitative information. As we mention in the next paragraphs, it has strong epistemological implication shaping the attitude we interpret social phenomena and comprehend their mutual relations. It must be clearly stressed that big data is not a framework only for nerds and computer scientists, but a truly multidisciplinary field of investigation. Although technological knowledge and skills are necessary to implement data management and computation, its explanatory power would be much limited without expertise in statistical-mathematical sciences -to develop and implement algorithms and plan robust experiment- and social scientist able to formulate relevant questions and to effectively interpret results.

2. Conceptual Framework

Technological innovation has historically shaped markets of artistic and cultural products by triggering new forms of cultural production and consumption patterns. For example, Bakkers (2014) has shown how technological innovation in the long run have contributed to the reduction of exogenous sunk costs of creations and experimentation in entertainment industries, influencing the dynamics and strategies of firms in this sector. In a similar vein, Potts (2013) highlights the multiple effects of the introduction of new technologies on cultural consumption, such as changes in relative prices of products, increased variety and new induced preferences.

Considering big data analytics as a novel application of digital and ICT technologies, there is however little work in cultural economics addressing in a comprehensive way how the adoption and diffusion of new digital and networking technologies such as Internet have affected the structure and activity of organizations in the arts and cultural sector (Handke et al. 2013). Conversely, more insights of the impact of digital technologies on the production and dissemination chain of cultural products can be found in organization theory and management

literature (i.e. Hirsch and Gruber, 2015), but without a special focus on the emerging challenges posed by big data.

In order to better understand the impact of big data analytics in cultural markets we then propose to rely on the conceptual framework proposed by Throsby and Bakshy (2012) to categorize and interpret how new technologies are being applied by cultural institutions.

Their approach starts from identifying the non-profit-oriented and multiple objective function of cultural organizations, which partly differs from profit-oriented market logic in pursuing and adopting technological innovation.

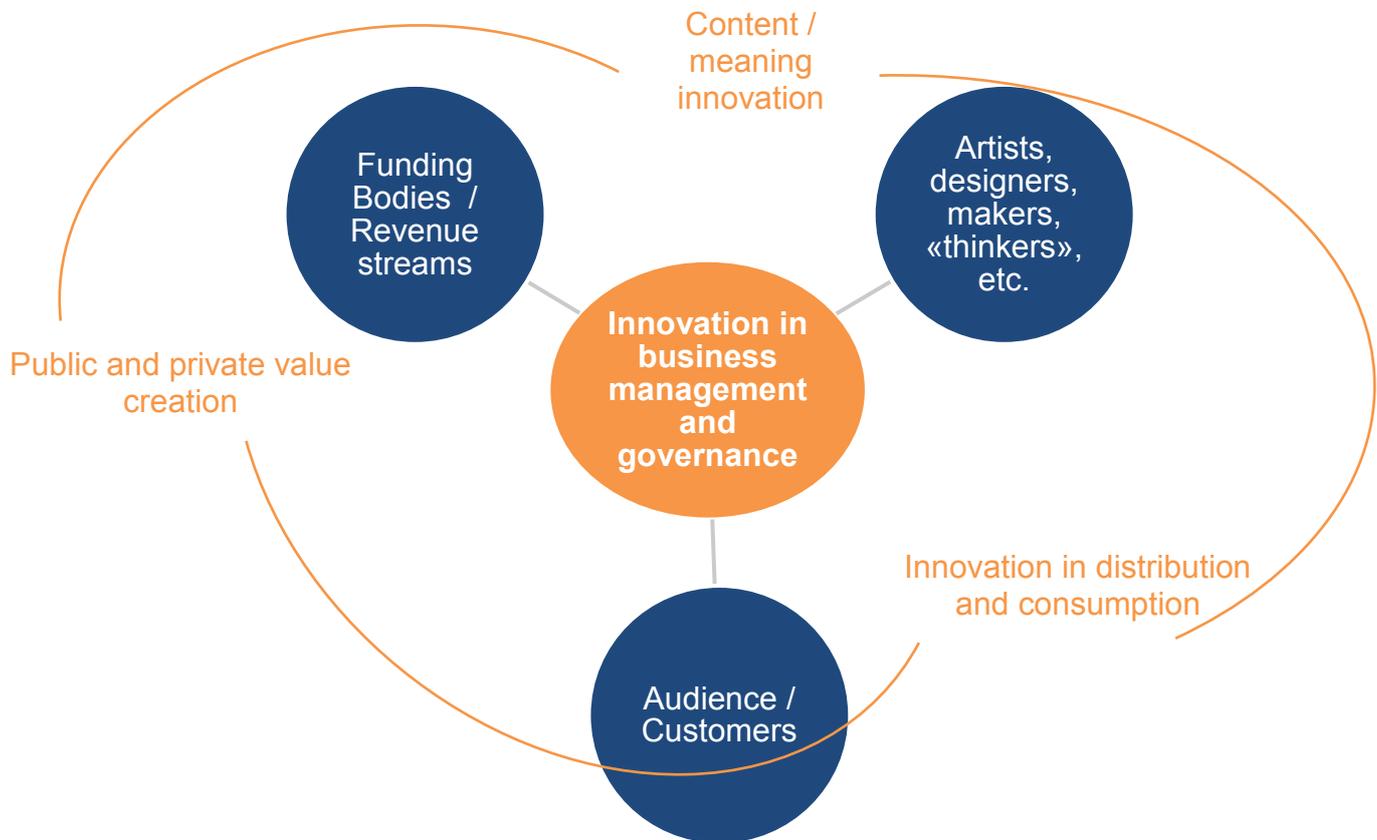
More importantly, the scholars recognize four main fields of innovative practices through which digital technologies can be applied and impact the activities of cultural organizations, namely innovation in audience reach, artform development, value creation and business models (Figure 1).

