

Understanding the changing role of CIOs in the big data and analytics era: an empirical investigation

(Track - Processes: Information Systems & Innovation)

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Abstract This paper investigates the changing role of the CIO at organizational level with regard to the rise of big data and big data analytics as a potential source of innovation and competitive advantage. Thus, the paper aims to provide an empirical and theoretical contribution to the research on the topic, by further exploring the emergent properties and understandings related to the role of CIO as a consequence of the need to adopt advanced analytics technologies for mastering big data. To this end we present the results of a qualitative research based on grounded theory carried out on data concerning CIOs of large companies from different industries in the Italian market. A substantive theory is discussed, showing the role of generation gap and power of new entrants as well as of project and execution excellence on the making of identity and recognition of the CIO as relevant at the time of big data analytics. The paper thus addresses the information systems and innovation challenges to new forms of organizing related to the CIO role, particularly with regard to IT and innovation units in incumbent businesses and corporations.

Keywords: Big Data, Analytics, CIO, grounded theory, information systems, innovation

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INTRODUCTION

The increasing relevance of Big Data and its impact on firms, individuals and governments (European Commission 2014) is stimulating a growing number of streams of research in the analytics field as well as in management of information systems (Gillon et al. 2014; Chen, Chiang, and Storey 2012; Marton, Avital, and Blegind Jensen 2013; Lavallo et al. 2011; Tamm, Seddon, and Shanks 2013). Notwithstanding the interest by practitioners for the role and actions of the CIO for big data and big data analytics (Akella, J., Marwaha, S., and Sikes 2014; Biesdorf, Court, and Willmott 2013; Buhl 2013), academic research on their impact on the changing role of the CIO (Ragowsky et al. 2014) is still dependent on results concerning more general issues such as, e.g., sources of power and influence (Karpovsky and Galliers 2012; Lim, Han, and Mithas 2013), the perception of its value by the top management and relationship with other executives (Manfreda and Indihar Štemberger 2013) or the of the contribution of the IT function in organizations (Guillemette and Paré 2012).

Thus, in this paper we aim to provide a contribution to this research stream by further exploring the emergent properties and understandings related to the impact of big data and big data analytics on the role of the CIO. To this end we present the results of a qualitative research based on grounded theory carried out on data concerning CIOs and IT executives of large companies from different industries in the Italian market. The paper thus addresses the information systems and innovation challenges to new forms of organizing related to the CIO role, particularly with regard to IT and innovation units in incumbent businesses and corporations.

The paper is structured as follows. We first analyze the literature background, further motivating the research focus of this study. Then the research method is presented. The final part of the paper presents a discussion of main findings of this study and defines the needs for further research on the topic.

BACKGROUND AND MOTIVATIONS

The MISQ article by Applegate and Elam (1992) on the changing role of CIO, formed one of the main motivations for this work, being the CIO a central subject and reference at practitioner level for the research on information systems strategy (Merali, Papadopoulos, and Nadkarni 2012).

Back in late 80s and early 90s there were big changes and challenges in the business, technological and political environment including the Internet revolution and on-line businesses, the massive use of computers at global level, the automation and integration of business processes and the digitalization. All these challenges had reshaped the role of CIOs (Applegate and Elam 1992). The last few years another wave of transformation of the business, social, national and international environment mainly due to the mass production of data (Baesens *et al.* 2014) indicates another radical change and a big challenge for CIOs (Chen, Chiang, and Storey 2012).

For the purpose of this research we first have conducted an extensive literature review based on review methodologies like those proposed by Cooper (1988) and Brereton *et al.*, (2007). The search was carried out from 15th June to 15th September 2014 first on libraries and database search engines like AISel, IEEE Xplore, Science Direct, ProQuest, Google Scholar and then on the AIS Basket of eight Journals which includes: (a) European Journal of Information Systems (EJIS), (b) Information Systems Journal (ISJ), (c) Information Systems Research (ISR), (d) Journal of Information Technology (JIT), (e) Journal of Management Information Systems (JMIS), (f) Journal of Strategic Information Systems (JSIS), (g) Journal of the Association for Information Systems (JAIS) and (h) MIS Quarterly (MISQ). The period considered is from 1st January 2008 to 1st September 2014.

The analysis of the selected papers shows that the majority of them mainly focus on big data and in few cases on big data and analytics. In addition to this, the literature review depicts that the term 'CIO' was reported mainly in the keywords and introduction. This led us to the conclusion that the topic (CIO, big data and analytics) is still unexplored and has yet to be assessed. Taking these issues into account, we decided to investigate this area using a grounded theory approach (Glaser and Strauss 1967; Urquhart 2013; Charmaz 2006) that allows collecting empirical data and analyzing them in order to come up with the proposition of a new theory (Miles and Huberman 1994).

RESEARCH METHOD

From March 2012 to July 2014, CIOs and senior Information Technology (IT) executives from large corporations headquartered in Italy have been involved in ten workshops made up of thirty (30) participants each (Liamputtong 2011). The workshops, organized under the umbrella of a research program on the digitalization of business (Table 1 shows the demographics for the participants to the program), have been held as focus groups moderated by two of the authors, while the other authors assisted as participants. The workshops, all held in English, have been focused on topics such as big data, big data and analytics, the impact of these trends on the role of the CIO, the organization of IT unit, and the overall changes on IT governance. The workshops structure encompasses a first introduction to the topic by an expert, both from academia or consultancy.

