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Do Board IT Competencies Influence the Digital Orientation of the Firm? Sample of Italian Public Listed Companies

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INTRODUCTION

The evolution of technologies and the growth of digital services have put companies in a position to adapt to a profound transformation from an organizational, structural and behavioral point of view. Research by the International Data Corporation (2020) have shown an increase in the worldwide spending in digital transformation technologies from 2016 to 2019 and this trend is expected to grow even in the future. Moreover, during the 2020, the outbreak of the COVID-19 pandemic brought about the need for intense digital transformation, so much that it is considered one of the major drivers of this last trend (Iansiti & Richards, 2020). Digital transformation of the work environment, adaptation of relationships with customers and suppliers are all effects that have brought with them, like all contexts of deep transformation, challenges for leaders. It is therefore necessary for companies to have a clear vision of the influence that the digital transformation will have on processes, organization, boards and business models in order to remain competitive and align the overall company structure with consumer choices and exogenous variables that may alter the market environment.

Over the past decade, digital transformation has been a process and a goal that for some companies has been an opportunity for growth and for others a force to be tamed. Internet of Things, social media, 3d printing, cloud computing, robotics, cybersecurity, and autonomous technology are innovations that cause a tremendous force for change and evolution. As a result, lot of companies have started to understand how to achieve a good degree of digitization and what changes digital transformation would involve. Social, market, strategic, organizational changes given by the irruption of new digital technologies have put companies in front of a choice, whether to establish new innovative strategies, based on the use of digital technologies to bring the company a better performance, (Hess et al., 2016) or not. A transition to a digital business vision implies not only opportunities but also risks related to the impact of the digital transformation on the organization and the board of directors (Bankewitz, Aberg and Teuchert, 2016), consequently it is necessary attention from the executives regarding the ways, timing and consequences that the impact of DT will have on the company they manage. Some of the changes highlighted by the scholars involve changes at the organizational level such as: the change of the strategic context, the increase of information sharing and information transparency, the use of analytical technologies for big data, a short-term strategic vision and the disappearance of the organizational boundaries. Regarding the impact on the board of directors, in particular, the increased sharing and ease of finding information has led to a transformation of roles within boards that can no longer be static as there is an ongoing need to align board members' knowledge and skills with the challenges of digital change. In addition, the extremely dynamic environment that characterizes this kind of process has highlighted the need for a transition of the behavior of boards in order to align their strategic vision with market changes. This kind of behavior can be achieved by moving from typical tasks to a decision-making agenda based on a short-term strategy (Nicholson & Newton, 2010).

In this sense it is useful to highlight the lack of technology committees, understood as centers of knowledge creation, within 75% of companies (Isaca, 2011). The panorama of Italian companies is particularly

disadvantaged, compared to the average of the 28 European countries, from the point of view of the degree of transformation (-4.3%) and integration (-8.6%) of digital technologies (EU Digital Transformation Scoreboard, 2018). The comparison of the Italian reality to the European one tends to find its motivation mostly in the training of the human capital of companies and in the presence of figures with knowledge or experience in the field of digital and information technology. In fact, with respect to this last aspect treated, Italy marks a value 3% lower than the EU28 average, and 28% lower than the best performing country (Employed ITC Specialists-Eurostat, 2018). Also the activities within the company that aim at the development of IT-Digital skills are 16% lower than the European average (Bandini & Caprio, 2018). It is in this context that arises the need to adopt a new vision, to recalibrate the strategic compass in such a way that it can indicate the right orientation towards the administrative coherence of the company in an innovative and technological environment. Many scholars have proposed different types of strategic orientations, based on performance, learning, knowledge, technology, but which are not very effective in the face of the exponential growth of digital technologies. Noting the lack of adherence by the constructs just listed Quinton et al. (2018) proposed a new strategic orientation, digital orientation. This latter construct observes how firms that are characterized by a combination of an entrepreneurial, market, and learning orientation manage to gain more benefits from leveraging digital technologies than others. However, the characteristics taken as a key element by Quinton et al. (2018) do not take into account the fact that the strategic orientations examined are not related to the digital-technology dimension (Schweiger at al., 2019). Based on these observations and leveraging the work on the implications of digital technologies by Nambisian et al. (2019) and the strategic alignment model by Henderson & Venkatraman (1999), Kindermann et al (2020) proposeed a new and more comprehensive version of digital orientation. The construct presented by the latter scholars gives strong importance to the relationship between the external and internal components of the company as well as the organizational and technological components. The digital orientation of Kindermann et al. (2020) is divided into four dimensions: digital technology scope, digital capabilities, digital ecosystem coordination and digital architecture configuration. This construct will be the cornerstone of this paper.

The purpose of this thesis is to understand how much the key players, the decision-makers, who have the role of managing the adherence of a company's strategic orientation to the external market environment can influence the degree of its digital orientation. In this study the executive directors are recognized as decision makers (Ocasio, 1997) and in particular we intend to identify how much the presence of prior knowledge and experience acquired by executives in the digital-IT field can influence the digital orientation of the company they manage. In order to arrive at this result in a coherent manner, it is necessary to follow a logical scheme capable of linking the two extremes of the reasoning. A study presented by Bowman (1984) shows how it is possible to extrapolate the strategic orientation of companies through content analysis of their annual reports. Through the typology and frequency of the words present in these documents it is possible to understand the intensity of the executives' attention (Whorf, 1956; Shapir, 1944) which, in turn, influences the strategic moves of the company (Ocasio, 1997). An in-depth analysis on behavioral sciences has established how knowledge

and skills acquired during the university period have the power to influence an individual's attitude towards a particular field (Patterson, 2012), as well as prior work experience (Claes & Ruiz-Quintanilla, 1998) and industry background (Milliken & Martins, 1996).

In order to study this phenomenon, we have collected data regarding both executives (i.e. educational background in IT, work experience in IT-digital positions, work experience in IT-digital industries, number of executives with these characteristics) and data regarding the presence of words belonging to the construct of digital orientation in the annual reports of the companies in the sample. Through the software NVivo was performed a search query using computer-aided text analysis. The results of the CATA consist of the number of times a specific word appears in an annual report of a specific company. We then divided the number of times each word was found in an AR by the number of pages it was composed of, this measure will be called digital word coverage. Then the results of digital word coverage were normalized for 100 pages.

