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Innovating through digital revolution

The role of soft skills and Big Data in increasing firm performance

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Abstract

Purpose – The purpose of this paper is to investigate the relations among soft skill, information technologies and Big Data for building a possible bridge able to link human and technology dimensions for increasing firm performance.

Design/methodology/approach – Using the Business-focused Inventory of Personality , work personality of 4,758 human resources engaged in 72 high-tech European firms has been analyzed and its relations with firms' investment in Big Data and firms' economic performance have been tested using the structural equation modeling (SEM).

Findings – The research shows the existence of strong relations between some elements of human resources' personality such as the work motivation and the social competencies and the firms' economic performance. At the same time, the research clarifies the mediated effect of firms' investment in Big Data in the relations between human resources' organizational behavior and the firms' economic performance.

Originality/value – The paper extends previous managerial contributions about Big Data management and human resource management providing evidence on which build more effective managerial models in the era of digital transformation.

Keywords Big Data, Artificial intelligence, Soft skills, High-tech European firms

Paper type Research paper

1. Introduction

For a long time, managerial and marketing studies have focused their attention on the role of "tangible resources" such as raw materials, production processes and physical structures as key levers for ensuring firms' survival and competitiveness (Jauch and Glueck, 1988; Dakin, 1993). Nowadays, the challenging social and economic dynamics are showing the relevance of "not tangible resources" as key elements on which act for building managerial and business models able to support firms in catching emerging market opportunities (Teece, 1998; Chesbrough, 2010; Almatrooshi *et al.*, 2016).

Among "not tangible resources," an increasing relevance has been acquired by the multiple instruments rooted in the field of information and communication technologies (ICTs) (Roberts, 2000; Fuchs, 2009; Aquino *et al.*, 2018; Gupta *et al.*, 2018). The spread of social networks, virtual realities, electronic devices, 3D printers and artificial intelligence (AI) supported systems among the others are clear evidence of disruptive changes that are radically changing the world in which we all live.

Within the challenging debate about opportunities and risks provided by the ICT, several contributions have been specifically provided with reference to the multi- and

trans-disciplinary domains of Big Data (McAfee *et al.*, 2012; Chen *et al.*, 2013) and AI (Liebowitz, 2001; Brodie and Mylopoulos, 2012). Accordingly, a number of theoretical perspectives have been adopted for examining firm innovation processes, including cognitive theory, dynamic capabilities theory, institutional theory, market orientation perspective, resource-based view and sociotechnical approaches (Huizingh, 2011; Garud *et al.*, 2013).

According to the large part of these contributions, ICTs are considered as a source for process innovation, while process innovation is considered as catalyst for understanding the business value of ICT. In such a view, Big Data can support the application of business intelligence (BI) tools, while AI can support the definition of more efficient work processes (Chen *et al.*, 2012).

Despite the multiple advancements in knowledge provided with reference to BI and AI, a large part of existing research approaches seems to be oriented to consider them as domains related only to firms' processes and infrastructures (Chen and Zhang, 2014), while only few contributions have been provided with reference to the role of human resources in managing processes based on Big Data and AI (Powell and Dent-Micallef, 1997). Still, a general halo of uncertainty seems to linger with reference to the conditions that affect human resources in the adoption of Big Data and AI (Linoff and Berry, 2011).

With the aim to bridge this gap, the paper adopts an interpretative perspective centered on human resources for providing a possible conceptual framework able to link human and technology dimension under the shared umbrella of business management. The main aim of the paper is to identify possible link able to support an efficient and suitable combination between human resources' features and opportunities offered by the advancements in knowledge in technology field. In such a line, the cognitive domain of 4,758 human resources engaged in 72 high-tech European firms is analyzed using the Business-focused Inventory of Personality (BIP) for defining key elements of human resources' work personality. After this, the relations between key elements of human resources' work personality, firm's investment in Big Data and firms' revenues have been analyzed using structural equation modeling (SEM) for tracing possible elements on which managerial researchers and practitioners can act for improving efficiency in the relation between firms' human and technology dimension. Accordingly, the rest of paper is structured as follow: Section 2 defines the literature overview on which reflections herein are based and Section 3 proposes the hypotheses development. Section 4 illustrates methodology and research process. In Section 5, the results are presented and, in Section 6, they are discussed for underling theoretical and practical implications of the research. Finally, Section 7 proposes some final remarks, limitations and future directions for research.

2. Literature overview

The emerging trend toward open innovation requires an integrative perspective and it calls for a rethinking of traditional perspectives about firm boundaries for considering knowledge exploration, retention, and exploitation inside and outside organizational boundaries (Chesbrough, 2006; Del Giudice and Della Peruta, 2013).

Quantitative empirical studies about external knowledge sourcing provide evidence that involving a large number of external sources in innovation is a promising choice for improving firms' economic performance (Chesbrough *et al.*, 2006; Perkmann and Walsh, 2007; Del Giudice and Della Peruta, 2016). Open innovation scholars also agree that external sourcing of knowledge does not replace in-house research and development and they highlight the importance of "absorptive capacity" which allows firms to identify, absorb and make use of external knowledge (Spithoven *et al.*, 2010).

Moreover, a large number of works have been concerned with the role of the diverse relationships and cooperation developed by firms with other stakeholders to "absorb"

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external knowledge (Zahra and George, 2002; Huang and Rice, 2009; Scuotto, Del Giudice, Bresciani and Meissner, 2017). The general idea is that the capacity of a firm to exploit external knowledge is a critical determinant of its capacity for innovation (Chesbrough, 2006; Scuotto, Del Giudice, della Peruta and Tarba, 2017).

As summarized in Table I, six knowledge capacities are needed to capture internal and external knowledge exploration, retention and exploitation: inventive, absorptive, transformative, connective, innovative and disruptive capacity (Argote *et al.*, 2003; Lane *et al.*, 2006).

While inventive capacity refers to internal exploring new knowledge, absorptive capacity relates to exploring external knowledge. Based on Cohen and Levinthal's original definition of recognizing, assimilating and applying external knowledge, Zahra and George (2002) differentiated between potential and realized absorptive capacity. In a similar vein, Lane *et al.* (2006) distinguished exploratory, transformative and exploitative learning processes. Following this reconceptualization, the studies about the absorptive capacity in the knowledge management framework focus the attention on the knowledge acquisition (Gray, 2006).

From a different perspective, connectivity capacity is closely related to absorptive capacity. Accordingly, connective capacity comprises the process stages of maintaining knowledge in interorganizational relationships and subsequently reactivating this knowledge (Xia and Roper, 2008; Saviano and Caputo, 2013).

Studies about open innovation proposed by knowledge management literature suggest that firms should use external as well as internal ideas. Thus, new innovation models entail new forms of interactions and collaborations for fostering new products and processes development within varying contexts (Bellantuono *et al.*, 2013; Saviano *et al.*, 2018).

Generally speaking, innovation management process is a relevant part of the operations of many businesses (Slack *et al.*, 2010; Scuotto, Santoro, Bresciani and Del Giudice, 2017). Innovation process management is a systematic approach for nurturing the creative capabilities of employees and for creating a workplace environment that encourages new ideas for workflows, methodologies, services and products (Ahmed and Shepherd, 2010).

Gartner's recommendations to IT leaders interested in launching an innovation management program are to follow a disciplined approach based on five steps (Gartner, 1990): strategize and plan: settle on a shared view of aims and plans; develop governance: establish a process for making decisions; drive change management: build systems by which people can communicate and socialize via multiple channels; execute: make sure to draw from a wide range of sources to generate ideas for innovations that will transform the business, align the initiatives with business goals and then update and drive new elements of the initiatives in response to changing business requirements; and measure and improve: monitor and measure how the innovation process affects business outcomes.

