Transforming big data into knowledge: the role of knowledge management practice

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Purpose – The study aims to empirically investigate how big data collected from social media contribute to knowledge management practices, innovation processes and business performance.

Design/methodology/approach – The study used 418 questionnaires collected from firms that actively invest in marketing, advertising, and communication in the Italian market. The hypotheses testing and analysis were conducted using structural equation modeling.

Findings – The results reveal that customers' data gathered from social media produce different effects on knowledge management practices and firms' innovation capacity. Furthermore, increased innovation capacity turned out to affect customer relationship performance directly, while it contributes to gain better financial performance only when it is used to gain relational outcomes.

Originality/value – The outcomes of the study help firms to develop a clear understanding about which big data retrieved from social media can be useful to improve their knowledge management practices and enhance their innovation capacity. Moreover, by investigating the mediating role of big data knowledge management in the context of social media knowledge acquisition and innovation capacity, this study also extends the mediation variables used to understand the relationship between knowledge capabilities and practices and innovation constructs.

Keywords: Market orientation; Customer collaboration; Big data knowledge management; Innovation capacity; Firm performance; Social media

Type – Research paper

1 Introduction

Introducing new customer-centric tools, social media have transformed the way firms communicate and interact with customers. Posts, likes, tweets, digital pictures and videos, geotags are only some sources of big data that firms are collecting, storing, managing, and analyzing to understand how they can serve customers better (Fosso Wamba et al., 2015, 2017; Khan and Vorley, 2017; Pauleen and Wang, 2017). In 2017, more than 3 billion people worldwide, and 34 million people in Italy, actively used social media each month (Kemp, 2018), generating a huge amount of data that can represent an endless and continuously updated source of information. Nowadays, social media represent an external source of knowledge thanks to which firms can assume data-driven decisions, improving their innovation capacity and staying ahead of competition (Bean and Kiron, 2013; Mukherjee et al., 2017; Nuruzzaman, Gaur, et al., 2018). By managing big data, firms can derive information useful to enhance their operational efficiency, innovate their products/services and processes, reinforce their relationships with customers and, consequently, enhance their overall performance (Fosso Wamba et al., 2017). According to the resource-based view and the knowledge management literature, being market oriented and actively collaborate with customers allow firms to develop intangible assets, such as knowledge and market sensitivity, that can be deployed to innovate and increase firms' performance (Gaur et al., 2011). However, extracting knowledge from big data, integrating them within firms' processes, and turning insights into decision-making actions poses significant challenges (Chen et al., 2012; Contractor et al., 2016; Nuruzzaman, Gaur, et al., 2018) and firms are struggling on understanding how they can effectively exploit all these information to achieve higher level of innovation capacity and, consequently, improve their performance.

For this reason, both academics and practitioners have deeply investigated big data and social media in order to evaluate how these phenomena are changing the dynamics of the competitive environment (Erevelles et al., 2016; Fosso Wamba et al., 2015; Rothberg and Erickson, 2017). However, how big data gathered from social media can contribute to knowledge management practices, innovation processes and business performance remains largely unexplored. To bridge this gap, the study proposes a conceptual model that aims to analyze the causal relationships among social media market orientation, in terms of both proactive and reactive orientation, social media customer collaboration, big data knowledge management, innovation capacity and firms' performance.

In this perspective, the contributions of the research are the following. First, by analyzing both the direct and indirect effects, the study demonstrates that different ways to acquire customer-related data from social media differently affect knowledge management practices and firms' innovation capacity. Second, the research examines the mediating role of big data knowledge management in the context of social media knowledge acquisition and innovation capacity, by extending the mediation variables used in previous studies to understand the relationship between knowledge capabilities and practices and innovation constructs. Finally, the study tests the causal relationship between innovation capacity and business performance, obtaining mixed results. If on the one hand innovation capacity directly influences customer relationship performance, on the other, innovation capacity seems to affect financial performance only when it is used to gain relational outcomes.

The paper is structured as follows. In the next section, the study provides the theoretical background and develops the research hypotheses. Then, the methodology used and the results obtained are presented. Following this, the theoretical and practical implications of the study's findings are discussed and limitations and direction for future research are presented.

2 Literature review

2.1 Market orientation, big data knowledge management and innovation capacity

Market orientation can be intended as the process firms adopt to systematically generate and disseminate customers' data and intelligence in order to understand current and future customers' needs (Kohli and Jaworski, 1990), and it is related to firms' attitude to rely on information about customers to define market strategies and create superior value (Narver and Slater, 1990). More in detail, market orientation has been conceptualized on the basis of two different approaches, the behavioral approach and the cultural approach (Gaur et al., 2011). According to the behavioral approach, market orientation is a set of ongoing activities that contributes to enhance customer relationship performance, including knowledge generation and dissemination, and firms' ability to promptly respond to customers' instances (Kohli and Jaworski, 1990). Instead, the cultural approach posits that market orientation consists of three different components (customer orientation, competitor orientation, and interfunctional coordination) and two decision criteria (long-term focus and profitability) that let firms to create a superior value for their customers continuously and gain a competitive advantage (Narver and Slater, 1990).

In a dynamic-capabilities perspective (Eisenhardt and Martin, 2000), market orientation allows firms to develop a deeper understanding of customers' wants and needs (Hult and Ketchen, 2001; Jaworski and Kohli, 1993), supports firms in selecting the most effective resource combinations to meet market conditions (e.g., Slater & Narver, 1995) and, consequently, it can be a source of superior competitive advantage.