Based on a sample of 128 Italian listed companies over a 3-year period from 2016 to 2018, hypotheses were tested using a linear regression based on fixed effects. Hypotheses were examined regarding the effect that the presence and the number of IT-digital characteristics of an ED could have on the degree of digital orientation, and finally on the moderating effect that board of directors' characteristics could have on the effect between the ED and the construct. The results obtained show a positive interaction between the presence of IT-digital knowledge and experience of an executive and the degree of digital orientation, showing the greatest interaction effect between EDs who had undertaken IT-digital studies and digital orientation. Another interesting result shows that the mere presence of an ED with IT characteristics is able to influence the response variable more than a greater number of EDs with IT-digital characteristics within the same board. Regarding the moderation effects, the effects were all negative. The effects with the greatest intensity are board independence and board size.

This research generates several theoretical contributions to research regarding corporate governance. First of all, thanks to the results, Ocasio's (1997) attention-based view is extended, bringing to the forefront the coherence of the link between strategic moves and the prior experience and knowledge of decision makers. The results also underline how different contexts of the board of directors can negatively moderate the free expression of an executive's background, limiting the power to influence the company's strategic orientations. By introducing within the theoretical formula the degree of influence of EDs with a given digital background, it extends the study of digital orientation (Kindermann et al., 2020) by making it not only a tool for measuring the degree of digital transformation of a company, but also an output of decision-making systems. This latter observation could shift the focus from a construct understood as mere data to one whose application, quality, and quantity may depend on the specific characteristics of executives and the governance context in which they find themselves. Second, this paper extends the research possibilities in terms of the study of strategic orientations. By creating a scalable theoretical framework that does not refer exclusively to digital orientation, it is possible to adapt the framework to different strategic orientations such as market and technology

orientation (Zhou et al., 2005), learning orientation (Mavondo et al., 2005), or performance orientation (Matzler & Mueller, 2011) by investigating when EDs' knowledge and skills can influence different constructs.
In chapter 1, the literature review, after an introduction of the Italian situation in terms of digital transformation, is developed in two sections, the theoretical background, which analyzes the impact of digital transformation on the organization and the board of directors, and the development of the theoretical model. The latter analyzes the need for companies to undertake a new strategic orientation, suitable to the external context in which they are immersed, and then analyzes the construct of digital orientation explaining how the characteristics of the board and executives can influence the intensity of this strategic orientation. The chapter will end with a presentation of the model's hypotheses. Chapter 2 presents the method used in the analysis of this study. Beginning with an explanation of the sample chosen for the research and the data collection, the chapter goes on explaining the dependent variable entered into the study, the digital word coverage, and the independent and control variables. Next, the construct validation and operationalization techniques used by previous scholars introduce the central analysis carried in this paper. Within our analysis it is described: the use of CATA, vocabulary selection, and the rules for interpreting the results of computer-aided text analysis. The chapter ends with the regression study used for hypothesis validation.
Finally, chapter 3 addresses the regression results and chapter 4 addresses the interpretation of the results, future implications for practitioners and scholars, and limitations of this study.

1. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

In this work, the literature review it's divided in two sections. The first part analyzes the increasing relevance of the digital transformation process and its impact on the organization and board; The second part proposes a theoretical model on which the hypotheses of this study are based. The model investigates the findings of research works on a theoretical construct capable of highlighting the degree of digital transformation within a company (digital orientation) and on the influence that the characteristics of the board of directors and the executive directors can exert on the choices and strategic moves of the company of which they are part, with particular reference to the digital orientation. In the next section, an analysis of the Italian digital transformation context frames the country's situation. A review of the state of Italian digitization will be useful for a correct interpretation of the results of the study of the reference sample of this paper.

1.1. Digital transformation process in Italy

In 2016, Italy implemented the "Piano Nazionale Industria 4.0" with the aim of creating opportunities for all companies that are going through an internal transformation given the increasing presence of digital technologies. Italy's national plan for Industry 4.0 is part of the broader Digitising European Industry strategy being pursued at EU level. The DEI strategy, adopted by Europe in 2016, is an overarching strategy that aims to reinvigorate the European Union's competitiveness in digital technologies by ensuring that every sector in Europe, whether large or small, wherever it is located, can fully benefit from digital innovation.

Nineteen national digital transformation programs have been developed on the basis of the DEI. In the context of the DEI strategy, two different measurement indices can be observed: a Digital Transformation Enablers' Index (DTEI) and a Digital Technology Integration Index (DTII) to identify the performance of member states in terms of the enabling and integrating digital conditions experienced by means of a positioning score between 0 and 100. The scores allow for analysis of how countries are distributed in terms of enabling conditions and outcomes in comparison to other countries and to the EU28 average score. These indices focus on the geographic scope of digital transformation and provide insight to the analysis of enabling conditions for digital transformation at the EU level and for individual member states. In terms of DTII and DTEI, it is possible to understand that Italy is below the average of the 28 EU countries in both the measures. In particular, the conditions that enable digital transformation (DTEI), compared to the average, are 8.6% percentage points worse than digital integration itself (DTII), which is only 4.3% below the 28EU average (EU Digital Transformation Scoreboard, 2018). The international comparison, though not exhaustive, shows a general delay of Italian companies compared to those of other international realities and to the EU28 average also with regard to human capital and ICT skills. On the side of ICT specialists, the gap of Italian organizations is not high, approaching the EU average. In the case of companies with 10-49 and 50-249 total employees, the figure is decreasing in 2017 but there is a substantial convergence in the medium term compared to other European players (The Digital Economy and Society Index, 2018). As far as digital training is concerned, Italy lags behind the others with a significant gap. The values for all categories of Italian companies are significantly

lower when compared with those of the European realities considered. The percentage incidence of large companies that in 2017 started ICT training activities in Italy is 52%, while the EU 28 average is 68%. In the historical series, the gap consistently fluctuates between sixteen (2015, 2016 and 2017) and seventeen (2012, 2013) percentage points (Bandini & Caprio, 2018). Until now, the general outlook for Italy has been represented by negative aspects for the country, but there are also positive aspects to represent the commitment to a strategic plan for digital transformation. The market size of Industry 4.0 grew by 38.8% from 2017 to 2019 (estimates: Anitec-Assinform, 2020) and post-pandemic growth from 2021 to 2022 is estimated at 12.1%. The sectors where the greatest growth occurred between 2017 and 2019 in terms of digital technology spending were: insurance (10.4%), utilities (10.1%), industrial (10%), and healthcare (8.7%). All Italian regions recorded an increase in digital transformation spending from 2017 to 2019 (NetConsulting cube, 2020), demonstrating a uniform implementation of the 4.0 industry plan although some regions with better results (Lombardy, Trentino Alto Adige, Veneto, Emilia Romagna, Puglia and Piedmont) and others with worse results (Abruzzo, Sicily, Sardinia, Basilicata).