Following Gartner's recommendations, it is possible to note that digital transformation could be an interesting field for improving experience for both customers and employees. In the past, digital transformation was primarily integrated with business process management (BPM) tools, which aim to help companies in resources orchestration, routing work to the right people, manual task routine automation and self-service enabling where none existed before (Jeston, 2014). In a business landscape where companies need to be more agile,

	Knowledge exploration	Knowledge retention	Knowledge exploitation
Internal (intrafirm)	Inventive capacity	Transformative capacity	Innovative capacity
External (interfirm)	Absorptive capacity	Connective capacity	Desorptive capacity

Sources: Authors' elaboration from Argote *et al.* (2003) and Lane *et al.* (2006)

Table I. Capability-based view of open innovation processes

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BPM tools have helped line-of-business and IT departments to better align their goals and work processes (Smith and Fingar, 2003). Nowadays, new relevant opportunities for digital transformation are provided by the AI (Brodie and Mylopoulos, 2012) that combined with Big Data analytics (BBA) as "a collection of data and technology that accesses, integrates, and reports all available data by filtering, correlating, and reporting insights not attainable with past data technologies" (APICS, 2012, p. 6) are defining the "next management revolution".

More specifically, Big Data has the potential to support firms in identifying opportunities related to decision-making processes and in defining more efficient organizational processes through the data acquisition, filtering and coding (Caputo, 2018). Big Data is a broad and abstract concept that is receiving great recognition both from scholars and practitioners (Caputo *et al.*, 2018). Generally, it can be considered as a complex of tools for supporting firms' decision-making process by using technology with the aim to rapidly analyze large amounts of variegate data (e.g. structured data from relational databases and unstructured data such as images, videos, e-mails, transaction data and social media interactions) from a variety of sources to produce a stream of actionable knowledge (Perko and Caputo, 2018).

Furthermore, following the reflections rooted in the field of Big Data, several contributions have underlined the support of Big Data for organization's discovery of decision-making opportunities thanks to advanced analytics and data integration (Popovič *et al.*, 2012). According to Azma and Mostafapour (2012), there are two main features of data: the organizational learning process and the smart processing of data. The organizational learning includes the discovery of new knowledge and the dissemination of this knowledge; on the other hand, smart processing refers to the analysis and assessing of information with the aim to ensure the definition of efficient plans and the adoption of adequate control approaches.

From the process perspective, the main goal of the complex of technologies rooted in the field of Big Data is to improve the decision-making process reducing the time spent for the decision (Provost and Fawcett, 2013). From the product perspective, the domain of Big Data is considered as the complex of IT component that can be used to generate analytics for managers as the decision makers (Hazen *et al.*, 2014). Finally, from the organizational perspective, Big Data field should be considered as a part of a decision environment that combines both technologies and human capacities for obtaining decisions aligned with firms' plans (Chen *et al.*, 2012). In nutshell, Big Data tools provide to the firms the opportunities for reducing the time needed for routinary processes and, in this way, they can support firms in paying more attention to the definition of vision and mission.

3. Hypotheses development

3.1 Knowledge management and work motivation

Recognizing the validity of previous contributions about knowledge management (Ruggles, 1998; Alavi and Leidner, 2001; Gold *et al.*, 2001; Hussein *et al.*, 2016), it is possible to state that knowledge management strongly affects the way in which firms define their relational approaches both from internal and external perceptive. With specific reference to the internal perspective, Ardichvili *et al.* (2006) show that firms' attention to knowledge management influences the ways, in which human resources perceive their role in social and economic configurations contributing to the firms' economic results. In the same directions, Jiang *et al.* (2012) underline that a strong firms' attention on the levers of knowledge management influences the ways, in which human resources approach to their work in terms of motivation, engagement and commitment with several consequences in terms of their contributions to firms' economic performance. Again, Yahya and Goh (2002) show that human resources' work motivation is a consequence of the total amount of knowledge available inside the firms and it

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is a consequence of the way in which firms manage the available knowledge. Finally, Al Mehrzi and Singh (2016) show that it exists a link between perceived organizational support and organizational culture mediated by employee motivation.

Recognizing the validity of all these contributions and considering firms' revenues as a suitable manifestation of firms' economic performance, it is possible to state that:

H1. There is a positive relationship between human resources' work motivation and firms' revenues.

3.2 Human resources' social competence and digital transformation

Among the technology-based innovations, AI technology is becoming predominant in marketing fields such as customer relationship management (Ngai *et al.*, 2009). By using supervised machine learning, BPM tools thanks to the support provided by the AI can support an easily identification of valuable targets in the market (Dumas *et al.*, 2005). In such a vein, BPM tools and AI allow human employees to focus the attention on the more productivity processes (Weske *et al.*, 2004).

In nutshell, managerial studies show that thanks to the combination between BPM and AI, human resources have the opportunities for better focusing their attention to the so-called human-based competencies (Wang and Wang, 2006). With regard to the complex of social competencies, human resource has the opportunities for better understanding markets' expectations and needs with the aim to better delivering/providing firms' services and products (Powell and Dent-Micallef, 1997). In this direction, Cappelli and Crocker-Hefter (1996) underline that human resources' social competencies are a relevant lever on which firms should act for improving their market share and economic performance. In the same way, Huselid *et al.* (1997) underline that human resources' social competencies direct impact on firms' economic performance because they influence market's perception about firms' image. Again, Becker and Gerhart (1996) show that human resources with high social competencies provide a value added to firms interested in building loyalty-based relationships with the market for improving their economic performance. According to all these contributions and considering firms' revenues as a suitable manifestation of firms' economic performance, it is possible to state that:

H2. There is a positive relationship between human resources' social competencies and firms' revenues.

3.3 Big Data and human resources' organizational behavior

Reflecting upon the general domain of Big Data, it is possible to state that after that data are collected and stored, the biggest challenge for firms is related to their analysis and to the extraction of valuable information (Carayannis *et al.*, 2018). In such a perspective, Caputo *et al.* (2017) underline that Big Data and BBA can be efficiently used by firms only if human resources are able to effectively organize their work processes. More specifically, Brown *et al.* (2011) show that BBA act on the internal organizational flow and that the human resources' organizational behaviors affect the opportunities for companies to adopt Big Data tools and approaches. In the same direction, LaValle *et al.* (2011) focus the attention on the way in which human resources affect the firm organizational behaviors stating that firms' willingness to invest in Big Data depends by the human resources' ability to understand and catch the opportunities provided by the so-called digital transformation. Accordingly, it is possible to speculate that:

H3. There is a positive relationship between human resources' organizational behaviors and firms' investment in Big Data.

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Recognizing the validity of conceptualizations provided by managerial studies in the field of Big Data (Zikopoulos and Eaton, 2011; McAfee *et al.*, 2012; Waller and Fawcett, 2013), it is also possible to state that an effective contribution of Big Data to firm's organizations and decisions is possible only in the case in which human resources are able to understand the strategic value of Big Data (Carayannis *et al.*, 2018). Using different words, as underlined by Bozionelos and Singh (2017), it is possible to state that human resources' emotion intelligence (EI) affects the ways in which human resources perceive external world providing it a meaning and classifying through a subjective hierarchy of social and economic dynamic. In such a vein, Amendola *et al.* (2018) underline that human resources perspectives (or more generally emotions) define the firms' approach toward innovation affecting their willingness and orientation in the adoption of new technologies. In the same direction, Pradhan *et al.* (2017) demonstrate that human resources' EI influences employees' adaptation and then the possibility for success of firms' strategies. From a different perspective, Sagiroglu and Sinanc (2013) show that only firms with human resources inspired by an innovative conceptualization of the market are oriented to start new (also technology-based) processes. Following these contributions, the paper states that:

H4. There is a positive relationship between human resources' emotions and firms' investment in Big Data.

Furthermore, reflecting upon the role of Big Data in firms' managing processes, several contributions should be considered also with reference to the impact of Big Data on firms' economic performance (Chae *et al.*, 2014; Wamba *et al.*, 2017). In such a view, Wamba *et al.* (2017) demonstrate that firms' attention to Big Data, and more generally, to ICT positively impacts on firms' economic performance, while Brown *et al.* (2011) empirically verify the link between firm's attention and investment in Big Data and firms' market performance. From a different perspective, Weill (1992) shows that Big Data improves the quality of several firms' internal processes with positive effects on firms' economic performance, while Provost and Fawcett (2013) show the high contribution provided by Big Data to firms' selling strategies and the related positive impact of firms' revenues. According to all these contributions, the paper speculates that:

H5. There is a positive relationship between firms' investment in Big Data and firms' revenues.