Narver et al. (2004) suggest that market orientation can be reactive or proactive. Firms that implement a reactive market orientation try to identify, understand and satisfy the expressed needs of customers, while those firms that adopt a proactive market orientation are more focused on recognizing and responding to customers' latent needs.

While some studies have suggested that to find out new market opportunities and exploit them, firms have to adopt at least one of the two market orientation main approaches (Marvel and Lumpkin, 2007; Nguyen et al., 2015), others convey that firms should practice both proactive and reactive market orientation to acquire data about customers and used them to empower their knowledge (Kristensson et al., 2008; Nguyen et al., 2015; Ordanini and Maglio, 2009). In the new digital domain, being customer oriented is a crucial competence for firms and social media are a primary source of big data that firms can adopt to understand customers' expressed wants and latent needs, collaborate with them, co-create products and services that meet their exigencies (Gaur, 2006; Gupta et al., 2010; Stefanou et al., 2003). However, firms' ability to transform big data acquired from social media into knowledge depends on the extent to which they are able to evaluate new information and opportunities, use them to improve their knowledge capabilities, recombine existing information, generate new solution, and add value through knowledge management practices (Cambra-Fierro et al., 2011; De Dreu and West, 2001; Nguyen et al., 2015; Tiwana and McLean, 2005). In this perspective, even if proactive and reactive market orientations should be simultaneously adopted to acquire and exploit information, if and how these two approaches contribute to generate customer-related knowledge remains under-investigated (Nguyen et al., 2015; Ozkaya et al., 2015). Therefore, based on the above discussion, it is expected to find a positive effect of both proactive social media market orientation and reactive social media market orientation on big data knowledge management.

H1. Proactive social media market orientation has a positive influence on big data knowledge management

H2. Reactive social media market orientation has a positive influence on big data knowledge management

Being oriented toward markets sustains firms in developing new ideas (Hurley and Hult, 1998). Market-oriented activities, if combined with appropriate capabilities, may contribute to acquire advantages in product and process innovations (Slater and Narver, 1998). Furthermore, thanks to the information acquired through social media, firms can improve their innovation capacity and better address customers' needs by developing new ideas or products (Slater and Narver, 1998). Despite previous studies have focused on market orientation, both proactive and reactive, and innovation (Narver et al., 2004), they have found mixed results concerning the effect of market orientation on innovation (Nguyen et al., 2015). More in detail, some authors have found a positive impact (Atuahene-Gima, 2005; Gotteland and Boulé, 2006; Kam Sing Wong and Tong, 2012; Narver et al., 2004; Vega-Vázquez et al., 2012), others have demonstrated a negative effect (Frambach et al., 2003; Perry and Shao, 2005) or no effect (Im and Workman, 2004; De Luca et al., 2010). Moreover, literature has suggested that reactive market orientation can contribute to the development of incremental innovations, while proactive market orientation, leading to deeper insights into customers' needs, can be exploited by firms to develop radical innovations (Deshpandé et al., 1993; Narver et al., 2004). Extant literature suggests that proactive orientation allows firms to disrupt their existing capabilities and create new ones that could be exploited to develop radical innovation and carry out new products/services or processes, while reactive orientation allows firms only to enhance their existing capabilities and use them to develop incremental innovations (Forsman, 2011; Nuruzzaman, Singh, et al., 2018).

Being market oriented lets firms respond to changes, boosting their innovation capacity through continuous innovation (Deshpandé et al., 1993; Fidel et al., 2016). Therefore, it is expected to find a positive relationship between both forms of market orientation and innovation capacity.

H1 bis. Proactive social media market orientation has a positive influence on innovation capacity

H2 bis. Reactive social media market orientation has a positive influence on innovation capacity

2.2 Customer collaboration, big data knowledge management and innovation capacity

Customer collaboration via social media refers to information gained from customers that actively interact and collaborate with firms in the value co-creation process (Constantinides et al., 2009). In value co-creation, customer is a fundamental player, performing as an active co-inventor of value (Lusch et al., 2007; Vargo and Lusch, 2008; Vega-Vazquez et al., 2013), and social media, allowing interactions and the sharing of information, interests and opinions between customers and firms and among peers, have facilitated the value co-creation process (Harrison and Barthel, 2009). Social media environment has enabled firms to directly and continuously collaborate with customers and develop a learning process from them (Sawhney et al., 2005). Consequently, by exploiting social media, firms can shape relationships with existing customers, acquire new customers, and set up communities that interactively collaborate to identify and understand existing and latent needs and develop solutions for customers (Sashi, 2012). Collaborating with customers through social media represents a primary determinant for firms to acquire customer-related data that, in turn, require to be adequately managed in order to gain a customers' knowledge useful to support co-creation processes (Bharati et al., 2014; Fidel et al., 2016). In a dynamic-capability perspective, collaborating with customers lets firms acquire that external knowledge required to generate new learning and accumulate experience useful to develop an enduring source of competitive advantage (Alegre et al., 2011; Marsh and Stock, 2006).

Thus, the study investigates the relationship between customer collaboration through social media and big data knowledge management practices, and posits that:

H3. Social media customer collaboration has a positive influence on big data knowledge management

Previous studies have investigated customer collaboration within the innovation process. According to Wind and Mahajan (1997) firms that cultivate strong collaborations with their customers acquire useful information that can be exploited for the development of successful innovations. Customers no longer play a passive role, merely answering questions or allowing observations, but actively take part to the innovation process as valuable co-creators. In other terms, by actively collaborate with customers, firms have the opportunity to deploy them as a strategic resource that can be involved to jointly discover customers' latent needs and, consequently, empower firms' innovation capacity (Ordanini and Parasuraman, 2011; Vargo and Lusch, 2008). As social media allow firms to establish collaborative conversations and enhance relationships with customers (Greenberg, 2010; Trainor, 2012), social media represent a tool through which cooperate with customer and support the value co-creation process (Trainor et al., 2014).