1.2. Background

1.2.1. Digital transformation process

The process of digital transformation implies very deep changes within society and markets due to the use of digital technologies (Majchrzak et al., 2016). Digital transformation also affects the company from a strategic point of view, in fact, it was discussed by Hess et al. (2016) that companies must find a way to establish innovative strategies, through the use of digital technologies, in order to achieve better operational performance. From a competitive standpoint, however, the influence that the digital transformation process has on companies doesn't end there. In fact, the need to find new paths for value creation in order to remain at the top of the market implies changes in a variety of business areas. Changes to the business organization are necessary: the structure, internal production and non-production processes, as well as the corporate culture and its digital dynamic capabilities must be able to support a "digital" process of value creation (Selander & Jarvenpaa, 2016; Carlo et al., 2012; Karimi & Walter, 2015).

On the same line of thinking Berghaus and Back (2016) and Rossman (2018) developed a digital maturity model. The existence of this kind of model is essential in order to make clear the idea of what the digital transformation process really is. Analyzing the two digital maturity models, it is possible to find common dimensions between which digital transformation develops, such as strategy, business model, process digitization, culture, governance, people and technology. For the sake of the record and to better understand what dimensions researchers have deemed most relevant to assessing the maturity of the digital transformation process in a company, an additional assessment model, devised by Gill and VanBoskirk (2016), called "The Digital Maturity Model 4.0" will be proposed. This model is articulated in four dimensions: (1) culture, (2) technology, (3) organization and (4) insights. The model describes the categories as follows:

1. *Culture: a company's approach to digitally driven innovation, and how it empowers employees with digital technology;*
2. *Technology: a company's use and adoption of emerging technology;*
3. *Organization: how aligned a company is to support digital strategy, governance, and execution.*
4. *Insights: how well a company uses customer and business data to measure success and inform strategy.*

1.2.2. The impact of the digital transformation on the organization

Transitioning to a digital mindset means understanding the opportunities as well as the risks associated with using digital technologies. In 2017 more than seven hundred executive and non-executive director board members rated the exponential evolution of technology as one of the top five risks related to their company's business (Amato, 2016). It therefore appears to be a logical conclusion that a board member should pay attention to where and how the digital transformation process is going to impact within a business ecosystem (Grove et al., 2018). According to a study by Bankewitz, Aberg and Teuchert (2016), the effects of digital transformation on the organization can be divided into five main dimensions:

1. Changing strategic context: the digital transformation process causes changes within the competitive environment. It causes barriers to entry to decrease, revolutionizes pre-existing value chains as well as business models (Schwab, 2016). Digitization also decreases information asymmetry, making it much easier for consumers to trace the main characteristics of products or services;
2. Sensor- and crowd- approaches: Newell and Marabelli in (2014) developed the concept of the "crowd." The "crowd" is a digital environment in which the increasing use of wearable mobile technology allows individuals and organizations to search and share information and knowledge in a mutualistic exchange model based on interests and goals. In this way companies have the opportunity to exploit knowledge in order to speed up decision-making and forecasting processes on market trends and preferences of individuals;
3. Big data: "*is the Information asset characterized by such a high volume, velocity and variety to require specific technology and analytical methods for its transformation into value*" (De Mauro et al., 2016). The process of creating consumer and market data is continuous (Dreischmeier et al., 2015), using data to create decision-making strategies expands opportunities for value creation. Big data analytics is a science that during the last few years has been refined a lot and has the power to create a situation of competitive advantage over competitors as it allows you to make the right decision at the right time (Barham H., 2017);
4. Short-term strategizing: the dynamic and continuosly-changing environment created by digitization makes long-term planning difficult to implement. Predicting future trends can be an unreliable evaluation process given the short-term nature of strategic contexts (Dreischmeier et al., 2015). Organizations, on the other hand, focus on short-term strategic objectives, adjusting strategy incrementally as competitive and market environments change (Constantiou & Kallinikos, 2015);

5. Disappearance of organizational boundaries: the exchange of knowledge and information takes place well beyond the boundaries of the organization. In order to stay in time with the digital world, companies begin to outsource tasks to gain the ability to temporarily perform operations in order to learn and bring in-house knowledge about managing the digital transformation process. Corporate governing bodies have the power to exert a fundamental role on how companies can develop digital knowledge and skills internally and consequently respond to the implications of digitization (Valentine & Stewart, 2013). In order to enable value extraction from new digital technologies, it must be understood that corporate boards must be engaged in decision-making processes related to digital transformation.

1.2.3. The impact of digital transformation on boards

The digital transformation also appears to have effects at the level of the board of directors, in particular, there are two changes that the transition to digital is able to induce (Bankewitz, Aberg & Teuchert, 2016):

1. Transition from boards to networks**:** the sharing of information and the ease of reaching a certain level of knowledge of a subject is increasing more and more thanks to new digital technologies. In a digital environment, information is shared across organizational boundaries. The "crowd" generates information in the form of opinions, comments that are publicly accessible. Orlikowski and Scott (2014) found that these comments and opinions can influence the way an organization and its executive members behave. It can be concluded that the easier it is for the "crowd" to access company information, the more power they will be able to exercise, indirectly, over the management of the company. Similarly, the easier it is to find information publicly, the more willing the executive members will be to have a more transparent attitude towards the "crowd" (Bankewitz, Aberg & Teuchert, 2016).

   Previous literature (Valentine and Stewart, 2013; Schwab, 2016; Huse 2007) regarding the composition and tasks of board members suggested that boards should operate as virtual networks in which the concept of static roles has to be forgotten there has to be an abandonment of the typical formal constraints that characterize organizations. Given the highly dynamic environment caused by digital transformation, boards should continually change their internal structure of member knowledge and skills aligning it with the digital challenges facing the company.