The four categories encompass all the potential stakeholders related to a cultural organization's mission (audience, artists, donors and policy makers, entrepreneur and workers), suggesting that innovation practices arising from new technologies can emerge and trigger multifaceted impacts and effects that should be considered under a unified approach.

3. How Big Data can change the cultural and creative industries

Everything from the running of the smallest event to the very way society thinks about and manages overall investment in arts and culture looks different when seen through the lens of big data; each sector of cultural activity can benefit if it is able to respond to these emerging opportunities. Taking advantage of big data, which encompasses new approaches to measurement, sophisticated analytics and the adoption of the models of decision-making which they necessitate, will require policy makers and practitioners alike to tackle significant challenges, some of them novel.

Figure 1. Innovation in the CCI. Personal elaboration on Bakhshi, and Throsby (2012)



In the next paragraphs we intend to show the possible impact of big data at three levels. First, although a big data analytics approach are quite diffused in the digital marketing and business intelligence fields, they can foster audience engagement even and open up dramatic opportunities for a long-term relationship with consumers (Sashi, 2012). We claim that ICT technology and in particular the combination of connectivity and digitalization have the potential to dramatically enhance participation in cultural activities and, at the same time, provide cultural organizations with tools to track and analyze consumer perceptions, sentiments and feelings, thus allowing unprecedented opportunities to reorient and enhance the value proposition of cultural activities and their organizational and managerial practices. Nowadays, consumers are seizing the opportunity to co-create, co-

produce and inoculate their own values into what they consume. Digital media can tremendously contribute to increase (or, vice versa, depress) 'buzz' around a cultural organization or event, and enhance participation and engagement, both online and offline, spurring a new wave of brand and reputation management (Tsimonis and Dimitriadis, 2014).

Second, cultural organizations have struggled to a sustainable business models which allow them to achieve their objectives and fulfill their mission. Own sources of revenue have proved to be marginal in the overall museums and theatres income, in particular when based on ticketing. New business models should look at digital business where main value for funders and shareholders come from the number of affiliates, followers and fans. Cultural organizations are requested to build on their attractiveness and powerful symbolic value to engage their audience and build on the their reputation. Exploiting information generated by their audience is strategic to attract potential business funders often willing to pay for access customer behavior.