Financial services, including banking and insurance, where the main industry represented followed by utilities and manufacturing. The companies, having different IT budget, were not only large local organizations, but also representatives or branch of corporations active at European as well as global level. Along the workshops, interviews have been carried out on CIOs and IT executives of companies for a subset of industries from the ones participating to the workshops. Also in this case financial services is the main industry considered and the executives provenance is nearly equally distributed, being 40 executives internally hired with regard to the 34 coming from outside the company. It is worth noting that the background of the IT executives of the companies considered for the interviews see a prevalence of them (40 executives) having a background routed in discipline such as management of information systems, engineering or computer science, against 22 executives with a business background, that is routed in economics, management or accounting, and 20 having a hybrid background for education or experience. Among the population of 74 interviewees, a sample of 18 informants has been then selected for intensive interviews, being also participants to the workshops. Interviews were mainly open-ended or made up of a limited number of questions (max 5) in order to obtain reach material, avoiding the imposition of preconceived concept on it at the data collection step of the research activity (Charmaz 2006).

The audio documents, transcripts, and memos from the workshops and the interviews have been analyzed following the three steps of grounded theory as in the Barney Glaser perspective, that are *open*, *selective*, and *theoretical coding* (Urquhart 2013; Glaser 1978). The aim of the

application of grounded theory for qualitative data analysis is framed under the main goal of trying to generate a theory from the available data. However, the study aims also to produce an understanding of the impact big data and analytics on the role of CIO, also by the meaning provided to them by the executives involved in transformation initiatives (Walsham 1993). Thus, while the Glaser perspective provides a rigorous approach to the data analysis, abduction allows pursuing the most plausible explanation (Charmaz 2006). Finally, a *substantive theory* is discussed, emerging from the data analysis and the interpretation by the authors. The theory pertains to the phenomenon (Urquhart 2013), that in our case is the changing role of CIO with regards to big data and analytics.

MAIN FINDINGS AND CONTRIBUTIONS

The joint consideration of big data and analytics is a relatively recent development, particularly, within the domain of management of information systems (MIS). Analyzed often from a technological perspective, the topic emerges as yet pretty unexplored as for the impact on the main executive profile representative of MIS within companies. This argument motivates the choice for carrying out the grounded theory presented in previous sections. The focus on CIO and IT executive of companies acting in a specific country (Italy, in our case), while providing a substantive theory for the context, however requires further theoretical sampling (Glaser and Strauss 1967) for an increased generality of the theory, for example considering similar groups in other countries for a certain area such as, e.g., the ones within the European Union, first. Furthermore, a parallel and alternative path for further theoretical sampling may concern a narrow focus on single industries in the Italian market.

Figure 1 about here

Considering the above limitations in terms of scalability and generalization of the research results, Figure 1 shows the substantive categories grounding the emerging themes related to the impact of big data and analytics on the role of the CIO, making up the substantive theory, which is shown by the diagram in Figure 2. The substantive theory insights can be associated to the statement “*Generation Gap and New entrants framing the diversity of CIO role for Big Data and Analytics adoption*”. Consequently, the four themes we have identified are strictly dependent on

the substantive categories as for their definition and relationship to each other (the latter is represented by arrows, where a direction of the impact is provided).

Figure 2 about here

While the theme 1 (*Diversity of the CIO role*) emerges as having a certain centrality with regards to three of substantive categories (*Identity and recognition*, *Uncertainty about innovation*, *Project and execution excellence*), the chain of evidence that moves from open coding to theoretical coding through selective coding points out that causes and conditions for theme 1 are worth analyzing with regards to themes related to *Cultural shift* and *Power of new entrants*, that are theme 2 (*Generation gap impact on mindset and IT profession*) and theme 3 (*The centrality of marketing and human resources*). Also, theme 4 (*Questioning the novelty of Big Data and analytics innovation*) is worth investigating in relationship to conditions for theme 2. Finally, theme 5 (*Measure and control as CIO specialties*) is worth considering for an investigation on strategies and processes for identity and recognition of the role of CIO as well as balancing the power of new entrants, such as marketing and human resource executives.

Taking the above issues into account, we suggest that in the case of the Italian market the main factors emerging from the rise of big data and big data analytics refer to *cultural shift* in IT mindset and professionalism related to a generation gap and the power of new entrants, specifically marketing and human resource executives. These issues challenges the identity and the recognition of the role of the CIO and the IT within organizations, with consequent strategy of questioning the novelty of big data and big data analytics as well as their potential in terms of innovation. The data let emerge also the relevance of project and execution excellence as building blocks for the definition of the changing identity and recognition by the CEO and other executives. Under this perspective, big data and big data analytics seem to provide a basis for using, e.g., key performance indicators as conversations tool for making evident the value of IT, thus, balancing the contribution of new entrants in the IT innovation leadership arena, such as, e.g., marketing and human resource executives.

The resulting substantive theory may provide a contribution focused on big data and big data analytics to the literature on the changing role of CIO, showing, for example, the relevance of project and execution excellence in the current transition (see, e.g., Ragowsky et al. 2014) or on

the evaluation by CEO and other C-managers (see, e.g., Manfreda and Indihar Štemberger 2013). Finally, the research allows to emphasize the challenges related to the generation gap in framing the identity of the CIO and the IT at organizational and corporate level, arguing for the need for further research on IT organization behavior and models allowing an appropriate absorption of skills and capabilities by the IT (Francalanci and Morabito 2008), such as, e.g., the ones of data scientists (Davenport and Patil 2012) in domains where persist diverse cultural orientations and mindset legacies.

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Appendix 1: Figures