   Top management teams at companies like UBS, American Express and Cott Beverages have placed significant value on networking and creating leadership networks. In their management experience, they have found that the process of networking is essential for a good governance and business success, especially in an age in which new and faster ways of interconnection are being created among humans (Giovagnoli et al., 2004). Leadership networks are essential for collaboration among board members because each, being aware of their own knowledge and skills, can share them and find spaces for complementarity with other board members' skills. Board members are then expected to bring to the

differentiated boardroom experiences, interests and visions that will help the organization in creating value (Huse, Hoskisson, Zattoni & Viganò, 2009).

2. Replacement of the board tasks with the board agenda**:** digitalization brings with it an extremely dynamic environment in which there is often a change in the competitive and strategic environment and in which companies must evaluate decisions in the short term rather than the long term. The short-term decision-making leads to a change of the tasks of boards. Boards should change the way they behave by shifting the focus from tasks to perspectives of action that are based on a board agenda (Nicholson & Newton, 2010). Boards should therefore, in their role as decision-making bodies, align their agendas with changes in the market environment by taking greater account of short-term decisions (Bankewitz, Aberg & Teuchert, 2016). In this view, knowledge management is one of the main drivers to enable the company to have teams with good information storage capacity (Kor & Mesko, 2013) and consequently improve the ability to adapt to market changes (Bankewitz, Aberg, Teuchert, 2016) by sharing the informations before and during the decision-making process. In other words, it is possible to define knowledge management as one of the factors for a company to remain competitive. In a study carried out by Ndlela and du Toit (2001) in South Africa for the company Eskom, the largest distributor of electrical energy in the country, it was observed that the presence of a knowledge management program plays a key role in creating a competitive advantage for companies all around the world. A consequence of adopting knowledge management is the creation of a committee. As it is intended to be a center of creation and management of new knowledge, a committee is usually proposed when there is a need to apply specific knowledge and skills to a particular business sector that existing boards cannot cover. A ITGI research proposed by the organization Isaca (2011) found the presence of a technology committee in less than 25% of the companies studied. In 2016 the same company through the work of Lankton, CISA, CPA & Price, (2016) found an increase of 10% of technology committees being present in 35% of the companies in the sample.

   The importance of the phenomenon of digital transformation, however, requires a greater awareness, especially because boards usually do not have this kind of knowledge within them. Nevertheless, the above-mentioned study (Lankton, CISA, CPA & Price, 2016) assumes that in the future many more companies will implement a specific committee for the technology area.

1.3. Digital orientation, board & EDs influence

1.3.1. Recalibrating the strategic compass: a new digital direction

Since the 1990s, business management studies and research on compositional strategies have yielded a good base of results on the positive impact that strategic orientation has on firm performance. The strategic orientation of a company consists of the business choices of the company itself, taken in consideration of its values and beliefs, in order to improve the performance. Practitioners have defined different dimensions of strategic orientation as market and technology orientation (Zhou et al., 2005), learning orientation (Mavondo et al., 2005), or performance orientation (Matzler & Mueller, 2011).

Today, however, the exponential growth of digital technologies and their increasing presence in most choices affecting both supply and demand puts previous strategic orientations to the test. Consumers due to improvements in web browsing have transformed the way they experience products and services and the way they access and share information (Hamill et al., 2010), companies are experimenting new ways to produce goods through 3D printers (D'aveni, 2013) and to coordinate human actions with mechanical processes with the Internet of Things. This premise calls into question the applicability of previous models to new digital technologies and new levels of dynamism and change in competitive environments. Along these lines, Quinton et al. (2018) observed that the companies that were able to take the greatest advantage of the opportunities created by digital technologies were those companies with a combination of different strategic orientations: entrepreneurial, market and learning orientation. The reason lies in the proactive and market-insight driven behavior that companies, characterized by this combination of strategic orientations, have towards dynamic environments in the context of the digital economy.

Quinton et al. (2018) called this combination the digital orientation. However, this definition does not take into account that the three components proposed, even if they indicate a propensity for dynamic adaptive skills in a digital context, they do not properly address the issue of digitization and in any case are not technology-induced orientations (Schweiger et al. 2019). This lack is corroborated by a work of Nambisan et al. (2019). The latter scholars described the implications of digital technologies on business processes and outcomes. The implications and outcomes are grouped into three major themes: (1) affordances, the action potential that comes with the usage of an object (digital technology) that is related to the usage of a specific user in the field of innovation or management; (2) generativity, the potential exerted by a digital technology in the creation of a spontaneous change by unrelated and uncoordinated elements; (3) openness, the degree of incremental facilitation that the use of digital technologies can provide in terms of who can participate, how and what is possible to contribute, and in terms of the end result.

In light of these three new themes, the concept of digital orientation seems to go far beyond what was previously conceptualized by Quinton et al. (2018) and opens up a new way for research to look at the construct. At this point, it is useful to introduce the Strategic Alignment Model (SAM) theorized by Henderson & Venkatraman (1999). The SAM is a framework for conceptualize and give the direction for an efficient

management of the information technology strategic area. The model consists of two dimensions - *strategic fit* which describes the relationships between internal and external components and *functional integration* which describes the combination of the organizational and technological components through four "fundamental domain" of strategy (internal-technological, external-technological, internal-organizational, external-organizational).

1.3.2. Defining the construct of the digital orientation

Kindermann et al. (2020) noticed that both the digital orientation definition by Nambisan et al. (2019) and the SAM by Henderson & Venkatraman (1999) gave strong importance to the relation between internal and external components in addition to the strategic connection of the organizational and technological components and their need to be coordinated. So, they built a new and more complete definition of digital orientation that will result in a merge of the two research. In particular, in the new definition of digital orientation there are four domains of strategic intersection (Kindermann et al., 2020):

(1) *digital technology scope* (external/technological): the set of digital technologies available to the company to ensure that there is an opportunity to create value for consumers. This domain refers to the *affordances* theme proposed by Nambisian et al. (2019) and refers to the action potential of digital technologies that depends on the company, the individual, the technology and its use. Because the final outcome of this domain relates to how the use of digital technologies can bring value to consumers, it relates to the external-technological domain of the strategic alignment model.