Third, for institutional stakeholders information from data is extremely important to plan and implement effective and focused cultural policies. Most of actual cultural policies are not informed by the knowledge about users and totally incapable to target people not attending cultural activities. Predictive power of a big data approach is supposed to better address needs and expectations of cultural consumers and better allocate public resources.

3.1. Big Data and cultural consumption

Data availability has brought about radical changes in understanding of consumer behaviour and consequently in marketing practice. First, the centrality of the consumer is the main trait of contemporary marketing practice, which has witnessed a shift from a product-centric to a customer-centric perspective. The approach of companies in producing and marketing goods and services has undergone some remarkable changes through its evolution. In the initial, mass-marketing phase, companies were trying to sell the same product to all buyers, adopting a one-size-fits-all approach. Recognition of the diversity of customers' needs and desires led to the second phase, known as product-variety marketing. Companies began

manufacturing products and creating services with different features, which could respond to customers' diverse tastes. Strong competition in all markets led to the third phase, known as segmentation marketing, which is marked by an effort to identify, group and satisfy different customer categories. Thus, firms now seek to create a more sophisticated offer based on their knowledge about different customer segments.

A second major change that has marked contemporary marketing theory and practice concerns the management of customers. Namely, there has been a shift from a transaction to a relationship orientation. The relationship orientation means *“proactively creating, developing and maintaining committed, interactive and profitable exchanges with selected customers over time”* (Garrido and Camarero, 2014, p.95). In contrast to the transaction orientation, which centers on increasing revenues at a single purchasing occasion, the relationship orientation adopts a long-term perspective and aims to enhance customer lifetime value (CLV), that is, the value of all profits earned from a customer during their entire relationship with a company or organization. It has been acknowledged that customers have a life cycle that companies should seek to manage at each stage (Ang and Buttle, 2006). The paradigm shift towards individual consumers, the enhancement of their loyalty, and the desire to improve retention rates have led to the emergence of customer relationship management (CRM) in marketing and management practice also in the CCI. The attempts to precisely define CRM have proved to be more difficult than it may seem. Namely, CRM has been implemented in a variety of forms and for diverse purposes. The role of IT and software cannot be underestimated, but CRM should be understood more broadly – as a business strategy. Customer-related data is used to segment customers and develop targeted offers for different segments or even individual customers. Because of the Internet and the various communication channels it has enabled, customized offers can be communicated directly to clients at a very low cost. Personalized communication is more efficient and economical compared to mass advertising and, unlike traditional media, allows for two-way communication with feedback and interactions with customers.

The museum sector is a helpful example to show how this framework applies to the CCI. There are a number of studies examining loyalty in museums that have found several factors to be equally as important as satisfaction to retain visitors. To be more specific, staff services, perceived organizational efforts, organizational identification, and existing visitor loyalty have emerged as the four key factors. The accessibility and friendliness of museum personnel has a positive impact on visitors' decisions to renew their membership (e.g. Harrison and Shaw, 2004; Maher et al., 2011). High-quality customer service in museums consists of paying attention to each visitor, and being able to respond to their needs and interests as well as to provide accurate and relevant information about the exhibits. Further, visitors respond positively to perceived efforts in relationship investment by organizations. A study carried out by Siu et al. (2013) showed that visitors value a museum's effort to provide new and innovative services more than tangible rewards. Garrido and Camarero (2014) conducted an extensive analysis of museums from four European countries – France, Italy, Spain, and the UK – and observed that organizational learning, namely an organization's effort to learn more about customers and use that insight for development of new products and processes, has a positive impact on visitor loyalty and community involvement.

3.2. Big Data and cultural organizations

Development and change can be challenging for any organisation, but in a time of increasing competition for funds, there is a need for CCI to embrace the digital era which in turn can be used to gain the interest of customers who may otherwise spend their precious leisure time and funds elsewhere. In order to do this, there is a need for organisations to consider the development of new business models, not just digital strategies.