4. Methodology and research process

4.1 Sample and data collection

Considering the pervasive nature of digital transformation for European companies involved in high-tech sectors (European Commission, 2017), a sample of 1,175 human resources engaged in 23 high-tech European firms is analyzed using a questionnaire based on the BIP (Hossiep and Paschen, 2008). BIP is a psychological questionnaire used for investigating professional characteristics of human resources (Birknerova, 2012). The questionnaire is composed by 210 through which human resources' occupational orientation and occupational behavior are measured via a six-point-based scale (Kauer *et al.*, 2007; Langendörfer, 2008).

The choice to focus the attention on the high-tech firms is motivated by their strong attention on technology-based innovations and to the opportunities for better identifying their investment in the field of Big Data using official websites and documents (CIONET and Next Value, 2017).

Building upon the "SEP ELITE Tech Scaleup 100" launched by Mind the Bridge in partnership with ELITE, London Stock Exchange Group's business support and capital raising program (Mind the Bridge and ELITE, 2018), all the firms included in the list have been contacted via e-mail explaining the aim of the research and describing the

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research process. After the first contact, 86 firms have declared their interest in participating in the research and a link to a questionnaire composed by 70 items inspired by BIP model has been sent to the firms that have declared their interest in participating to the research requiring them to share the link with their human resources. Therefore, the research is based on a survey methodology, which is useful to enhance the generalization of results.

The questionnaire was directed to investigate human resources' perceptions about four independent variables: human resources' work motivation, human resources' social competencies, human resources' organizational behavior and human resources' emotions management. According to the BIP model, these categories have been split up in items and, for each items, a certain number of sentences have been formulated requiring to the firms' human resources to express their opinion using a seven-point Likert scale in which 1 means "strongly disagree" and 7 means "strongly agree."

In Table II, they are summarized the main contents of the questionnaire.

During the data collection period, 14 firms changed their opinion declaring that it was not possible to collect data about the perceptions of their human resources so the final sample is composed by 72 high-tech European firms. From these firms, 4,758 human resources have completed the questionnaire from June to November 2018.

During the research, data related to the companies inside the sample such as firms' revenues and firms' investment in Big Data projects in the period from 2015 to 2017 have been collected using official data set provided by Amadeus (2018) – a Bureau van Dijk data set (https://amadeus.bvdinfo.com/).

Independent variables	Items	Items' meaning	Number of sentences used for measuring the item
Human resources' work motivation	Results orientation	Capability to work for producing results	5
	Power orientation	Capability to motivate other human resources using recognized structures and processes	5
	Leadership orientation	Capability to motivate other human resources using social influence	5
Human resources' social competencies	Feeling	Capability to understand relational signals	5
	Capabilities for building relationships	Capability for building relational network and long-term interactions	5
	Sociality	Capability for building conditions for collaboration and positive interactions	5
	Team orientation	Capability to work in team and to support team work	5
	Assertiveness	Capability to defend personal idea and identity	5
Human resources' organizational behavior	Conscientiousness	Capability to perform the work according to shared standards and procedures	5
	Flexibility	Capability to adapt himself to external changes	5
	Action orientation	Capability to product results	5
Human resources' emotions management	Emotion stability	Capability to manage personal emotions	5
	Capacities to work under pressure	Capability to produce results also in condition of physical and/or psychological stress	5
	Self-loyalty	Capability to maintain personal position as consequence of the emotional independence	5

Table II. Variables under investigation, meanings and number of items

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4.2 Data analysis

The data collected have been analyzed respecting the rules about the privacy and adopting all the techniques for avoiding possible biases (Ott and Longnecker, 2015). The data have been analyzed and organized with the aim to test the hypotheses reported in Table III.

The hypotheses have been tested via covariance-based SEM using IBM® SPSS® Statistics – Version 25. According to Ullman and Bentler (2012), SEM is "a collection of statistical techniques that allow a set of relationships between one or more independent variables (IVs), either continuous or discrete, and one or more dependent variables (DVs), either continuous or discrete, to be examined" (p. 661). The research approach is based on SEM because it is a method through which it is possible "over performing a series of multiple regressions; namely, it provides a test of the overall model fit" (Savalei and Bentler, 2006, p. 339). Following Reinartz *et al.*'s (2009) suggestion, a covariance-based SEM has been conducted because it outperforms variance-based SEM in terms of parameter consistency and is preferable in terms of parameter accuracy.

Before conducting the test via SEM, the relations among the variable were examined for analyzing common method bias (MacCallum and Austin, 2000; Bandalos, 2002). Harman's single factor test to extract a single factor indicated an explained variance of 27.93 percent, providing an evidence about the absence of common method bias (Malhotra *et al.*, 2006). According to Podsakoff *et al.* (2003), "the basic assumption of this technique is that if a substantial amount of common method variance is present, either (a) a single factor will emerge from the factor analysis or (b) one general factor will account for the majority of the covariance among the measure" (p. 889).

Finally, according to Lomax and Schumacker (2004), R^2 was measured for defining the capability of dependent variables to explain the variance of independent variables. The research shows that the measurement model has an R^2 equal to 0.75 evidencing a strong effect size (Moore *et al.*, 2013).

Building upon the hypotheses summarized in Table III, the conceptual model of the research has been defined as reported in Figure 1.

To evaluate the model fit, a number of incremental, absolute and parsimonious fit indices were measured (Barrett, 2007; Steiger, 2007), including the goodness of fit index (GFI), the normed fit index (NFI), the comparative fit index (CFI), the standardized root mean square residual (SRMSR) and the root mean square error of approximation (RMSEA).

5. Findings

5.1 Internal consistency reliability and construct validity

For verifying the reliability of the data collected through the questionnaire, the Cronbach's α coefficients were measured with reference to all the independent variables. A Cronbach's α value equal or higher than 0.7 is considered suitable for applied research (Nunnally, 1978), while a Cronbach's α value equal or higher than 0.6 can be considered suitable in the case of exploratory research (Hair *et al.*, 2012). As reported in Table IV, all Cronbach's α coefficients exceed the cut-off value of 0.7.

Table III. Hypotheses under investigation

H1 (+)	There is a positive relationship between human resources' work motivation and firms' revenues
H2 (+)	There is a positive relationship between human resources' social competencies and firms' revenues
H3 (+)	There is a positive relationship between human resources' organizational behaviors and firms' investment in Big Data
H4 (+)	There is a positive relationship between human resources' emotions and firms' investment in Big Data
H5 (+)	There is a positive relationship between human resources' organizational behaviors and firms' revenues mediated by firms' investment in Big Data

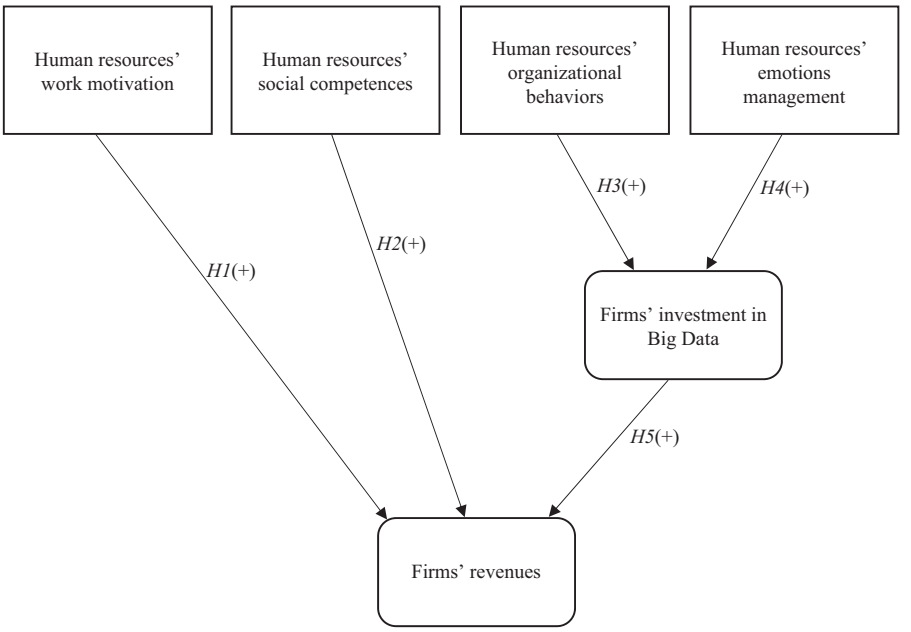

Figure 1.
The conceptual model

	Cronbach's α	AVE	HRs' work motivation	HRs' social competencies	HRs' organizational behavior	HRs' emotions management
HRs' work motivation	0.815	0.682	*0.826*			
HRs' social competencies	0.724	0.571	0.679	*0.830*		
HRs' organizational behavior	0.901	0.652	0.708	0.703	*0.807*	
HRs' emotions management	0.827	0.530	0.643	0.667	0.713	*0.728*