(2) *digital capabilities* (internal/organizational): represents mostly the human and at the same time the organizational part of the affordances. Defines the process of absorbing learning routines regarding digital technologies. There must be an effort from the company to increase the level of knowledge of the company's employees so that the company can exploit certain digital technologies. This process takes place internally and at an organizational level as it is closely linked to the management of the company's structure.

(3) *digital ecosystem coordination* (external/organizational): in a digital ecosystem, more than one component is directed toward creating value for the customer. In this sense, a coordination of the various elements in order to create digital platforms has the potential to exploit the idiosyncratic effect created between the various components to achieve enhanced customer value creation. Idiosyncratic effects are exploited by shaping the structure of the company's relationships with stakeholders from a collaborative perspective in open digital ecosystems. Due to this last aspect this dimension belongs to the external-organizational domain and relate to the openness theme.

(4) *digital architecture configuration* (internal/technological): the development of an architecture dedicated to the digital branch and the consequent configuration of decision-making processes, of responsibilities related to the execution of technological changes, as well as the digitalization of internal processes. A good digital architecture allows the company to be more flexible and adapt more

easily to changes in demand and market conditions. In particular, a developed digital architecture allows organizations to be faster in internalizing technology routines with the aim of creating and capturing value. This dimension relates to the internal-technological domain of SAM and the generativity theme of the model proposed by Nambisan et al. (2019).

The concept of digital orientation proposed by Kindermann et al. (2020) is consistent and interesting as the four dimensions on which it moves are the result of a research work aimed at relating the strategic domains proposed in the SAM by Henderson and Venkatraman (1999) to the key themes on digitization proposed by Nambisan et al. (2019).

The four dimensions described are interconnected and related. A firm that develops the four dimensions in an inconsistent and unrelated way, e.g., by not developing one of them, is more likely to miss the full benefits of an innovation initiative and indeed increases the likelihood of failure. This observation further enhances the view of the four dimensions as part of a single construct. That we can define as follow: *"Digital orientation is an organization's guiding principle to pursue digital technology-enabled opportunities to achieve competitive advantage. It encompasses the dimensions of digital technology scope, digital capabilities, digital ecosystem coordination, and digital architecture configuration.* The need for coordination cannot be ignored by board members and executives who, in the guise of decision makers, must be prepared, in terms of knowledge and skills, to address this challenge.

1.3.3. EDs' influence on company's strategic orientation

Knowledge and skills developed during the university period have power to influence behavior and attitude toward a particular field (Patterson, 2012). Similarly, previous work experiences also have a positive influence towards individuals' behavior (Claes & Ruiz-Quintanilla, 1998) as well as industry background (Milliken & Martins, 1996). The education and prior experience of managers is recognized as a driver of innovation (Mumford, 2000) as it plays an important role in identifying the need for innovation within the company and creating an environment conducive to its application (Damanpour and Schneider, 2006). On the other hand, the values and principles of managers are also capable of fostering innovation; in fact, managers who have a favorable attitude towards innovation positively influence the adoption of new technologies (Nystrom et al., 2002).

Knowing this, it is possible to assume that the behavior and attitude of decision-makers is influenced by the knowledge and skills previously assimilated as well as previous work experiences. In this sense, a study by Ocasio (1997) is useful for the purposes of analysis. The study demonstrates that the behavior of a company is the result of the focus of attention of its executives'. In the model based on the attention of Ocasio (1997) those who take the decisions are in the more proactive part of the company, there where it takes life the action yielded from the inputs of the attentional and decisional models.

The end result of the attentional and decision-making inputs are the strategic moves and behavior of the company. The strategic moves of a company are all those actions taken by the organization and the directors to anticipate or respond to changes in the market environment, including both explicit and implicit decisions. The attention-based view takes into account two aspects that influence the selection of strategic moves: the first concerns the identity and interests of the decision-makers while the second concerns the environment surrounding the decision-makers at the time of the decision and the subsequent procedures and communication channels to be undertaken (Ocasio, 1997).

1.3.4. Board characteristics' influence on company's strategic orientation

The characteristics and composition of the board of directors of a company have been the focus of many studies conducted by practitioners of the subject, the role and central position that this management body holds within the organizational structure of a company has made scholars question how much power of influence it can exercise on the strategic orientation of a firm. The influence of board characteristics on the degree of internationalization of firms (Barroso et al., 2011), social influence (Stevenson & Radin, 2009), firm performance (Withers & Fitza, 2017), sustainability (Jizi, 2017), and many other categories of influence have been studied.

One of the most relevant categories of research conducted in recent years on board influence relates to firm innovation and digitization (Umrani et al., 2017; Chen et al., 2016; Asensio-Lopez & Cabeza-Garcia, 2019; Aberg et al., 2017). An essential aspect of the board is its composition. A key part of the board is made up of outside directors who play an important role as their independence allows for more cynical control over management and allows the company to collage to interest groups it would otherwise have difficulty reaching (Adams et al., 2008). The figure of the outside director is essential in the quick acquisition and dissemination of knowledge as their extensive network fosters this kind of advantage (Westphal, 1999). As Kim and Kim (2015) state, outside directors serve as acquisition points for external resources and consequently have the ability to facilitate strategic change and innovation within the company. Following this line of reasoning, Shapiro et al. (2015) demonstrated a positive relationship between the presence of independent directors on the board and changes in strategic direction as well as strategic moves related to innovation.

Another important aspect regarding the characteristics of the board is its size. The size of a board is positively related to inefficient and slow decision-making processes (Cheng, 2008). The more a board grows in the size of its membership, the more the problems of coordination and communication among directors outweigh the advantages of having a larger portfolio of managers to rely on (Jensen, 1993; Gladstein, 1984). Increasing the size of boards can significantly lead to the inhibition of strategic choices due to the aforementioned problems that can be caused by scarce group cohesion (Shaw, 1981), scarce participation in decision-making processes (Jewell and Reitz, 1981; Judge and Zeithaml, 1992), or potential conflict caused by coalition building (O'Reilly et al., 1989). Decisions involving complex and ambiguous choices are more likely to have an inefficient outcome when affected by the dynamics present in large groups (Olson, 1982). Larger boards can also make

the firm's adaptation to changes in the strategic environment in which it operates uncertain and less responsive (Goodstein et al., 1994); these attitudes are especially true when the firm is faced with particularly complex and turbulent changes in the strategic environment (Meyer, 1982). Within a board, a feature capable of influencing its efficiency is the duality of the functions of chief executive officer and chairman, this feature is called CEO duality. A combination of the roles of the two figures can lead to an increased risk of opportunistic behavior by the CEO that could lead to a decrease in the efficiency of the board.