Professionals in museums, theatres, festivals and other cultural organizations have recognized the advantages of nurturing long-term relationships with their audience and enhancing customer loyalty and commitment. In order to encourage repeat attendance, organizations resort to the creation of membership schemes and the organization of special events. If membership programs are well designed, i.e. able

to attract audience and donors, they have several advantages and potentially a higher ROI than do special events (Maher et al., 2011). This is because members join such schemes for a number of intangible benefits, whose symbolic value often exceeds that of tangible benefits, especially at higher tiers (Paswan and Troy, 2004). In addition, museums can count on revenues from membership fees whether members actually attend exhibitions or not.

Subscription models developed in the digital economy should be considered when implementing digital strategies into membership schemes. They have been applied successfully across a range of cultural industries such as television, film, radio and music and an increase in subscription revenues is currently the key driver of growth within the creative sector as a whole.

Subscription models will continue to be dependent on the benefits offered. While this requires further programming and scheduling of events and activities that spread equally across a year and cover the wide range of public interests, it will encourage staff to become more creative when programming. It would also require long term strategic planning, yet this could produce lasting benefits for any cultural organization.

Again the museum sector can show that in most of CCI there is a huge potential for organizational change to adapt to evolving taste and to personalise and tailor experiences and products.

One example of such emerging approach comes from the Dallas Museum of Art (DMA)³ - one of the largest art museums in America, located in the nation's largest arts district in downtown Dallas. The museum is supported by contributions and donations from the public, City of Dallas Office of Cultural Affairs and the Texas Commission on the Arts. It charges no admission fee as well as offering free memberships.

In 2012 the value of the admission tickets and entry-level membership (18k paid members) corresponds to only 7% of the budget. In January 2013 it introduces the program of free-membership in order to expand the customer base among non-visitors: in 2 years 90k free-members.

³ www.dma.org

The DMA has found that due to the amount of data one participant can produce, approximately 1,000 records in one visit, the database and analysis of data has required extensive work as well as greater cross departmental collaboration. This was also due to the unexpected high volume of interest in the program, originally thought to be 20,000 members in one year and found to be five times larger. The amount of staff need, now 25-35 people just working on the DMA Friends program, was larger than anticipated.

New membership scheme brought three innovations at DMA:

- A new model of attendance, which offers a range of additional services and enhances the museum experience.
- A new organizational mode: in DMA Partner program 11% of partners in 2013 are new and new donors (e.g. the Meadows Foundation Grant has donated \$ 300,000 to support the DMA friends).
- A new business model based on a free loyalty card.

Table 1 Characteristics of Museum Membership Scheme at DMA (2015)

DMA Friends is a free membership program that allows you to earn badges and points to unlock special rewards when you visit the DMA.
Visitors can sign up to be a DMA Friend at the kiosks inside the museum.
At the time of enrolment, new DMA Friends receive a card that allows them to chart their engagement with the Museum.
Visitors can link their mobile phone to their DMA Friends account.
As you participate in activities around the museum you add Activity Codes to your DMA Friends Account which earns you points.
If you were already a DMA Partner you can also become a DMA Friend.
The new membership scheme encourages the sharing of your museum experience on social media sites.

The vision behind this marketing tool is a broader vision for the data-driven museum. The museum can be a multiplier of urban areas related to cultural consumption thanks to a coalition loyalty program (Breugelmans et al, 2014). A

loyalty card scheme can involve a wide network of retail and commercial activities at urban, regional and national level. The consumer can take advantage of discounts and promotions, earn points, enjoy preferential access and much more. Benefits to the coalition partners range from the acquisition of new customers by sharing with other partners to the reduction in operating costs and increase of ROI by decreasing churn. Most important, such an approach offers the opportunity to know the consumption habits of and enables coalition partners to seize new business opportunities by crossing data provided by the business intelligence system.