Note: Diagonal (italised) represent the square root of the AVE, while off diagonals represent the correlations

Table IV.
Relationships among study constructs

At the same time, the construct validity was analyzed combining convergent validity and discriminant validity. Specifically, convergent validity was measured by calculating the average variance extracted (AVE), while discriminant validity was verified by comparing the square roots of AVEs to the correlations between constructs. As reported in Table IV, the square roots of AVEs were all greater than their respective relationships, providing solid evidence of discriminant validity.

5.2 Hypothesis testing via SEM

Via SEM using IBM® SPSS® Statistics – Version 25, the hypotheses were tested and the results are reported in Table V. According to Hooper *et al.* (2008), all the hypotheses with a *p*-value lower than 0.05 can be considered verified with reference to the analyzed sample.

Finally, for verifying the model fit, several statistics such as GFI, NFI, CFI, SRMSR and RMSEA were measured. As reported in Table VI, all the cut-off values are exceeded.

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6. Discussions

According to the results reported in Table V, the study demonstrates the existence of positive relationships between human resources' work motivation and firms' revenues (*H1*). This result is aligned with previous studies provided by the research works rooted in the field of human resource management (HRM) (Schuler and MacMillan, 1984; Schneider, 1988; Ulrich *et al.*, 1995). Specifically, as underlined by Wright *et al.* (1994), the human resources' abilities to achieve the planned aims, organize the flow processes and stimulate collaborative relationships are one of the key levers for firms' competition. In such a vein, Barney and Wright (1998) state that human resources are the first source of firms' competitive advantages and Lengnick-Hall and Lengnick-Hall (1988) underline that human resources able to be aligned with firms' plans and are also able to stimulate firms' in achieving greater and more ambitious results. From a different perspective, Li *et al.* (2006) underline that human resources' work motivation is one of the emerging topics on which business researchers and practitioners should reflect for improving firms' performances and Putra *et al.* (2017) demonstrate that firms endowed by human resources strongly motivated are able to better catch market opportunities and face market challenges.

The results also show that there is a positive relationship between human resources' social competencies and firms' revenues (*H2*). This result can be considered a partial demonstration of previous sociological studies about the high relevance of social interactions within firms' environment as a way for improving firms' efficiency (Gamst, 1991). As underlined by Caputo and Evangelista (2019), human resources spend a large part of their life time in work environment and, for this reason, they demand to satisfy their need for social interactions as basic conditions for ensuring their productivity. From a different perspective, Cabrera and Cabrera demonstrate that social interactions within work environment are an efficient way for ensuring informal information flows through which human resources have the opportunities for aligning their behaviors to firms' plans supporting the achievement of firms' aims.

Furthermore, the study also demonstrates the positive relations between human resources' organizational behaviors and firms' investment in Big Data (*H3*). This result can be considered aligned with previous contributions provided with reference to the conditions required for a useful use of Big Data inside firms' processes (Leeflang *et al.*, 2014). As clarified by Han *et al.* (2011), Big Data is a complex set of tools that improve human resources' ability to read available data about specific dynamics and domains. Accordingly, Big Data orientation can

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Table V. Results of hypothesis testing via SEM

Hypothesis	*p*-value
H1 (+): HRs' work motivation → firms' revenues	0.0412
H2 (+): HRs' social competencies → firms' revenues	0.0238
H3 (+): HRs' organizational behaviors → firms' investment in Big Data	0.0481
H4 (+): HRs' emotions → firms' investment in Big Data	0.0760
H5 (+): Firms' investment in Big Data → firms' revenues	0.0437

Table VI. Model fit statistics

Model fit index	Cut-off values (source)	Measured value
GFI	> 0.90 (Jöreskog and Sörbom, 1996)	0.921
NFI	> 0.90 (Hu and Bentler, 1999)	0.903
CFI	> 0.90	0.971
RMSEA	< 0.06 (Hooper *et al.*, 2008)	0.031
SRMR	< 0.08 (Hooper *et al.*, 2008)	0.035

emerge only in the case in which firms are equipped with human resources able to understand the effective role of Big Data and digital transformation (Loebbecke and Picot, 2015). With reference to this, Sagiroglu and Sinanc (2013) show that Big Data can become a problem for firms in the case in which they are not approached in the correct way, while Carayannis *et al.* (2018) show that only acting on human resources' soft skills Big Data can support firms' processes through the definition of so-called Wise Data.

Finally, the research demonstrates that there is a positive relationship between firms' investment in Big Data and firms' revenues (*H5*). This result is aligned with previous studies about the managerial contributions of Big Data (Prescott, 2014; Frisk and Bannister, 2017; Dubey *et al.*, 2018). Specifically, Wamba *et al.* (2017) have demonstrated the positive impact of Big Data use on firms' performance, while Brown *et al.* (2011) have demonstrated the multiple advantages for firms related to an adequate investment and a correct use of Big Data.

Despite the general validity of the research herein not all the hypotheses are verified. Specifically, the study does not provide validation about the existence of positive relationships between human resources' emotions and firms' investment in Big Data (*H4*). This result can be discussed in the light of the complexity related to the domain of human emotions (Lane and Nadel, 1999). As clarified by Frey and Stutzer (2010), humans' emotion impacts all social and economic processes but the real challenge is to identify the correct way for measuring this impact. In the same direction, Powell and Dent-Micallef (1997) reflect about the role of human resources' emotions on firms' orientation toward innovation, and they recognized the complexity for defining instruments able to support human resources in understanding their emotions and communicating them in a suitable way.

6.1 Theoretical implications

According to the results reported in previous sections, it clearly emerges the need for extending the boundaries of social and managerial studies interesting in business performances with the aim to clarify the elements able to influence on work motivations. In such a perspective, managerial and marketing researchers should develop multi- and trans-disciplinary research paths aimed at defining approaches through which stimulate human resources involvement, engagement and commitment in firms' strategies and actions (Geroy *et al.*, 2000; Wright *et al.*, 2000).

The research also shows the need for developing theoretical framework able to explain paths and implications of social interactions in work environment as a way for increasing information sharing and employees' commitment (Chrusciel, 2006; Mittal and Dhar, 2015).

Again, discussed results underline the need for increasing the attention on human resources' ability to organize work processes and activities (Tikkanen *et al.*, 2005; Kesting and Parm Ulhøi, 2010). In such a perspective, the research calls the attention of managerial researchers on the need for developing instruments and processes through which increase not only human resources' problem-solving competences but also their decision-making competencies (Vaiman *et al.*, 2012; Alpkan *et al.*, 2010).

Finally, the research enforces the relevance of ongoing debate about the role of Big Data in managerial fields underling the need for in-depth investigation in which ways human resources and firms' processes can be modified for catch all the opportunities offered by the digital transformation (Liu *et al.*, 2011).

6.2 Practical implications

From practical point of view, the research underlines the need for developing tangible instruments through which stimulate human resources' work motivation. In such a perspective, it emerges the need for defining paths for human resources engagement based on individual personality and cognitive domain (Hess and Bacigalupo, 2011; Wang *et al.*, 2013).

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A possible advancement for business practices with reference to this point could be based on the firms' adoption of psychological instruments able to provide useful information about human resources' personality on which build personalized techniques for engagement and motivation (Canós-Darós, 2013).