In this perspective, since numerous researches report a positive relationship between customer collaboration and innovation capacity, the study posits:

H3 bis. Social media customer collaboration has a positive influence on innovation capacity

2.3 Big data knowledge management and innovation capacity

Knowledge management has been identified as an important antecedent of innovation (Carneiro, 2000; Dove, 1999), even if its effect on innovation is hard to determine (Darroch and McNaughton, 2002). However, previous studies convey that knowledge generation and dissemination play a crucial role in gaining a sustainable competitive advantage, such as innovation, because of their uniqueness to the firm (Day, 1994; Grant, 1996). In fact, according to Meso and Smith (2000) knowledge management is "the process of capturing the collective expertise and intelligence in an organization and using them to foster innovation

through continued organizational learning" (pp. 225). Knowledge management grasps the changes occurring in the environment and supports firms in integrating, building, and reconfiguring their competences. In this perspective, knowledge management has been associated with firms' practices like organizing knowledge repositories, adopting technologies that allow collecting data from internal and external sources, and developing mechanisms to share and transfer knowledge (Darroch and McNaughton, 2002; Gupta et al., 2000). In recent years, the knowledge process and practices have undergone a revolution since Web 2.0 and social media have altered the way through which firms create, share and capture data and, at the same time, have allowed firms to access big data that, if adequately managed, become an additional valuable knowledge asset (Erickson and Rothberg, 2014; von Krogh, 2012). Knowledge represents a basis for the development of a competitive advantage (Lusch et al., 2007) and, contributing to the enhancement of firms' innovation capacity, it results as a key element of firm competitiveness (De Clercq and Arenius, 2006; Nonaka, 1994). Moving from the assumption that innovation is the application of knowledge (Fidel et al., 2016), and that these two concepts are strictly connected one to each other, this study posits:

H4. Big data knowledge management has a positive influence on innovation capacity

2.4 Innovation capacity and firm performance

Innovation capacity can be defined as the firms' ability to develop and realize new processes and value propositions (Hurley & Hult 1998) that satisfy customers' current and latent needs (Adler and Shenbar, 1990). According to Deshpandé et al. (1993) innovation capacity is a source of competitive advantage because it allows firms to adapt themselves to the dynamic environment wherein they operate and compete. Developing and exploiting innovation capacity is not only a strategic choice but it is also a crucial aspect of firms' long-term competitiveness (Singh and Gaur, 2013).

Even if innovation is a high-risk and resource-consuming activity that requires significant R&D investments and a specific allocation of managerial and financial resources and, in the short-term, it could lead to performance not as much positive as expected (Lee et al., 2017), previous studies have demonstrated the importance of innovation in contributing to firms' long-run competitiveness and the existence of a positive relationship between innovation constructs and the different dimensions of firms' performance (Calantone et al., 2002; Hitt et al., 1997). Furthermore, Hurley and Hult (1998) reveal that firms' capacity to innovate, covering different strategic areas and business units, from product design to marketing, affects firms' competitiveness. Moreover, a number of studies note that generating and utilizing knowledge to improve firms' innovation capacity leads firms to achieve higher performance (Ozkaya et al., 2015; Palacios-Marqués et al., 2015). In fact, the capacity to better respond to customers' needs through the development of innovative products and services enhances both relational outcomes, such as customer satisfaction, customer loyalty, and customer retention, and financial outcomes, such as firms' sales, profitability, and market share (Fidel et al., 2015, 2016; Kostopoulos et al., 2011).

Thus, it can be assumed that innovation capacity is essential for firms to achieve superior business performance outcomes, in terms of both customer relationship performance and financial performance.

H5. Innovation capacity has a positive influence on customer relationship performance

H6. Innovation capacity has a positive influence on financial performance

2.5 *Customer relationship performance and financial performance*

Customers play a crucial role for firms to compete and succeed in the actual scenario. Since projecting and designing new products or services in collaboration with customers lead firms to propose an offer that is more highly valued by customers (Kristensson et al., 2008), firms are trying to involve them in co-creating new products. This effect influences also firms'

financial performance because customers who have access to products and services that respond to their needs and exigencies tend to establish a relationship with the brands and, consequently, to generate more purchases over times (Reinartz et al., 2004). Consequently, it emerges that customers have different economic value to firms that, in turn, are interested in implementing tools, technologies, and processes that can be used to establish better and longer relationship with customers (Zablah et al., 2004). In this perspective, firms have to understand how they are performing with their customers. Gupta and Zeithaml (2006) suggest that customer metrics can be classified as stated preferences, which are those unobserved preferences such as customer satisfaction, and revealed preferences, which are those related to customers' behavior such as customer loyalty and retention. Both these categories refer to customers' attitude to get engaged with firms and, thus, it may be expected they affect firms' profitability (Verhoef et al., 2010). Therefore:

H7. Customer relationship performance has a positive influence on financial performance