3.3. Big data and digital arts

Differently from many stakeholders in the world of art, who are typically sceptical about what they don't know and cannot have control on, many artists have actively and critically engaged with innovation in ICT and in particular with big data. There are many aspect of fascination in data which artists have tried to represent and interpret. First of all, by definition big data enlarge the possibility of codifying signals from potentially any language. Big data include not only numbers, but also meaningful text, sounds and images, and more in general anything that could be transformed in binary codes and processed by a computer machine.

From an artistic perspective big data unclose tremendous opportunities for visualizations. Lights, shapes and colours can bounce from real life to virtual reality and create a totally unpredictable world of meanings, furtherly breaking the traditional relation between art and the materiality of the work of art. "Sonification" is often another option to play with data in artforms which could have not even imagined a few decades ago.

The new possibilities of creation involve musicians and dancers, visual artists and designers, and a transdisciplinary multitude of professionals which work in more traditional fields. The visualization of data, which can be a minor issue for academic research, becomes pivotal to extract meaning and therefore value for different individuals. From the bank clerk analysing the credit profile of a customer to the user of any mobile application, the effectiveness of information is mediated by its visual appeal and ease.

Eventually, also digital fabrication seems to point at the dream of transforming information into a material form. In the near future, it will allow individuals to design and produce tangible objects on demand, wherever and whenever they need them. Leaving out of consideration the productive implication for many industries, this literally new “creative” power of intelligent machines allow artists to conceive new space-time dimensions.

4. Cultural policies in the age of Big Data

A final channel through which Big data analytics may influence the cultural sector is by providing new opportunities for measuring the economic and cultural value created by cultural organizations and use them for refining cultural strategies and policies. It is commonly recognized that adequate metrics are lacking to capture the complex set of direct, indirect, instrumental and intrinsic benefits created by the activities and services provided by cultural organizations (McCarthy et al., 2001). So far, value generation has relied on few quantifiable indicators, such as figures about audience attendance, revenues, number of educational programs, donors, friends, funds and sponsors attracted.

However, as the transition to digitization has enabled tracking in more systematic ways how different groups of audience access and use the services provided by cultural organizations, big data analytics may be used to develop novel metrics of value creation. As noted by Bertacchini and Morando (2013) for museums’ digital collections, collecting and crunching data about how museum content is utilized is an important asset for an organization in assessing the social impact and success of its activities or the fulfilment of its inherent public mission. In this context, some pioneering open access initiatives suggest that digital image metadata make it possible to track how audiences are integrating and connecting knowledge and information about museum artworks using Web 2.0 tools (Bray, 2009). For example, the images provided under an open-licensing scheme by the Brooklyn Museum to the Wikimedia Foundation are monitored according to the new tags and information added or modified and to the number and type of Wikipedia articles that are currently using an image of the collection. Reuse on Wikipedia is one of the most

easily traceable forms of creation of derivative cultural works and/or of creations of new context and links for collection images.

Big data analytics may also potentially improve the design and monitoring of cultural policies. In this case, the same big data analytics strategies to enhance the audience reach or to improve the measurement of the values created by individual cultural institutions may be equally used at a larger and more systemic territorial scale to coordinate policies in different cultural sectors, given the heterogeneity of cultural organizations and audiences, and relate them more closely to territorial dynamics. A parallel may be considered here with the digital realm, where tracking individuals' online cultural consumption patterns has already provided a better understanding of individuals' behavior and informed providers of cultural content in their marketing strategies. For example, the "superstars vs long tail" debate (Anderson, 2007; Brynjolfsson et al., 2006; Elberse, 2008) has shown that it is more likely that cultural omnivores sustain both the consumption of popular and niche products rather than having a more tailored and distributed consumption across diversified products, based on individual tastes.