According to the results of the study proposed in previous sections, it also emerges the need for managerial practitioners to develop approaches able to stimulate social interactions within work environment (Andriopoulos, 2001). In such a way, differently from the consolidated approaches based on the maximization of time spend in work processes, the research underlines the need for increasing time for social interactions as a way for improving firms' performance (Lin and Lee, 2006).

Again, the research calls the attention of managerial practitioners on the need for developing education processes not only based on the enforcement of human resources technical skills but also oriented to increase human resources' ability in planning their activities and work processes (Luoma, 2000).

Finally, the research demonstrates the validity of business approaches based on the investment in Big Data (Zeng and Khan, 2018). From this point of view, it emerges the need for managerial practitioners to accurately define the processes through which face the ongoing digital transformation for firms identifying the correct way for balancing human and technology dimensions (Dawes and Rowley, 1998).

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7. Final remarks, limitations and future directions for research

The general domain of digital transformation and the related research field interested in Big Data, BPM and AI can be considered the source of one of the most challenging debate in the field of managerial studies (Matt *et al.*, 2015). Over the last few years, an increasing number of researchers and practitioners have provided managerial studies about the impacts of digital transformation on firms' organizations and processes (Zhu *et al.*, 2006). At the state, the general part of these contributions focuses the attention on the digital (or technology) dimensions of the opportunities and processes that are emerging from the digital transformation without consider their impact and/or relations with the human dimensions of the firms (Perko and Caputo, 2018).

With the aim to bridge this gap, the paper tries to build a conceptual framework direct to link soft skills of human resources and the firms' orientation to technology-based innovations. The final aim is to partially clarify the relations between human and technology dimensions inside firms' environment aftermath the so-called digital transformation.

Accordingly, the research demonstrates the existence of several connections between human and technology dimensions in firms' setting opening to multiple managerial implications. In such a vein, as a result of the research herein it is possible to state that companies interesting in catching the opportunities provided by the digital transformation needed to act on human resource management and to build the conditions for an effective use of the multiple emerging instruments related to digital transformation inside the firm. From this perspective, several general recommendations can be derived as following summarized:

- Prioritize hybrid approaches: initially, technology-based tools should be leveraged toward only repeated, low-skill task. More complex tasks, like the use of AI for automatizing the supply chain it is needed wait until human resources do not develop an adequate level of confidence with the underlying technology.
- Identify feasibility across the firm: technology-based tools are most useful if they are adopted in firms' processes for which high skills of human resources are required. In these processes, technology-based tools can increase the productivity of firms building conditions for firms' competitive advantage.

- Align data with goals: firms should focus their attention on the collection and analysis of data related to their business activities. In such a perspective, firms should understand that not all the data are useful but that data can contribute to firms' performance only if they are analyzed in the light of efficient interpretation schemes for creating condition of wisdom.
- Look for "semi-structured data": analytics solutions are useful in finding trends in either structured data but semi-structured data could offer several opportunities for matching human creativity with technology advantages.

Summarizing the reflections and empirical results herein, the paper calls for the attention on the multiple dimensions of so-called digital transformation and specifically on the underestimated relevance of human resources in the firms' transformation and processes (Bowersox *et al.*, 2005). Accordingly, the role of human resources is analyzed using a holistic approach with the aim to link in a common conceptual framework several relevant elements of ongoing digital transformation.

Considering the pervasive nature of the digital revolution (Dreyer *et al.*, 2006), the reflections and empirical results herein can be considered only a small part of a more widen conceptual framework to which both researchers and practitioners are called to contribute for clarifying the pillars that will affect the next changes of the world in which we all live.

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References

Ahmed, P. and Shepherd, C. (2010), *Innovation Management*, Pearson Education, London.

Al Mehrzi, N. and Singh, S.K. (2016), "Competing through employee engagement: a proposed framework", *International Journal of Productivity and Performance Management*, Vol. 65 No. 6, pp. 831-843.

Alavi, M. and Leidner, D.E. (2001), "Knowledge management and knowledge management systems: conceptual foundations and research issues", *MIS Quarterly*, pp. 107-136.

Almatrooshi, B., Singh, S.K. and Farouk, S. (2016), "Determinants of organizational performance: a proposed framework", *International Journal of Productivity and Performance Management*, Vol. 65 No. 6, pp. 844-859.

Alpkan, L., Bulut, C., Gunday, G., Ulusoy, G. and Kilic, K. (2010), "Organizational support for intrapreneurship and its interaction with human capital to enhance innovative performance", *Management Decision*, Vol. 48 No. 5, pp. 732-755.

Amadeus (2016), available at: https://amadeus.bvdinfo.com (accessed July 22, 2018).

Amendola, C., Calabrese, M., Caputo, F. and D'Ascenzo, F. (2018), "Fashion companies and customer satisfaction: a relation mediated by information and communication technologies", *Journal: Journal of Retailing and Consumer Services*, Vol. 43, pp. 251-257.

Andriopoulos, C. (2001), "Determinants of organisational creativity: a literature review", *Management Decision*, Vol. 39 No. 10, pp. 834-841.

APICS (2012), "Exploring the Big Data revolution", available at: www.apics.org/docs/default-source/industry-content/big-data-report.pdf?Status=Master–2018.13.07 (accessed July 15, 2018).

Aquino, R.P., Barile, S., Grasso, A. and Saviano, M. (2018), "Envisioning smart and sustainable healthcare: 3D printing technologies for personalized medication", *Futures*, Vol. 103, pp. 35-50, doi: 10.1016/j.futures.2018.03.002.

Ardichvili, A., Maurer, M., Li, W., Wentling, T. and Stuedemann, R. (2006), "Cultural influences on knowledge sharing through online communities of practice", *Journal of Knowledge Management*, Vol. 10 No. 1, pp. 94-107.

Argote, L., McEvily, B. and Reagans, R. (2003), "Managing knowledge in organizations: an integrative framework and review of emerging themes", *Management Science*, Vol. 49 No. 4, pp. 571-582.

Azma, F. and Mostafapour, M.A. (2012), "Business intelligence as a key strategy for development organizations", *Procedia Technology*, Vol. 1, pp. 102-106.

Bandalos, D.L. (2002), "The effects of item parceling on goodness-of-fit and parameter estimate bias in structural equation modeling", *Structural Equation Modeling*, Vol. 9 No. 1, pp. 78-102.

Barney, J.B. and Wright, P.M. (1998), "On becoming a strategic partner: the role of human resources in gaining competitive advantage", *Human Resource Management: Published in Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management*, Vol. 37 No. 1, pp. 31-46.

Barrett, P. (2007), "Structural equation modelling: adjudging model fit", *Personality and Individual Differences*, Vol. 42 No. 5, pp. 815-824.

Becker, B. and Gerhart, B. (1996), "The impact of human resource management on organizational performance: progress and prospects", *Academy of Management Journal*, Vol. 39 No. 4, pp. 779-801.

Bellantuono, N., Pontrandolfo, P. and Scozzi, B. (2013), "Different practices for open innovation: a context-based approach", *Journal of Knowledge Management*, Vol. 17 No. 4, pp. 558-568.

Birknerova, Z. (2012), "Professional preconditions for successful managerial work", *Advances in Asian Social Science*, Vol. 1 No. 1, pp. 67-71.

Bowersox, D.J., Closs, D.J. and Drayer, R.W. (2005), "The digital transformation: technology and beyond", *Supply Chain Management Review*, Vol. 9 No. 1, pp. 22-29.

Bozionelos, N. and Singh, S.K. (2017), "The relationship of emotional intelligence with task and contextual performance: more than it meets the linear eye", *Personality and Individual Differences*, Vol. 116, pp. 206-211.

Brodie, M.L. and Mylopoulos, J. (Eds) (2012), *On Knowledge Base Management Systems: Integrating Artificial Intelligence and Database Technologies*, Springer Science & Business Media, New York, NY.

Brown, B., Chui, M. and Manyika, J. (2011), "Are you ready for the era of 'Big Data'", *McKinsey Quarterly*, Vol. 4 No. 1, pp. 24-35.

Canós-Darós, L. (2013), "An algorithm to identify the most motivated employees", *Management Decision*, Vol. 51 No. 4, pp. 813-823.