2.6 The mediation effects of big data knowledge management

Previous arguments provide the theoretical foundations for the final hypotheses of the study that assume big data knowledge management acts as a mediation variable of the relationships between proactive social media market orientation, reactive social media market orientation, social media customer collaboration and innovation capacity. Previous literature suggests that acquiring data and transforming them into knowledge contributes to strength firms' innovation capacity (Taghizadeh et al., 2018). For instance, some authors have investigated the relationship between knowledge acquisition and innovation by considering knowledge competence (Ozkaya et al., 2015), instrumental use of information (Gotteland and Boulé, 2006), organizational learning (Zhou et al., 2005), and research and development effectiveness (De Luca et al., 2010) as mediation variables. All these studies have considered different aspects of knowledge management to explain the complex effect of knowledge

acquisition orientation on innovation constructs. In this perspective, the study assumes that big data gathered through social media market orientation, in terms of both proactive and reactive, and social media customer collaboration are transformed into knowledge through big data knowledge management, and this, in turn, improve firms' innovation capacity. Thus:

H8. Big data knowledge management mediates the positive relationship between proactive social media market orientation and innovation capacity

H9. Big data knowledge management mediates the positive relationship between reactive social media market orientation and innovation capacity

H10. Big data knowledge management mediates the positive relationship between social media customer collaboration and innovation capacity

[Please insert Figure 1 about here]

3 Method

3.1 Sampling and data collection

The objective of this research is to investigate the role and the impact of social media market orientation, both proactive and reactive, and social media customer collaboration on big data knowledge management, innovation capacity and firm performances, as outcomes. Data on such constructs were collected through a self-administered web-based questionnaire dispatched to managers of firms that operate in Italy and use at least one social network to communicate and interact with their customers.

The chosen respondents for the questionnaire were managers whose holistic view enables them to provide reliable responses about their organizations' activities (Hambrick and Mason, 1984). In addition, the research was carried out within the Italian context because, according to We Are Social 2018 report, both firms and consumers daily use social media to share information, experiences and engage with brands (Kemp, 2018) and, consequently, the Italian market represents a suitable context for social media research.

The questionnaire, in which respondents self-reported their answers, was developed and divided into two sections. The first section was dedicated to study the seven constructs adapted from previous literature and revised to fulfill the research aim; the second part addressed the characteristics of the investigated firms. Prior to the data collection, a pre-test was conducted with 10 academics and managers to check the contents of the questionnaire and the appropriateness of the questions.

In order to achieve a large number of managers from a wide range of industries and different business sizes, the invitation to fill in the questionnaire was sent to 1.565 managers' email contacts sourced through a collaboration with LeFAC, a database that collects information and insights about firms that actively invest in marketing, advertising, and communication in the Italian market. From June to September 2016, 418 questionnaires were returned in a completed form, which represents a response rate of 26.7%. This response rate is in line with the common standards for web-based questionnaires administered to firms' managers (Anseel et al., 2010; Cycyota and Harrison, 2006). Since data collection was performed through an online questionnaire, respondents were not allowed to move forward to the following question if they did not answer to the previous one. Hence, the study did not provide any missing value.

3.2 Measures

All the measurement scales for operationalizing each construct of the conceptual model have been previously validated. The study uses a seven-point Likert scale to measure all the constructs' items.

Based on the research of Jaworski et al. (2000), Narver et al. (2004), Ordanini and Maglio (2009) and of Nguyen et al. (2015), the study measures proactive social media market orientation and reactive social media market orientation using a four-item scale and a three item-scale respectively. Proactive social media market orientation items measure firms'

ability in using social media to discover customers' latent needs, exploit new market opportunities, and cannibalize existing offerings. Reactive social media market orientation items examine firms' ability in using social media to acquire and generate information regarding existing customers' needs, exigencies, and satisfaction.

Further, adapting the scale proposed by Fidel et al. (2015, 2016) and by Santos-Vijande and Álvarez-González (2007), the study investigates social media customer collaboration and innovation capacity using a four-item scale each. Social media customer collaboration explains firms' ability to acquire knowledge from social media through the continuous interaction and conversation with their customer, while innovation capacity is related to firms' ability to develop new ideas or products using information derived from big data management.

Drawing from dynamic capability theory (Barney, 1991; Nielsen, 2006; Teece, 2009; Teece et al., 1997) and Alegre et al. (2011), Fidel et al. (2015, 2016), and O'Connor and Kelly (2017) works, the study measures big data knowledge management using a seven-item scale. Big data knowledge management describes firms' abilities and capabilities to exploit big data-enabled technologies and infrastructures to gain and share a deeper knowledge about customers.

Finally, the study uses a five-item scale to measure customer relationship performance (Rapp et al., 2010; Trainor et al., 2014) and a three-item scale to evaluate financial performance (Grissemann et al., 2013; Ozkaya et al., 2015). Comparing firms' performance to competitors, customer relationship performance assesses firms' success in satisfying and retaining customers, while financial performance construct evaluates firms' sales growth, profitability, and market share.

Appendix 1 presents the scale items of each construct analyzed in this study.

3.3 Data analysis

Using LISREL 8.80, the structural equation modeling (SEM) technique was applied in order to empirically test the relationship of proactive social media market orientation, reactive social media market orientation, social media customer collaboration, big data knowledge management, innovation capacity, customer relationship performance and financial performance.

4 Results and hypotheses testing

4.1 Measurement model

Using SPSS and LISREL 8.80, the study estimates Cronbach's alphas (CA), item-to-total correlations (ITTC), and confirmatory factor analysis (CFA) to test reliability, convergent validity and discriminant validity of each construct (Anderson and Gerbing, 1988; Jöreskog and Sörbom, 2005).