In a similar vein, we contend that by pooling and analyzing information about cultural organizations' activities and individual audience profile and behavior for different cultural services, big data analytics may provide new tools to achieve some crucial goals in cultural policy:

- Enhancing the planning of the local cultural offer, which is traditionally poorly coordinated across several cultural, heritage and arts institutions in a region.
- Integrating and facilitating different cultural consumption patterns
- Addressing socio-economic barriers to the access of cultural activities

For illustrative purpose, a promising application to reach these goals may come from an improved use of data generated by users' passes to networks of museums and other art and cultural institutions. These schemes are usually designed as a marketing solution for cultural tourists or, in few cases, for local residents, such as the Dutch Museum pass or the Carta Musei Piemonte (Werff et al., 2014; Brondino et al., 2011). The academic and policy interest for these schemes has so far being mainly relegated on understanding the effect that a bundling pricing strategy,

coupled with unlimited or extended accessibility, have on the aggregate demand for the involved cultural services and their implication in terms of financial sustainability. By contrast, far less has been explored the potential of analyzing data and information related to individual passholders to better coordinate the local cultural offer and to devise cultural policies which exploit the customization of cultural services and differential pricing to various audience segments.

5. Possible limitations

A first potential drawback to the widespread and optimistic adoption of big data analytics in the cultural sector stems from privacy concerns related to audience behavior.

This concern is not specific to the cultural domain, but has already been clearly identified as one of the main social challenges and potential unintended negative consequences of the rise of big data. According to Boyd and Crawford (2012), big data as a radical socio-technical phenomenon may lead to new wave of privacy incursions and invasive marketing which can eventually reduce consumers' welfare or even arbitrarily deter alleged deviant behavior.

From an economic viewpoint, privacy in the age of big data poses to consumers and organizations newer trade-offs. Individuals benefit from sharing more and more information about themselves with firms and providers to enhance customization and usability of services. At the same time, the decline in the cost of storing and manipulating information has led organizations a growing incentive to price discriminate, coupled with the increasing ability to price discriminate (Odlyzko, 2003). On the opposite side, consumers want to avoid misuse of the information they pass along to others, while organizations are leveraging more and more from the value of aggregated data and don't want to alienate their data with policies deemed as intrusive (Brandimarte and Acquisti, 2012).

The optimal solution to these trade-offs mainly depends on the value that individuals and society attach to private information about identity and behavior in different realm of human action. The main challenge is therefore to understand whether the adoption of big data in the cultural field, where cultural values and preferences are

particularly relevant not only in driving consumers choice but also in revealing individuals' identities, will lead to larger concerns or not.

From the perspective of the philosophy of science, the challenge of big data is much more delicate and could deeply affect some foundations of academic research, especially in social sciences. It is not in the scope of the paper to develop such an argument, but still it is important to remind a major aspect attached to the emergence of big data. Big data implies a resurgence of inductive over deductive research aimed at discovering hidden or latent pattern in data and therefore formulating some theoretical hypothesis. Provocatively labelled as the "end of theory" (Anderson, 2008), the fear of the return to empiricism has been criticized by Kitchin (2014) who instead calls for a new paradigm of "data-driven science" combining prediction and causation. According to the author, social sciences and humanities can only benefit from leaving behind neo-positivistic approaches to attain more breadth, depth and reliability in current understanding of human behaviour.

A final critical aspect of big data concerns its actual diffusion and application in organizations. The promise of advancement in business intelligence and improvement in market comprehension is not enough to start a change that could dramatically transform the daily work of many companies and institutions. Paradoxically, this process could be more easily accepted in cultural organizations which have seldom implemented a proper information system and can quickly close this information gap.

Conclusion

The paper presents a changing research perspective in cultural economics, management and policy offered by the rise of the big data. The relatively limited and dispersed literature on big data shares the idea that the ICT and mobile revolutions have issued the whole potential of information whose value is still to be captured. Organizations churn out a burgeoning volume of transactional data, securing trillions of bytes of information about their customers, suppliers, and operations. Millions of networked sensors are being embedded in the physical world in devices such as

mobile phones, smart energy meters, automobiles, and industrial machines that sense, create, and communicate data in the age of the Internet of Things. There are many ways that big data can be used to create value across sectors of the global economy: new modes of competition and value capture driven by big data as consumers, companies, and public institutions exploit its potential (MGI, 2011).