On the discussion of which model to choose, whether that of role separation or union, most research argues that division of roles empower the internal control bodies of the company to control more of the managers' decisions and decrease conflicts within the board (Fama & Jensen, 2007). On the other hand, the presence of CEO duality within a board involves, contrary to what has just been said, less control over the actions of managers who would have the opportunity to pursue their projects even if they were not the best choice for the shareholders. This statement finds validity in the demonstration given by the study of Jeremias (2007) which confirms the correlation between the presence of CEO duality and a worse company performance both in financial terms and in terms of innovation. A further study (Blibech & Berraies, 2018) conducted on a sample of 60 Tunisian listed companies confirmed the negative correlation between the presence of CEO duality and the company's innovation performance.

1.4. Hypothesis development

1.4.1. Executive directors level hypotheses

As analyzed in the previous paragraphs, the pre-existing literature has paved the way for new questions regarding the influence of the individuals who are considered as decision makers and run the company on a day-to-day basis, which are referenced in the figure of executive directors (Deloitte, 2014; Forbes & Milliken, 1999). Previous scholars have defined the impacts of digitization on organizations and boards (Bankewitz, Aberg, and Teuchert, 2016) and disclosing how much corporate governing bodies have the power to exert a fundamental role on how companies can develop digital knowledge and skills internally and consequently respond to the implications of digitization (Valentine & Stewart, 2013). Kindermann et al. (2020) therefore developed a conceptualization of digital orientation based on the theoretical foundation composed of the research work of Nambisian et al. (2019) and Henderson & Venkatraman (1999) that show the involvement of firms in the digital transformation process.

The first hypotheses are based on theories that explain the power that the executive members of a company's governing bodies have over the methodologies in which digital skills and knowledge are introjected (Valentine & Stewart, 2013) and that state that the strategic moves and outcomes of a company are affected by how the attention of their executive directors is distributed (Ocasio, 1997). Additionally, an in-depth look at behavioral sciences has shown how knowledge and skills developed during college have the power to influence an individual's attitude toward a particular field (Patterson, 2012), as well as previous work experience (Claes & Ruiz-Quintanilla, 1998) and industry background (Milliken & Martins, 1996). These latter theories allow us

to advance the first set of hypotheses, which aims to measure the impact that the presence of digital knowledge, skills or experience among executive directors has on the digital orientation of the company which they manage.

H1a: The presence of executive directors with an educational path related to the IT-digital sector positively influences a company's digital orientation.
H1b: The greater the number of EDs with IT-digital education within a board the greater the company's digital orientation;
H2a: The presence of executive directors with previous work experience in an IT-digital related role positively influences a company's digital orientation.
H2b: The greater the number of EDs with IT-digital work experience within a board the greater the company's digital orientation;
H3a: The presence of executive directors with previous work experience in a field particularly focused on or inherent to innovation or IT-digital positively influences a company's digital orientation.
H3b: The greater the number of EDs with IT-digital industry background within a board the greater the company's digital orientation.

1.4.2. Board level hypotheses

The board of directors is described as the body within which the process of decision-making and decision-control takes place (Fama and Jensen, 1983). Previous literature in the field of business management has highlighted a crucial role of the BoD in strategic decisions (Asensio-Lopez et al., 2019). An essential aspect of the board is its characteristics.
Several studies have analyzed some of these features such as board size, board independence, and CEO duality in relation to their effect on the degree of adaptation to change in the strategic environment surrounding the company and the degree of innovation. More specifically looking at how these characteristics influence the degree of innovation and adaptation to changes in the strategic environment, it has been noticed that the number of non-executive independent directors positively influences these elements (Kim and Kim, 2015; Shapiro et al., 2015).
In contrast, board size (Goodstein et al., 1994) and the presence of duality in the figures of CEO and chairman (Jeremias, 2007; Blibech & Berraies, 2018) are positively related to a low degree of innovation and a reduced ability to adapt to changes in the strategic environment. In the context of this study, in which we analyze a trend, that of digital, which has disrupted the way in which firms have had to adapt their relationships with each other and in their relationships with clients and suppliers, characteristics such as the tendency to innovate and the ability to adapt to changing external factors is of extreme importance in understanding how these factors influence the degree of digital orientation in the firm. What is at issue is whether BoD characteristics

have the ability to moderate the level of influence on the firm's digital orientation that the EDs' overall knowledge and skills are able to exert.

H4: The degree of influence on the digital orientation of the company that an ED is able to exert is positively moderated by the percentage of non-executive independent board directors.

H5: The degree of influence on the digital orientation of the company that an ED is able to exert is negatively moderated by the board size.

H6: The degree of influence on the digital orientation of the company that an ED is able to exert is negatively moderated by the CEO duality.

2. DATA & METHODOLOGY

This chapter will begin with an introduction to the sample taken into consideration, composed of companies and executive directors. Subsequently, the variables used in the study will be outlined and finally after a draft of the previous analysis techniques used for the operationalization of the digital orientation construct, it will be given details of the methodology used to perform the study.

2.1. Sample and data collection

A study by Bowman (1984) on strategic orientation, explains that annual relations content analysis is effective in extrapolating business strategies, it was decided to use these corporate documents in order to derive the digital orientation of the companies considered. These documents signal the focus of managers' attention and are published periodically. Other studies show how the choice of words within corporate documents is related to the strategic orientation of the company itself (Short et al., 2010). On this basis it has been created the sample we intend to use for the study.