All Cronbach's alpha values exceed the suggested threshold of 0.70 (Bagozzi and Yi, 1988; Nunnally and Bernstein, 1994), ranging from 0.787 to 0.915, signifying an acceptable reliability of each of the study constructs.

With regard to convergent validity test, all item loadings are greater than the recommended threshold of 0.50 (Hair, Joseph F.; Anderson, Ronald L.; Tatham, Anderson y Black, 2006), all the composite reliability (CR) values are higher than the minimum threshold of 0.70 (Bagozzi and Yi, 1988; Nunnally and Bernstein, 1994), and all the average variance extracted (AVE) values exceed the recommended threshold of 0.50 (Fornell and Larcker, 1981). Together, these results indicate an adequate convergent validity for all constructs. Furthermore, all AVE values are greater than the squared correlations of the constructs, showing a good level of discriminant validity of the measurement scales (Fornell and Larcker, 1981). Thus, also the discriminant validity of the constructs is supported.

Table 1 shows reliability, convergent and discriminant validity examinations, and Table 2 presents the correlation matrix.

[Please insert Table 1 about here]

[Please insert Table 2 about here]

Finally, due to the use of a structured questionnaire in which respondents self-reported their answers, several approaches to minimize the potential for common biased effect are used. In particular, by pre-testing the survey, the item statements were clarified to reduce items ambiguity and the items related to the dependent variables were not located near to the independent ones. Moreover, as suggested by Podsakoff et al. (2003), the Harman's single-factor test was carried out. All measurement items were loaded into an exploratory factor analysis (EFA), using principal components extraction and unrotated factor solution, to check if the variance of all items was explained by only one component. No evidence of common method bias was found.

4.2 Structural model

The structural model results, including the relationships among constructs, overall explanatory power, completely standardized coefficients and t-values are presented in Table 3. The structural model has an acceptable fit with the empirical data, with Chi-Square 1498.25127; Degrees of Freedom (DF) 392; Chi-Square/DF 3.822; Root Mean Square Error of Approximation (RMSEA) 0.089525; Comparative Fit Index (CFI) 0.96413; Standardized RMR (SMRM) 0.14341. All items load significantly on their assigned latent constructs.

T-values indicate that seven out of ten research hypotheses presented in Figure 1 are supported. The relationships between proactive social media market orientation and big data knowledge management and between proactive social media market orientation and innovation capacity are positive and significant ($\gamma = 0.48047$, $t = 7.60512$, $p < 0.01$; $\gamma = 0.19626$, $t = 3.26636$, $p < 0.01$), supporting H1 and H1*bis*. Reactive social media market

orientation positively and strongly affects innovation capacity (γ = 0.60888, t = 10.97465, p < 0.01), while it seems not to directly affect big data knowledge management (γ = -0.00093, t = -0.01916), supporting H2*bis* and rejecting H2. Social media customer collaboration exhibits a positive and significant influence on big data knowledge management (γ = 0.25015, t = 4.39176, p < 0.01) but not on innovation capacity (γ = 0.08382, t = 1.59638), supporting H3 and rejecting H3*bis*. Furthermore, the relationship between big data knowledge management and innovation capacity is positive and significant (β = 0.16058, t = 2.89399, p < 0.01), supporting H4. With regard to business performance, innovation capacity positively and significantly affects customer relationship performance (β = 0.61503, t = 10.78117, p < 0.01), while it seems not to directly affect financial performance (β = -0.06812, t = -1.46505), supporting H5 and rejecting H6. Finally, customer relationship performance positively and strongly affects financial performance (β = 0.90387, t = 17.05798, p < 0.01), supporting H7.

The structural model explains 43.08% of the variance in big data knowledge management (R^2 = 0.43084), 69.08% of that in innovation capacity (R^2 = 0.69082), 37.83% of that in customer relationship performance (R^2 = 0.37827), and 74.59% of that in financial performance (R^2 = 0.74588).

The causal relationships among constructs and the hypotheses test are synthesized in Table 3.

[Please insert Table 3 about here]

4.3 Mediation effects of big data knowledge management

Table 4 presents the total, direct, and indirect effects from the mediation analyses and indicates the mediation types.

Proactive social media market orientation has a positive total effect on innovation capacity (γ = 0.26324, t = 4.99144, p < 0.01). It has a positive direct effect (γ = 0.19626, t = 3.26636, p < 0.01), as well as an indirect effect through big data knowledge management (γ = 0.07428, t = 2.74181, p < 0.01; 2.74; [.02.13]). This indicates partial mediation, supporting the hypothesis

that big data knowledge management mediates the positive relationship between proactive social media market orientation and innovation capacity. Reactive social media market orientation has a positive total effect on innovation capacity ($\gamma = 0.48973$, t = 10.87559, $p < 0.01$). It has only a positive direct effect ($\gamma = 0.60888$, t = 10.97465, $p < 0.01$), while the indirect effect through big data knowledge management is not significant ($\gamma = -0.00012$, t = -0.01915; ns; [-.02.01]). This indicates that big data knowledge management does not mediate the positive relationship between reactive social media market orientation and innovation capacity. Finally, social media customer collaboration has a positive total effect on innovation capacity ($\gamma = 0.11839$, t = 2.39724, $p < 0.05$). The direct effect is not significant ($\gamma = 0.08382$, t = 1.59638). However, the indirect effect through big data knowledge management is significant ($\gamma = 0.03835$, t = 2.41712, $p < 0.05$; 2.42; [.01.07]). This indicates full mediation, supporting the hypothesis that big data knowledge management mediates the positive relationship between social media customer collaboration and innovation capacity.