Applying this framework to the CCI we stressed the innovative potential of big data arising from the conjoint effect of predicting cultural consumption, updating business models, enlarging art production and enhancing funding policies.

Prediction and arts intrinsically belong to opposite epistemologies. Nevertheless, since big data is not simply a set of methods for advanced quantitative analysis, but an articulated framework aimed at opening up an improved understanding of human behaviour, the CCI can take advantage of this approach from different sides.

References

- Anderson, Chris (2006). *The Long Tail: Why the Future of Business is Selling Less of More*. New York, NY: Hyperion
- Anderson, C., 2008. The end of theory: The data deluge makes the scientific method obsolete. *Wired*, 23
- Ang, L. and Buttle, F., 2006. Customer retention management processes: A quantitative study. *European journal of marketing*, 40(1/2), pp.83-99.
- Bakhshi, H. and Throsby, D., 2012. New technologies in cultural institutions: theory, evidence and policy implications. *International journal of cultural policy*, 18(2), pp.205-222.
- Bakker, G. (2014). Sunk costs and the dynamics of creative industries. *The Oxford Handbook of Creative Industries*.
- Bertacchini, E., and Morando, F. (2013). The future of museums in the digital age: New models for access to and use of digital collections. *International Journal of Arts Management*, 15(2), 60-72.
- Boyd, D., and Crawford, K. (2012). Critical questions for big data: Provocations for a cultural, technological, and scholarly phenomenon. *Information, communication & society*, 15(5), 662-679.

- Brandimarte, L. and Acquisti, A., 2012. The economics of privacy. *The Oxford Handbook of the Digital Economy*, pp.547-571.
- Bray, P. 2009. "Open Licensing and the Future for Collections." In *Museums and the Web 2009: Proceedings*, J. Trant and D. Bearman, eds. Toronto Archives and Museum Informatics. Accessed 16 November 2011 at <http://www.archimuse.com/mw2009/papers/bray/bray.html>.
- Brondino, G., Bollo, A., Gariboldi, A., and Leon, F. (2011). The Abbonamento Musei Torino Piemonte experience. *Economia della Cultura*, 21(1), 59-76.
- Breugelmans, E., Bijmolt, T. H., Zhang, J., Basso, L. J., Dorotic, M., Kopalle, P. & Wunderlich, N. V. (2014). Advancing research on loyalty programs: a future research agenda. *Marketing Letters*, 1-13.
- Brynjolfsson, E., Hu, Y. J., and Smith, M. D. (2006). From niches to riches: Anatomy of the long tail. *Sloan Management Review*, 47(4), 67-71.
- Bughin, J., Chui, M. and Manyika, J., 2010. Clouds, big data, and smart assets: Ten tech-enabled business trends to watch. *McKinsey Quarterly*, 56(1), pp.75-86.
- Chen, H., Chiang, R.H. and Storey, V.C., 2012. Business Intelligence and Analytics: From Big Data to Big Impact. *MIS quarterly*, 36(4), pp.1165-1188.
- Elberse, A. (2008). Should you invest in the long tail?. *Harvard business review*, 86(7/8), 88.
- Garrido, M.J. and Camarero, C., 2014. Learning and relationship orientation: an empirical examination in European museums. *International Journal of Nonprofit and Voluntary Sector Marketing*, 19(2), pp.92-109.
- Handke, C., Stepan, P., and Towse, R. (2013). Cultural Economics and the Internet. *Handbook on the Economics of the Internet, Forthcoming*.
- Harrison, P., and Shaw, R. (2004). Consumer Satisfaction and Post-purchase Intentions: An Exploratory Study of Museum Visitors. *International Journal of Art Management*, 6(2): 23-32.
- Hirsch, P. M., and Gruber, D. A. (2015). Digitizing Fads and Fashions. *The Oxford Handbook of Creative Industries*, 421.
- Hutter, M., 2008. *Beyond price: Value in culture, economics, and the arts*. Cambridge University Press.