Cappelli, P. and Crocker-Hefter, A. (1996), "Distinctive human resources are firms' core competencies", *Organizational Dynamics*, Vol. 24 No. 3, pp. 7-22.

Caputo, F. (2018), *Approccio sistemico e co-creazione di valore in sanità*, Vol. 1, Edizioni Nuova Cultura, Roma.

Caputo, F. and Evangelista, F. (2019), "Information sharing and cognitive involvement for sustainable workplaces", *Corporate Social Responsibility: Concepts, Methodologies, Tools, and Applications*, Information Resources Management Association (USA), IGI Global, London, pp. 1403-1420.

Caputo, F., Walletzky, L. and Štepánek, P. (2018), "Towards a systems thinking based view for the governance of a smart city's ecosystem: a bridge to link smart technologies and Big Data", *Kybernetes*, doi: 10.1108/K-07-2017-0274.

Caputo, F., Evangelista, F., Perko, I. and Russo, G. (2017), "The role of Big Data in value co-creation for the knowledge economy", in Vrontis, S., Weber, T. and Tsoukatos, E. (Eds), *Global and National Business Theories and Practice: Bridging the Past with the Future*, EuroMed Press, pp. 269-280.

Carayannis, E., Del Giudice, M., Saviano, M. and Caputo, F. (2018), "Beyond Big Data: from smart to wise knowledge management", in Barile, S., Espejo, R., Perko, I. and Saviano, M. (Eds), *Cybernetics and Systems: Social and Business Decisions*, Giappichelli-Routledge, London, pp. 261-267.

Chae, B.K., Yang, C., Olson, D. and Sheu, C. (2014), "The impact of advanced analytics and data accuracy on operational performance: a contingent resource based theory (RBT) perspective", *Decision Support Systems*, Vol. 59, pp. 119-126.

Downloaded by Doctor valentina cillo At 07:10 03 May 2019 (PT)

Downloaded by Doctor valentina cillo At 07:10 03 May 2019 (PT)

Chen, C.P. and Zhang, C.Y. (2014), "Data-intensive applications, challenges, techniques and technologies: a survey on Big Data", *Information Sciences*, Vol. 275, pp. 314-347.

Chen, H., Chiang, R.H. and Storey, V.C. (2012), "Business intelligence and analytics: from Big Data to big impact", *MIS Quarterly*, pp. 1165-1188.

Chen, J., Chen, Y., Du, X., Li, C., Lu, J., Zhao, S. and Zhou, X. (2013), "Big Data challenge: a data management perspective", *Frontiers of Computer Science*, Vol. 7 No. 2, pp. 157-164.

Chesbrough, H. (2006), "Open innovation: a new paradigm for understanding industrial innovation", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *Open Innovation: Researching a New Paradigm*, Oxford University Press on Demand, Oxford, pp. 1-21.

Chesbrough, H. (2010), "Business model innovation: opportunities and barriers", *Long Range Planning*, Vol. 43 Nos 2/3, pp. 354-363.

Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds) (2006), *Open Innovation: Researching a New Paradigm*, Oxford University Press on Deman, Cambridge.

Chrusciel, D. (2006), "Considerations of emotional intelligence (EI) in dealing with change decision management", *Management Decision*, Vol. 44 No. 5, pp. 644-657.

CIONET and Next Value (2017), "Digital transformation in Europe: what's next", available at: www.cionet.com/Data/files/groups/Report%20Digital%20Transformation%20in%20EU.pdf–2018.20.06 (accessed July 30, 2018).

Dakin, G. (1993), "Shaping the future: business design through information technology", *Journal of the Operational Research Society*, Vol. 43 No. 9, pp. 1249-1250.

Dawes, J. and Rowley, J. (1998), "Enhancing the customer experience: contributions from information technology", *Management Decision*, Vol. 36 No. 5, pp. 350-357.

Del Giudice, M. and Della Peruta, M.R. (2013), *Unpacking Open Innovation: Highlights from a Co-Evolutionary Inquiry*, Springer, New York, NY.

Del Giudice, M. and Della Peruta, M.R. (2016), "The impact of IT-based knowledge management systems on internal venturing and innovation: a structural equation modeling approach to corporate performance", *Journal of Knowledge Management*, Vol. 20 No. 3, pp. 484-498.

Dreyer, K.J., Hirschorn, D.S., Thrall, J.H., Mehta, A. and PACS, A. (2006), *A Guide to the Digital Revolution*, Springer Science, New York, NY.

Dubey, R., Gunasekaran, A. and Childe, S.J. (2018), "Big Data analytics capability in supply chain agility: the moderating effect of organizational flexibility", *Management Decision.*, Vol. 29 No. 2, pp. 478-484.

Dumas, M., Van der Aalst, W.M. and Ter Hofstede, A.H. (2005), *Process-Aware Information Systems: Bridging People and Software through Process Technology*, John Wiley & Sons, Hoboken, NJ.

European Commission (2017), "GROW/F3 digital transformation scoreboard 2017", London, available at: https://ec.europa.eu/docsroom/documents/21501/attachments/1/translations/en/renditions/native-2018.20.06

Frey, B.S. and Stutzer, A. (2010), *Happiness and Economics: How the Economy and Institutions Affect Human Well-Being*, Princeton University Press, Princeton, NJ.

Frisk, J.E. and Bannister, F. (2017), "Improving the use of analytics and Big Data by changing the decision-making culture: a design approach", *Management Decision*, Vol. 55 No. 10, pp. 2074-2088.

Fuchs, C. (2009), "Information and communication technologies and society: a contribution to the critique of the political economy of the internet", *European Journal of Communication*, Vol. 24 No. 1, pp. 69-87.

Gamst, F.C. (1991), "Foundations of social theory", *Anthropology of Work Review*, Vol. 12 No. 3, pp. 19-25.

Gartner, W.B. (1990), "What are we talking about when we talk about entrepreneurship?", *Journal of Business Venturing*, Vol. 5 No. 1, pp. 15-28.

Garud, R., Tuertscher, P. and Van de Ven, A.H. (2013), "Perspectives on innovation processes", *Academy of Management Annals*, Vol. 7 No. 1, pp. 775-819.

Geroy, G.D., Wright, P.C. and Jacoby, L. (2000), "Toward a conceptual framework of employee volunteerism: an aid for the human resource manager", *Management Decision*, Vol. 38 No. 4, pp. 280-287.

Gold, A.H., Malhotra, A. and Segars, A.H. (2001), "Knowledge management: an organizational capabilities perspective", *Journal of Management Information Systems*, Vol. 18 No. 1, pp. 185-214.

Gray, C. (2006), "Absorptive capacity, knowledge management and innovation in entrepreneurial small firms", *International Journal of Entrepreneurial Behavior & Research*, Vol. 12 No. 6, pp. 345-360.

Gupta, S., Kumar, S., Singh, S.K., Foropon, C. and Chandra, C. (2018), "Role of cloud ERP on the performance of an organization: contingent resource based view perspective", *The International Journal of Logistics Management*, Vol. 29 No. 2, pp. 659-675.

Hair, J.F., Sarstedt, M., Ringle, C.M. and Mena, J.A. (2012), "An assessment of the use of partial least squares structural equation modeling in marketing research", *Journal of the Academy of Marketing Science*, Vol. 40 No. 3, pp. 414-433.

Han, J., Pei, J. and Kamber, M. (2011), *Data Mining: Concepts and Techniques*, Elsevier, Amsterdam.

Hazen, B.T., Boone, C.A., Ezell, J.D. and Jones-Farmer, L.A. (2014), "Data quality for data science, predictive analytics, and Big Data in supply chain management: an introduction to the problem and suggestions for research and applications", *International Journal of Production Economics*, Vol. 154, pp. 72-80.

Hess, J.D. and Bacigalupo, A.C. (2011), "Enhancing decisions and decision-making processes through the application of emotional intelligence skills", *Management Decision*, Vol. 49 No. 5, pp. 710-721.

Hooper, D., Coughlan, J. and Mullen, M. (2008), "Structural equation modelling: guidelines for determining model fit", *Electronic Journal of Business Research Methods*, Vol. 6 No. 1, pp. 53-60.

Hossiep, R. and Paschen, M. (2008), *BIP—Business-Focused Inventory of Personality*, Hogrefe, Oxford.