[Please insert Table 4 about here]

5 Discussion

Despite the current hype surrounding big data and social media has attracted the interest of both academics and practitioners, the impact of big data acquired from social media on knowledge management practices, innovation processes and business performance remains largely unexplored. Transforming customer-related data into meaningful information through the development of knowledge management capabilities and practices has become a critical asset for firms to boost their innovation capacity and to achieve greater economic and customer value. In this context, the conceptual model proposed and tested in this study investigates the causal relationships among social media market orientation, in terms of both proactive and reactive orientation, social media customer collaboration, big data knowledge management, innovation capacity and firms' performance outcomes, in terms of both

customer relationship performance and financial one. Moreover, the study tests the mediating role of big data knowledge management to reveal if and how transforming social media customer-related information into knowledge leads firms to improve their ability to design and implement innovative products/services that address existing and latent customers' needs.

This study offers several theoretical contributions to the extant literature on knowledge management, social media and big data management.

The first set of findings concerns the direct effects of proactive and reactive social media market orientation and social media customer collaboration, as different ways of data acquisition from social media, on big data knowledge management and innovation capacity. Findings reveal that the different ways through which firms gather social media information have different impacts on big data knowledge management and innovation capacity, displaying some interesting results. In line with previous research (Hurley and Hult, 1998; Lado and Maydeu-Olivares, 2001), market orientation, in terms of both proactive and reactive orientation, positively and significantly affects firms' ability to implement innovative products/services in order to better satisfy customers' needs, suggesting that these two types of market orientation are crucial in enhancing firms' innovation capacity.

However, even if some researchers have suggested that firms that generate and use market and customer intelligence, and integrate knowledge through customer collaboration are able to improve their knowledge management practices (Nguyen et al., 2015), this study provides mixed results. In fact, the study suggests that only proactive social media market orientation and social media customer collaboration positively influence big data knowledge management, while reactive social media market orientation seems to not represent a key capability in managing and transforming customer-related information into knowledge. This result could be due to the fact that through responsive orientation firms collect information

about customers' expressed needs (Slater and Narver, 1998) that do not need to be treated and managed with ad hoc knowledge management practices to become useful for the firms' innovative processes.

Second, the study extends the current understanding of knowledge management practices by providing empirical support for the mediating role of big data knowledge management as a critical firms' resource in the relationships between proactive social media market orientation and innovation capacity and between social media customer collaboration and innovation capacity. These interesting results indicate that, in contrast to reactive market orientation that affects innovation capacity only directly, these other two ways of acquiring knowledge enhance innovation capacity indirectly through the mediating role of big data knowledge management. Since innovation is a high-risk and resource consuming activity (Nguyen et al., 2015), the study reveals that big data knowledge management supports firms in transforming data into meaningful information, in improving their ability to exploit customer-related knowledge arising from social media, and in strengthening innovation capacity. In line with previous studies (Fidel et al., 2016; Lusch et al., 2007) these results are important because they highlight that, thanks to big data knowledge management practices, firms can effectively bridge the gap between discovering and understanding customers' latent needs and developing innovation. In this perspective, this study extends the mediation variables used to explain the relationship between knowledge acquisition and innovation, pointing out that big data knowledge management represent a crucial requirement for innovation and value creation. Moreover, the study also suggests to treat proactive and reactive social media market orientation as coexisting but separate constructs (Narver et al., 2004; Ordanini and Maglio, 2009) because they have different direct and indirect effects on firms' innovation capacity, with big data knowledge management as mediator. Finally, another contribution of the study can be found in the mixed results emerged from the analysis of the direct

relationship between innovation capacity and business performances. In particular, the study reveals that firms' capacity to implement innovation and shape organizations to successfully face the dynamic competitive environment allows firms to directly achieve greater relational outcomes and, only through these relational results, improve their financial performance. In line with previous researches (Calantone et al., 2002; Taghizadeh et al., 2018; Zeng et al., 2015), this study highlights that innovation capacity gives firms the ability to utilize their resources to realize new products and services (or new processes or marketing activities) and to better satisfy customers' wants and needs, enhancing firms' customer relationship performance. However, although previous studies have pointed out also the positive and direct effect of innovation on financial performance (Bigliardi, 2013), this study reveals that innovation capacity affects financial outcomes only through customer relationship performance. This result suggests that firms' innovation capacity alone does not directly influence financial results but if the innovation capacity is used to gain customers' satisfaction, loyalty and retention can effectively facilitate firms' in achieving higher financial performance. In fact, innovation capacity is a key strategic resource of firms' overall competitiveness because it supports long-term customer relationship management, enabling firms to enhance their performance and, consequently, remain competitive (Fidel et al., 2015; Singh and Gaur, 2013).

6 Conclusions, implications, and future perspectives

The objective of this study is to examine the direct and indirect effect of social media market orientation, proactive and reactive, social media customer collaboration on innovation capacity and firm performances, as well as the mediating effect of big data knowledge management. The results of the study clearly show that firms need to search for and manage

customer knowledge in order to innovate and, consequently, to perform better both in term of customer relationship performance and financial performance. This study's evidences provide guidance to practitioners who are daily engaged in managing social media and exploiting big data and customer-related information.

First, findings reveal that, even if it is crucial to use social media to collect information about customers' needs, not all data have the same explicit informative value. Consequently, information need to be treated differently in order to better understand customers' needs and develop innovation. This result has a significant implication for practitioners because it suggests that managers have to evaluate accurately which of the data gathered from social media have to be processed through knowledge management practices to obtain knowledge useful to improve firms' innovation capacity.