Data on executives, boards and annual relations have been collected for Italian public listed companies on the FTSE MIB index. Data on executives have been hand-collected from curriculum vitae and non-financial business documents while the data on boards were collected through the BoardEx database. The ARs were hand-collected from the companies' corporate websites. The sample is composed of Italian companies listed on the FTSE MIB index, starting from a sample of 174 firms. The process of creating the sample of firms, for which the ARs will be analyzed, began by checking the data availability by country and year on the BoardEx platform, searching for companies whose executive directors had a reference to the studies and whose board data were consultable on the platform. The output of this process led to 128 companies. As a result, the sample consists of 384 annual reports from 128 companies, covering the years from 2016 to 2018. It has been chosen this period of time because data collected for a single year may not be representative of the relations between the Boards, the EDs and the digital orientation. The sample is a balanced panel as all the data were available in that period.

2.2. Variables of the study

The next few paragraphs will explain the variables to check the two hypotheses advanced previously. The variables will be divided into dependent variables, independent variables, and control variables.

2.2.1. Dependent variable: digital word coverage

The word coverage is a measure that has been widely used by previous scholars in the context of interpreting a strategic orientation operationalized for CATA of firm documents (McKenny, 2018; Short et al., 2010; Kindermann et al., 2020). Word coverage is a measure that indicates the frequency of one or more words divided by a unit of measurement such as pages or words. In this study we introduce the digital word coverage, a measure that describes the number of words in annual reports that refer to digital orientation divided by the number of pages that a particular AR counts. This measure will be normalized per 100 pages, expressed in this

way the digital word coverage indicates the number of words referring to the digital orientation and its dimensions that can be found per 100 pages. It was possible to derive the variable through the use of the content analysis software NVivo, suggested by Krippendorff's (2018), and through Adobe Acrobat page count software. Using NVivo, it was possible to run text queries that resulted in the number of times a particular word appeared within an AR. Adobe Acrobat software, on the other hand, was used to count the number of pages in a given AR.

2.2.2. Independent variables

To test the first set of hypotheses (1a, 2a, 3a) regarding the influence of EDs' prior experiences on the level of digital orientation of the company they manage, three different independent variables were used, IT education, IT work experience e IT industry background. The variables were operationalized by analyzing resumes and non-financial company documents that pertained to executives' prior knowledge and experience.

The independent variable we use to test the first hypothesis, regards the relationships between prior EDs' IT-digital knowledge and the digital orientation of the firm, is IT education. IT education is defined as the presence within an ED's education path of an academic degree or a specialization course in computer science, computer engineering, information technology. IT education is a dummy variable that assume a value of 1 when there is the presence of an academic background concerning the courses of study previously indicated and the value of 0 when there will be a path of study not related to the IT-digital world.

The independent variable we use to test the second hypothesis, regards the relationships between prior EDs' digital-IT experience and the digital orientation of the firm, is IT work experience. IT work experience describes the presence of present or past work experience in the IT-digital field, it refers to work experience such as: CTO, CDO, launching digital projects, consulting for IT-digital firms, other IT or other digital related job positions. IT work experience is a dummy variable that assume a value of 1 when there is the presence of previous work experience concerning job positions relative to the ones indicated and the value of 0 when there will be a path of career not related to a IT-digital work position.

The independent variable we use to test the third hypothesis, regards the relationships between prior EDs' IT-digital background in a IT-digital related industry and the digital orientation of the firm, is IT industry Background. IT industry background is a dummy variable that assume a value of 1 when there is the presence of previous work experience in a IT-digital related industry, even if not executing a IT-digital job position, and a value equal to 0 when there is no presence of previous working experience in a IT-digital related industry. IT-digital industries are information technology, software, computer services, media (when there is a particular propensity through digital services) as well as telecommunication services.

Three additional independent variables were then considered to test the hypotheses 1b, 2b, 3b. The three added variables are treated as absolute measures and consider the number of EDs within a board that respond positively and non-conjointly to IT education, work experience and industry background. These independent variables are "n° of total EDs with IT education", "n° of total EDs with IT work experience", "n° of total EDs

with IT industry background". Finally, an aggregate variable called “IT involvement” was created, this variable represents the presence within it of at least one response 1 of the dummy variables IT education, IT work experience, IT industry background.

2.2.3. Control variables

The control variables used include firm size level measurement as practiced in other studies that analyzed the impact of corporate governance on firm outputs (Haynes et al., 2019; Kindermann et al. 2020). To examine whether independent variables predict firm digital orientation, a control with firm age was conducted, as younger firms are found to be more dynamic in adapting to digital contexts (Sebastian et al., 2017). It was then checked with firm profitability (ROA) as the size of this index is positively correlated with the digital orientation construct (Kindermann et al., 2020) and finally we checked by firm size by placing the number of employees in the firm as a variable as research by Mithas & Rust (2016) explains how firm size affects the resources needed to develop digital orientation. Further control variables have been added regarding the level of indebtedness of companies, financial leverage ratio and whether a company belongs to a specific industry in order to determine if there is the presence of an endemic reflection of the construct in this variable. In particular this last variable was coded in a dummy with answer 1 if the company belongs to a high-tech industry identified by the aggregation of certain NAICS codes (Kile & Philips , 2009). The data were collected via Bureau VanDijk's Orbis database.

Following the elaborations proposed by previous scholars (Belkhir, 2009; Ahmed, 2006) regarding corporate governance, it was decided to introduce control variables regarding this dimension. The variables introduced are a measure regarding board size to specify the number of members present on the board of each company; a measure concerning board independence that explains the number of independent non-executive directors within each board, this measure was expressed both in terms of absolute size and relative size in respect to the total number of board members; a measure relative to the CEO power within the board called CEO duality, this independent variable has been treated as a dummy variable that has assumed a value equal to 1 when within a board the figure of the CEO was coincident with the figure of the chairman and a value equal to 0 when the opposite was true. The data were collected through BoardEx.

2.3. Previous analysis background

2.3.1. Validation of the construct through CATA

The issue of rigor in construct validation is a point of extreme importance in modern measurement theory (Kerlinger and Lee, 2000). Construct validity refers to the evaluation of inferences based on the concepts of interest while considering the degree to which the measure succeeds in representing the focal construct (Cronbach, 1971). One methodology by which it is possible to capture focal constructs that are difficult to measure is that of content analysis. A technique related to content analysis is called computer-aided text analysis (CATA) it is particularly interesting because it is able to process a large amount of data in a quick

and rigorous way for scientific research purposes. CATA is one of the primary tools available to scholars of organizational studies to validate theoretical constructs. Computer-aided text analysis is performed using software such as: VBPro, Concordance, Nvivo, DICTION, General Inquirer, CATPAC, LIWC and MECA (Krippendorff, 2018). Evaluating a construct begins with defining the construct's main concept. Short et al. (2010) recommend an approach to analysis using computer-aided text analysis that considers single words as units of measurement. There is a recommended procedure by Short et al. (2010) to enhance construct validity when it is used CATA as a method of analysis. The procedure is composed first by a deductive content validation to be then followed by an inductive content analysis.