Hu, L.T. and Bentler, P.M. (1999), "Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives", *Structural Equation Modeling: A Multidisciplinary Journal*, Vol. 6 No. 1, pp. 1-55.

Huang, F. and Rice, J. (2009), "The role of absorptive capacity in facilitating 'open innovation' outcomes: a study of Australian SMEs in the manufacturing sector", *International Journal of Innovation Management*, Vol. 13 No. 2, pp. 201-220.

Huizingh, E.K. (2011), "Open innovation: state of the art and future perspectives", *Technovation*, Vol. 31 No. 1, pp. 2-9.

Huselid, M.A., Jackson, S.E. and Schuler, R.S. (1997), "Technical and strategic human resources management effectiveness as determinants of firm performance", *Academy of Management Journal*, Vol. 40 No. 1, pp. 171-188.

Hussein, A.T.T., Singh, S.K., Farouk, S. and Sohal, A.S. (2016), "Knowledge sharing enablers, processes and firm innovation capability", *Journal of Workplace Learning*, Vol. 28 No. 8, pp. 484-495.

Jauch, L.R. and Glueck, W.F. (1988), *Business Policy and Strategic Management*, McGraw-Hill, New York, NY.

Jeston, J. (2014), *Business Process Management*, Routledge, London.

Jiang, K., Lepak, D.P., Hu, J. and Baer, J.C. (2012), "How does human resource management influence organizational outcomes? A meta-analytic investigation of mediating mechanisms", *Academy of Management Journal*, Vol. 55 No. 6, pp. 1264-1294.

Jöreskog, K.G. and Sörbom, D. (1996), *PRELIS 2 User's Reference Guide: A Program for Multivariate Data Screening and Data Summarization: A Preprocessor for LISREL*, Scientific Software International, Skokie.

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Kauer, D., Prinzessin zu Waldeck, T.C. and Schäffer, U. (2007), "Effects of top management team characteristics on strategic decision making: shifting attention to team member personalities and mediating processes", *Management Decision*, Vol. 45 No. 6, pp. 942-967.

Kesting, P. and Parm Ulhøi, J. (2010), "Employee-driven innovation: extending the license to foster innovation", *Management Decision*, Vol. 48 No. 1, pp. 65-84.

Lane, P.J., Koka, B.R. and Pathak, S. (2006), "The reification of absorptive capacity: a critical review and rejuvenation of the construct", *Academy of Management Review*, Vol. 31 No. 4, pp. 833-863.

Lane, R.D. and Nadel, L. (Eds) (1999), *Cognitive Neuroscience of Emotion*, Oxford University Press, Oxford.

Langendörfer, F. (2008), "Personality differences among orchestra instrumental groups: just a stereotype?", *Personality and Individual Differences*, Vol. 44 No. 3, pp. 610-620.

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*, Vol. 52 No. 2, pp. 21-31.

Leeflang, P.S., Verhoef, P.C., Dahlström, P. and Freundt, T. (2014), "Challenges and solutions for marketing in a digital era", *European Management Journal*, Vol. 32 No. 1, pp. 1-12.

Lengnick-Hall, C.A. and Lengnick-Hall, M.L. (1988), "Strategic human resources management: a review of the literature and a proposed typology", *Academy of Management Review*, Vol. 13 No. 3, pp. 454-470.

Li, Y., Zhao, Y. and Liu, Y. (2006), "The relationship between HRM, technology innovation and performance in China", *International Journal of Manpower*, Vol. 27 No. 7, pp. 679-697.

Liebowitz, J. (2001), "Knowledge management and its link to artificial intelligence", *Expert Systems with Applications*, Vol. 20 No. 1, pp. 1-6.

Lin, H.F. and Lee, G.G. (2006), "Effects of socio-technical factors on organizational intention to encourage knowledge sharing", *Management Decision*, Vol. 44 No. 1, pp. 74-88.

Linoff, G.S. and Berry, M.J. (2011), *Data Mining Techniques: for Marketing, Sales, and Customer Relationship Management*, John Wiley & Sons, New York, NY.

Liu, D.Y., Chen, S.W. and Chou, T.C. (2011), "Resource fit in digital transformation: lessons learned from the CBC bank global e-banking project", *Management Decision*, Vol. 49 No. 10, pp. 1728-1742.

Loebbecke, C. and Picot, A. (2015), "Reflections on societal and business model transformation arising from digitization and Big Data analytics: a research agenda", *The Journal of Strategic Information Systems*, Vol. 24 No. 3, pp. 149-157.

Lomax, R.G. and Schumacker, R.E. (2004), *A Beginner's Guide to Structural Equation Modeling*, Psychology Press, London.

Luoma, M. (2000), "Developing people for business success: capability-driven HRD in practice", *Management Decision*, Vol. 38 No. 3, pp. 145-153.

McAfee, A., Brynjolfsson, E., Davenport, T.H., Patil, D.J. and Barton, D. (2012), "Big Data: the management revolution", *Harvard Business Review*, Vol. 90 No. 10, pp. 60-68.

MacCallum, R.C. and Austin, J.T. (2000), "Applications of structural equation modeling in psychological research", *Annual Review of Psychology*, Vol. 51 No. 1, pp. 201-226.

Malhotra, N.K., Kim, S.S. and Patil, A. (2006), "Common method variance in IS research: a comparison of alternative approaches and a reanalysis of past research", *Management Science*, Vol. 52 No. 12, pp. 1865-1883.

Matt, C., Hess, T. and Benlian, A. (2015), "Digital transformation strategies", *Business & Information Systems Engineering*, Vol. 57 No. 5, pp. 339-343.

Mind the Bridge and ELITE (2018), "Sep elite tech scaleup 100", available at: https://startupeuropepartnership.eu/wp-content/uploads/2018/06/SEP100.pdf (accessed June 28, 2018).

Mittal, S. and Dhar, R.L. (2015), "Transformational leadership and employee creativity: mediating role of creative self-efficacy and moderating role of knowledge sharing", *Management Decision*, Vol. 53 No. 5, pp. 894-910.

Moore, D.S., Notz, W.I. and Flinger, M.A. (2013), *The Basic Practice of Statistics*, W.H. Freeman and Company, New York, NY.

Ngai, E.W., Xiu, L. and Chau, D.C. (2009), "Application of data mining techniques in customer relationship management: a literature review and classification", *Expert Systems with Applications*, Vol. 36 No. 2, pp. 2592-2602.

Nunnally, J. (1978), *Psychometric Methods*, McGraw-Hill, New York, NY.

Ott, R.L. and Longnecker, M.T. (2015), *An Introduction to Statistical Methods and Data Analysis*, Nelson Education, New York, NY.

Perkmann, M. and Walsh, K. (2007), "University–industry relationships and open innovation: towards a research agenda", *International Journal of Management Reviews*, Vol. 9 No. 4, pp. 259-280.

Perko, I. and Caputo, F. (2018), "Big Data implications for healthcare systems", *UKSS 2018: UK Systems Society Conference 2018, University of Portsmouth, Portsmouth, June 24–27*.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y. and Podsakoff, N.P. (2003), "Common method biases in behavioral research: a critical review of the literature and recommended remedies", *Journal of Applied Psychology*, Vol. 88 No. 5, pp. 879-903.

Popovič, A., Hackney, R., Coelho, P.S. and Jaklič, J. (2012), "Towards business intelligence systems success: effects of maturity and culture on analytical decision making", *Decision Support Systems*, Vol. 54, pp. 729-739.

Powell, T.C. and Dent-Micallef, A. (1997), "Information technology as competitive advantage: the role of human, business, and technology resources", *Strategic Management Journal*, Vol. 18 No. 5, pp. 375-405.

Pradhan, R.K., Jena, L.K. and Singh, S.K. (2017), "Examining the role of emotional intelligence between organizational learning and adaptive performance in Indian manufacturing industries", *Journal of Workplace Learning*, Vol. 29 No. 3, pp. 235-247.

Prescott, E.M. (2014), "Big Data and competitive advantage at Nielsen", *Management Decision*, Vol. 52 No. 3, pp. 573-601.