Second, the mediating role of big data knowledge management highlights how firms' market orientation and customer knowledge can be leveraged as a source of innovation and competitive advantage. A knowledge-management oriented firm generates and disseminates customer knowledge within the whole organization in order to innovate and better target customers' needs. From a managerial perspective, this result emphasizes the importance of developing big data knowledge management as a unique resource that can contribute to sharpen firms' innovation capacity and, consequently, increase their competitiveness.

Finally, analyzing the link between innovation capacity and firm performance, it has emerged that firm ability to innovate contributes to enhance customer relationship performance that, in turn, increase financial performance. In this perspective, managers should be aware that firms' innovation capacity can significantly contributes to firms' performance, but it not always affects financial results directly. Using innovation capacity to develop products and services that meet customers' needs and expectations, firms have the opportunity to improve

customer relationships and, by satisfying customers and securing their loyalty, firms can also achieve better financial performance.

This study has also some limitations that suggest avenues for future research. First, it investigates firms operating in Italy who invest in marketing, advertising, and communication. Future research should try to include in the sample also firms who operates in other countries, especially to find out differences and commonalities with foreign markets.

Second, the study adopts subjective measures to evaluate firms' performance and, more in detail, it relies on managers' perceptions about firms' financial and customer relationship performance. In order to better understand the causal relationships among the constructs investigated in the present study, future research should develop more objective measures of these variables.

Finally, the study does not consider that customer information acquired through social media can be very different because each tool has its own interaction protocol and engaging instruments. Future studies should investigate if and how big data retrieved from several social media provide different insights about customers.

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Constructs	α	CR	AVE
Proactive social media market orientation	0.859	0.875	0.639
Reactive social media market orientation	0.856	0.857	0.668
Social media customer collaboration	0.882	0.885	0.663
Big data knowledge management	0.898	0.901	0.566
Innovation capacity	0.787	0.801	0.512
Customer relationship performance	0.915	0.919	0.696
Financial performance	0.906	0.907	0.764

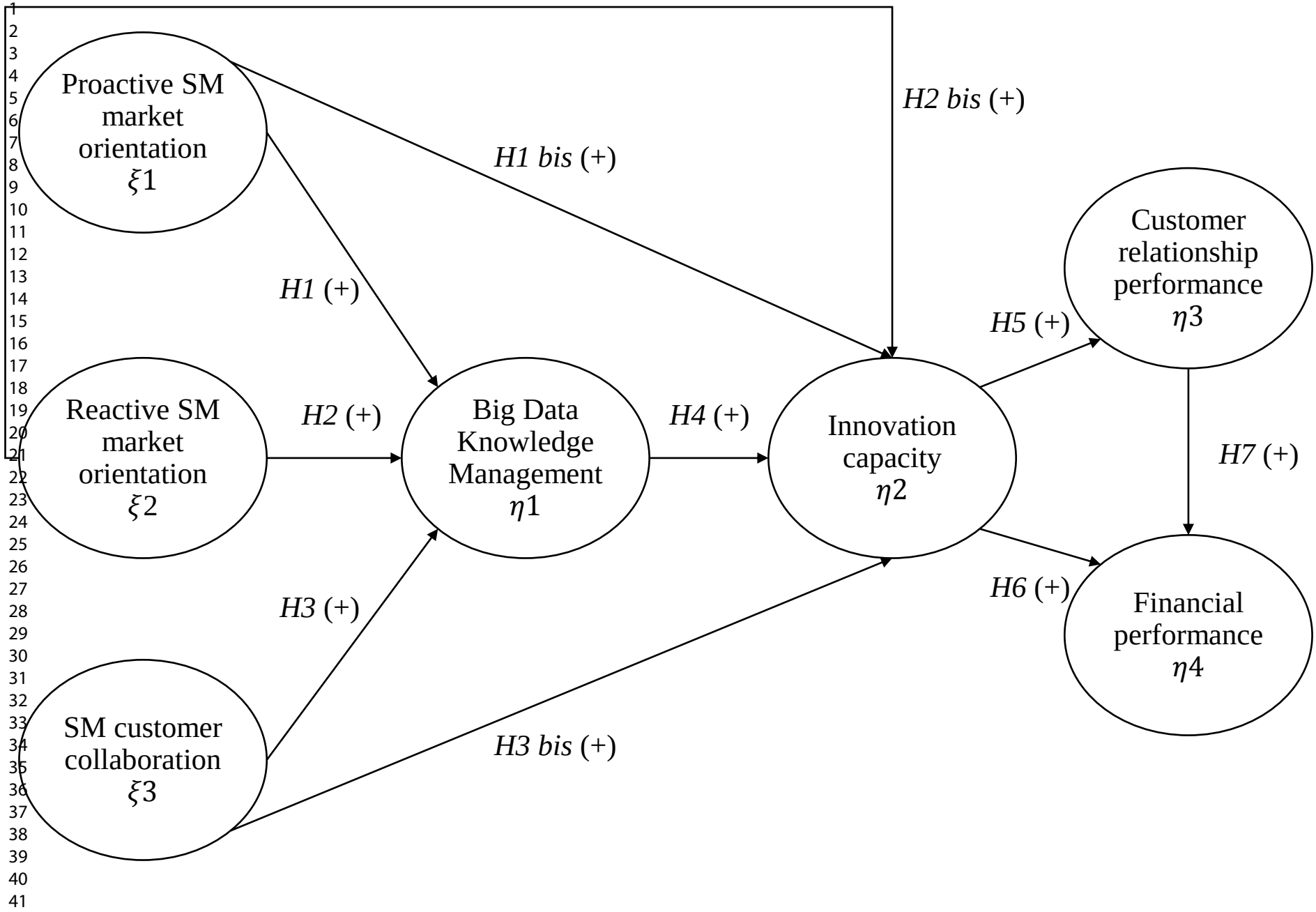
Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1)Proactive social media market orientation	1.000						
(2)Reactive social media market orientation	.373	1.000					
(3)Social media customer collaboration	.574	.348	1.000				
(4)Big data knowledge management	.624	.265	.525	1.000			
(5)Innovation capacity	.571	.654	.493	.488	1.000		
(6)Customer relationship performance	.351	.464	.303	.300	.615	1.000	
(7)Financial performance	.279	.368	.240	.238	.488	.662	1.000