- Kitchin, R., 2014. Big Data, new epistemologies and paradigm shifts. *Big Data & Society*, 1(1), p.2053951714528481.
- Klamer, A., 2004. Cultural goods are good for more than their economic value. *Culture and public action*, pp.138-162.
- Kwon, O., Lee, N. and Shin, B., 2014. Data quality management, data usage experience and acquisition intention of big data analytics. *International Journal of Information Management*, 34(3), pp.387-394.
- Laney D. (2001) 3d data management: Controlling data volume, velocity and variety. Gartner. Retrived on 18.09.15
<http://blogs.gartner.com/doug-laney/files/2012/01/ad949-3D-Data-Management-Controlling-Data-Volume-Velocity-and-Variety.pdf>
- LaValle, S., Lesser, E., Shockley, R., Hopkins, M.S. and Kruschwitz, N., 2011. Big data, analytics and the path from insights to value. *MIT Sloan Management Review*, 52(2), p.21.
- Lee S. and Linett P., (2013) New Data Directions for the Cultural Landscape: Toward a Better-Informed, Stronger Sector, Cultural Data Project, Philadelphia
- Lilley, A. and Moore, P. (2013) Counting What Counts. What Big Data can do for the Cultural Sector. NESTA, Magic Lantern.
- Maher, J.K., Clark, J., and Gambill Motley, D. (2011). Measuring Museum Service Quality in Relationship to Visitor Membership: The Case of a Children's Museum. *International Journal of Arts Management*, 13(2): 29-42.
- McCarthy, K. F., Ondaatje, E. H., Zakaras, L., and Brooks, A. (2001). *Gifts of the muse: Reframing the debate about the benefits of the arts*. Rand Corporation.
- MGI McKinsey Global Institute, (2011), Big data: The next frontier for innovation, competition, and productivity
- Odlyzko, A. (2003). Privacy, economics, and price discrimination on the Internet. In *Proceedings of the 5th international conference on Electronic commerce* (pp. 355-366). ACM.
- Oracle (2013) Big Data for enterprises.
<http://www.oracle.com/us/products/database/big-data-for-enterprise-519135.pdf>

- Paswan, A.K., and Troy, L.C. (2004). Non-Profit Organization and Membership Motivation: An Exploration in the Museum Industry. *Journal of Marketing Theory and Practice*, 12(2): 1-15.
- Potts, J. (2013). New technologies and cultural consumption. *Handbook of the Economics of Art and Culture*, 2, 215.
- Sashi, C.M., 2012. Customer engagement, buyer-seller relationships, and social media. *Management decision*, 50(2), pp.253-272.
- Schmarzo, B., 2013. Big Data: Understanding how data powers big business. John Wiley & Sons.
- Siu, N.Y-M., Zhang, T.J-F., Dong, P., and Kwan, H-Y. (2013). New service bonds and customer value in customer relationship management: The case of museum visitors. *Tourism Management*, 36: 293-303.
- Throsby, D., 1999. Cultural capital. *Journal of cultural economics*, 23(1-2), pp.3-12.
- Tsimonis, G. and Dimitriadis, S., 2014. Brand strategies in social media. *Marketing Intelligence & Planning*, 32(3), pp.328-344.
- Ularu, E.G., Puican, F.C., Apostu, A. and Velicanu, M., 2012. Perspectives on big data and big data analytics. *Database Systems Journal*, 3(4), pp.3-14.
- Ward, J.S. and Barker, A., 2013. Undefined by data: a survey of big data definitions. arXiv preprint arXiv:1309.5821.
- Werff, S., Koopmans, C., and Boyer, C. (2014). The effects of the Dutch museum pass on museum visits and museum revenues.