Provost, F. and Fawcett, T. (2013), "Data science and its relationship to Big Data and data-driven decision making", *Big Data*, Vol. 1 No. 1, pp. 51-59.

Putra, E.D., Cho, S. and Liu, J. (2017), "Extrinsic and intrinsic motivation on work engagement in the hospitality industry: test of motivation crowding theory", *Tourism and Hospitality Research*, Vol. 17 No. 2, pp. 228-241.

Reinartz, W., Haenlein, M. and Henseler, J. (2009), "An empirical comparison of the efficacy of covariance-based and variance-based SEM", *International Journal of Research in Marketing*, Vol. 26 No. 4, pp. 332-344.

Roberts, J. (2000), "From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer", *Technology Analysis & Strategic Management*, Vol. 12 No. 4, pp. 429-443.

Ruggles, R. (1998), "The state of the notion: knowledge management in practice", *California Management Review*, Vol. 40 No. 3, pp. 80-89.

Sagiroglu, S. and Sinanc, D. (2013), "Big Data: a review", *2013 International Conference on Collaboration Technologies and Systems, IEEE, May*, pp. 42-47.

Savalei, V. and Bentler, P.M. (2006), "Structural equation modeling", in Grover, R. and Vriens, M. (Eds), *The Handbook of Marketing Research: Uses, Misuses, and Future Advances*, Sage, London, pp. 330-364.

Saviano, M. and Caputo, F. (2013), "Managerial choices between systems, knowledge and viability", in Barile, S. (Ed.), *Contributions to Theoretical and Practical Advances in Management. A Viable Systems Approach (VSA)*, ARACNE Editrice S.r.l., Roma, pp. 219-242.

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Saviano, M., Caputo, F., Mueller, J. and Belyaeva, Z. (2018), "Competing through consonance: a stakeholder engagement view of corporate relational environment", *Sinergie, Italian Journal of Management*, Vol. 105, pp. 63-82.

Schneider, S.C. (1988), "National vs corporate culture: implications for human resource management", *Human Resource Management*, Vol. 27 No. 2, pp. 231-246.

Schuler, R.S. and MacMillan, I.C. (1984), "Gaining competitive advantage through human resource management practices", *Human Resource Management*, Vol. 23 No. 3, pp. 241-255.

Scuotto, V., Del Giudice, M., Bresciani, S. and Meissner, D. (2017), "Knowledge-driven preferences in informal inbound open innovation modes: an explorative view on small to medium enterprises", *Journal of Knowledge Management*, Vol. 21 No. 3, pp. 640-655.

Scuotto, V., Del Giudice, M., della Peruta, M.R. and Tarba, S. (2017), "The performance implications of leveraging internal innovation through social media networks: an empirical verification of the smart fashion industry", *Technological Forecasting and Social Change*, Vol. 120, pp. 184-194.

Scuotto, V., Santoro, G., Bresciani, S. and Del Giudice, M. (2017), "Shifting intra-and inter-organizational innovation processes towards digital business: an empirical analysis of SMEs", *Creativity and Innovation Management*, Vol. 26 No. 3, pp. 247-255.

Slack, N., Chambers, S. and Johnston, R. (2010), *Operations Management*, Pearson education, London.

Smith, H. and Fingar, P. (2003), *Business Process Management: the Third Wave*, Vol. 1, Meghan-Kiffer Press, Tampa, FL.

Spithoven, A., Clarysse, B. and Knockaert, M. (2010), "Building absorptive capacity to organise inbound open innovation in traditional industries", *Technovation*, Vol. 30 No. 2, pp. 130-141.

Steiger, J.H. (2007), "Understanding the limitations of global fit assessment in structural equation modeling", *Personality and Individual Differences*, Vol. 42 No. 5, pp. 893-898.

Teece, D.J. (1998), "Capturing value from knowledge assets: the new economy, markets for know-how, and intangible assets", *California Management Review*, Vol. 40 No. 3, pp. 55-79.

Tikkanen, H., Lamberg, J.A., Parvinen, P. and Kallunki, J.P. (2005), "Managerial cognition, action and the business model of the firm", *Management Decision*, Vol. 43 No. 6, pp. 789-809.

Ullman, J.B. and Bentler, P.M. (2012), "Structural equation modeling", in Weiner, I.B. (Ed.), *Handbook of Psychology*, 2nd ed., Wiley, New York, NY, p. 2.

Ulrich, D., Brockbank, W., Yeung, A.K. and Lake, D.G. (1995), "Human resource competencies: An empirical assessment", *Human Resource Management*, Vol. 34 No. 4, pp. 473-495.

Vaiman, V., Scullion, H. and Collings, D. (2012), "Talent management decision making", *Management Decision*, Vol. 50 No. 5, pp. 925-941.

Waller, M.A. and Fawcett, S.E. (2013), "Data science, predictive analytics, and Big Data: a revolution that will transform supply chain design and management", *Journal of Business Logistics*, Vol. 34 No. 2, pp. 77-84.

Wamba, S.F., Gunasekaran, A., Akter, S., Ren, S.J.F., Dubey, R. and Childe, S.J. (2017), "Big Data analytics and firm performance: effects of dynamic capabilities", *Journal of Business Research*, Vol. 70, pp. 356-365.

Wang, M. and Wang, H. (2006), "From process logic to business logic – a cognitive approach to business process management", *Information & Management*, Vol. 43 No. 2, pp. 179-193.

Wang, Y.L., Ellinger, A.D. and Jim Wu, Y.C. (2013), "Entrepreneurial opportunity recognition: an empirical study of R&D personnel", *Management Decision*, Vol. 51 No. 2, pp. 248-266.

Weill, P. (1992), "The relationship between investment in information technology and firm performance: a study of the valve manufacturing sector", *Information Systems Research*, Vol. 3 No. 4, pp. 307-333.

Weske, M., van der Aalst, W.M. and Verbeek, H.M.W. (2004), "Advances in business process management", *Data & Knowledge Engineering*, Vol. 50 No. 1, pp. 1-8.

Wright, P.C., Geroy, G.D. and MacPhee, M. (2000), "A human resources model for excellence in global organization performance", *Management Decision*, Vol. 38 No. 1, pp. 36-42.

Wright, P.M., McMahan, G.C. and McWilliams, A. (1994), "Human resources and sustained competitive advantage: a resource-based perspective", *International Journal of Human Resource Management*, Vol. 5 No. 2, pp. 301-326.

Xia, T. and Roper, S. (2008), "From capability to connectivity – absorptive capacity and exploratory alliances in biopharmaceutical firms: a US–Europe comparison", *Technovation*, Vol. 28 No. 11, pp. 776-785.

Yahya, S. and Goh, W.K. (2002), "Managing human resources toward achieving knowledge management", *Journal of Knowledge Management*, Vol. 6 No. 5, pp. 457-468.

Zahra, S.A. and George, G. (2002), "Absorptive capacity: a review, reconceptualization, and extension", *Academy of Management Review*, Vol. 27 No. 2, pp. 185-203.

Zeng, J. and Khan, Z. (2018), "Value creation through Big Data in emerging economies: the role of resource orchestration and entrepreneurial orientation", *Management Decision.*, doi: 10.1108/MD-05-2018-0572.

Zhu, K., Dong, S., Xu, S.X. and Kraemer, K.L. (2006), "Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies", *European Journal of Information Systems*, Vol. 15 No. 6, pp. 601-616.

Zikopoulos, P. and Eaton, C. (2011), *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, McGraw-Hill Osborne Media, New York, NY.

Further reading

Cabrera, E.F. and Cabrera, A. (2005), "Fostering knowledge sharing through people management practices", *The International Journal of Human Resource Management*, Vol. 16 No. 5, pp. 720-735.

Cohen, W.M. and Levinthal, D.A. (2000), "Absorptive capacity: a new perspective on learning and innovation", in Cross, R.L. and Israelit, S.B. (Eds), *Strategic Learning in a Knowledge Economy*, Taylor & Francis, New York, NY, pp. 39-67.

Hancock, G.R., Mueller, R.O. and Stapleton, L.M. (2010), *The Reviewer's Guide to Quantitative Methods in the Social Sciences*, Routledge, London.

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