Path	Completely std β and γ	t value	Hypotheses test
Proactive SM market orientation → Big data knowledge management	0.48047	7.60512***	Supported
Proactive SM market orientation → Innovation capacity	0.19626	3.26636***	Supported
Reactive SM market orientation → Big data knowledge management	-0.00093	-0.01916	Not Supported
Reactive SM market orientation → Innovation capacity	0.60888	10.97465***	Supported
SM customer collaboration → Big data knowledge management	0.25015	4.39176***	Supported
SM customer collaboration → Innovation capacity	0.08382	1.59638	Not supported
Big data knowledge management → Innovation capacity	0.16058	2.89399***	Supported
Innovation capacity → Customer relationship performance	0.61503	10.78117***	Supported
Innovation capacity → Financial performance	-0.06812	-1.46505	Not supported
Customer relationship performance → Financial performance	0.90387	17.05798***	Supported

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01

Path	Total effect	Direct effect	Indirect effect	Sobel test	Confidence interval 95%	Mediation type
Proactive SM market orientation → Big data knowledge management → Innovation capacity	0.26324***	0.19626***	0.07428***	2.74	[.02.13]	Partial (complementary)
Reactive SM market orientation → Big data knowledge management → Innovation capacity	0.48973***	0.60888***	-0.00012 (ns)	ns	[-.02..01]	No mediation (direct-only)
SM customer collaboration → Big data knowledge management → Innovation capacity	0.11839**	0.08382 (ns)	0.03835**	2.42	[.01.07]	Full (indirect-only)

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01


Proactive SM market orientation ξ1
Reactive SM market orientation ξ2
SM customer collaboration ξ3
Big Data Knowledge Management η1
Innovation capacity η2
Customer relationship performance η3
Financial performance η4
H1 (+)
H2 (+)
H3 (+)
H4 (+)
H5 (+)
H6 (+)
H7 (+)
H1 bis (+)
H2 bis (+)
H3 bis (+)

Proactive social media market orientation (adapted from Nguyen et al., 2015)
Our firm helps customers to anticipate developments in the markets using social media
Our firm continuously tries to discover additional needs of our customers of which they are unaware using social media
Our firm innovates using social media even at the risk of accelerating our products obsolescence
Our firm searches for opportunities using social media in areas where customers have difficulty in expressing their needs
Reactive social media market orientation (adapted from Nguyen et al., 2015)
Our firm constantly monitors our level of commitment and orientation to serving customer needs using social media
Our strategy for competitive advantage is based on our understanding of customer needs using social media
Our firm measures customer satisfaction systematically and frequently using social media
Social media customer collaboration (adapted from Fidel et al., 2016)
Our firm interacts with customers to obtain useful information for innovation using social media
The intensity with which our firm interacts with customers using social media is high
Our firm frequently uses social media to organize meetings with customers
The number of customers with whom our firm interacts using social media is high
Big data knowledge management (adapted from Alegre et al., 2011; Fidel et al., 2016)
Our firm uses coding systems of big data that we have collected about our customers using social media
Our firm uses internal mechanisms to promote exchange of big data/information on customers
Our firm uses participatory techniques among our employees and customers (such as client meetings, client interviews for improvements etc.)
Our firm uses tools to ensure big data about customers reach everyone in the firm
Our firm has information processing systems to process big data about customers
Our firm uses control systems and review the firm's existing information on customers
Our firm uses systems that allow the big data that were used in previous innovation tasks to be used in new innovation tasks
Innovation capacity (adapted from Fidel et al., 2016)
Our firm has introduced innovative products and/or services in the last 3 years
Our firm has innovated in production processes (adoption of new technologies, improved processes) in the last 3 years
Our firm has innovated in management processes (administrative area, human resources, new departments, project management) in the last 3 years
Our firm has innovated in marketing aspects (commercialization, penetrate in new markets and/or segments, new distribution channels, new forms of communication with customers and/or suppliers, new methods or pricing strategies) in last 3 years
Customer relationship performance (adapted from Trainor et al., 2014; Rapp et al., 2010)
Compared to competitors
Our customers work with our firm for a long time
Once we get new customers, they tend to stay with our firm
Our customers are very loyal to our firm
Our customers are satisfied with our firm
Customer retention is very important to our firm
Financial performance (adapted from Ozkaya et al., 2015; Grissemann, 2013)
Compared to competitors
Our sales have grown in the past two years
Our market share has grown
Our profitability has increased

Note: Respondents evaluated all the measurement items on 7-point scales ranging from 1 = Strongly disagree to 7 = Strongly agree