2.3.2. Kindermann's operationalization of the digital orientation

In this section we will analyze the operationalization through the CATA methodology of the digital orientation concept proposed by Kindermann et al. (2020). In operationalizing the construct of digital orientation Kindermann et al. (2020) performed the CATA methodology on the "CAT Scanner" software. The software is capable of extracting various measurements such as: single words, multiple words, and stem words (Mckenny et al., 2018). In selecting the reference sample, Kindermann et al. (2020) have chosen shareholder letters from companies listed on the S&P 500. Specifically, shareholder letters from 643 companies were considered, in the years 2001 to 2016, for a total of 6498 letters. The choice of letters to shareholders as an element of the sample is due to more than one reason:

- LTSs are publicly available and periodically published;
- It is the most used narrative text in management, as it is included in annual reports;
- It was noted by Barr et al. (1992) that LTSs highlight the issues to which managers' focus is directed;
- Short et al. (2010) demonstrated that content within the corporate documents can possibly influence the firms' actions.

The theoretical link that gives the possibility to create a pathway between the analysis of shareholder letters and the measurement of strategic orientations - in particular digital orientation - is based on three research works. The first two consist in the Sapir-Whorf hypotheses, these theories state that there is a relationship between the choice of words in corporate documents and the attention of managers regarding the issues that the chosen words indicate. A higher frequency of words identified within business documents indicates a higher intensity of managers' attention with respect to the implied themes. The second theory, on the other hand, is based on a research work done by Ocasio (1997) in which the main result is that the behavior of firms is *"the result of how firms channel and distribute the attention of their decision makers"*. As a result, it is possible to theorize that the "digital words" within the letters to shareholders indicate an increased interest in the digital topic. Entering into the practice of the research conducted by Kindermann et al. (2020), the scholars divided the process of operationalizing the construct of digital orientation into the following steps:

1. Creation of a preliminary word list based on the deductive and inductive theories by Short et al. (2010): in the first part the deductive theory led the researchers to create a list of words for each dimension present in the definition of digital orientation, they then expanded the words in the list with the help of an online synonyms site (thesaurus.com). This process results in 208 words.
2. Refinement of the word list according to the context of the content present in the LTSs: following the theory developed by McKenny et al. (2018) the researchers manually analyzed the ten percent of the sampled text. They then proceeded by analyzing the words present infrequently (present less than 100 times) and eliminating all words that less than 70% of the time explicated the construct. This resulted in the elimination of 60 words, bringing the number of total words in the list to 148.
3. Definition of a measurement scale to interpret the results of the text search queries: In this passage Kindermann et al. (2020) established rules for evaluating the scores of text search queries. To establish the rules, they relied on work done by previous researchers regarding operationalization through computer-aided text analysis of strategic orientations. They divided the coverage (n°of "digital words"/n° of total words) of digital-related words by the number of words within each individual document, then normalized the coverage measurement indicating the number of "digital words" per 1000 total words. Finally, they calculated the results by dimension for each year and company, the sumof these factors has resulted in the overall score related to digital orientation

2.4. Analysis

2.4.1. Computer-aided text analysis

In order to operationalize the construct taken into analysis in this study, computer-aided text analysis will be used, this tool is able to make contextual information explicitly available from other context sources. Using CATA software it is possible to run text search queries, this feature consists in searching for certain words in a given text and receiving as a result the number of times these words are found in the search performed. There are important benefits for choosing this method over surveys, human-performed content analysis, or interviews. In fact, this kind of analysis is applicable to both quantitative and qualitative research and is also applicable to longitudinal research (Duriau et al., 2007). Computer-aided text analysis does not suffer from subjective bias, allows for replicability of the model used by other studies (Morris, 1994), and allows for analysis of a much larger amount of content in a smaller amount of time (Short et al. 2010). The software chosen to perform the CATA is NVivo. NVivo is a software that allows to search for single, compound or stem words, so it was possible to search for combinations of words separated by spaces such as "digital transformation".

2.4.2. Keywords selection and refinement process

In order to proceed with the selection and refining process of the dictionary constructed to perform the CATA analysis, the recommendations of Short et al. (2010) and McKenny et al. (2018) on the deductive and inductive

approach to constructing vocabulary relevant to the study of the construct were followed. First, the analysis of two documents, one of which analyzed the most used keywords in the academic papers regarding digital transformation (Reis et al., 2018) and the other listed the main digital transformation activities that the new European digitalization plans envisaged for the time frame 2016-2023 (EU Digital Transformation Scoreboard, 2018), lead to a preliminary dictionary composed of 27 keywords able of capturing the digital orientation construct. This first step was then followed by three rounds of keyword skimming. The first round of skimming eliminated words that had an overly generalist meaning or indicated activities that could only be pursued in a few industries. The second round eliminated keywords that were redundant with each other or obsolete and the third round eliminated keywords that were found with a low frequency within the annual reports of the companies in the sample through a text word query on NVivo software. This process resulted in 9 remaining keywords. The resulting dictionary after the third round of skimming was then expanded by adding keywords that were synonyms or alternative ways to define a word already present in the dictionary, resulting in 14 keywords. Next, the vocabulary used by Kindermann et al. (2020) in a study on the digital orientation was analyzed. The vocabulary in the study had been constructed based on the recommendations of Short et al. (2010) and McKenny et al. (2018) and consisted of 148 keywords. From the initial dictionary, 35 keywords were chosen after re-running the three skimming rounds proposed previously, resulting in 49 keywords. Following the experience of Kindermann et al. (2020) about 10% of the results were analyzed manually and keywords that reflected the digital orientation construct less than 7 out of 10 times were removed, resulting in 45 keywords. Finally, words were assigned to the digital orientation dimensions following the definition of each dimension and once the descriptive statistics were calculated, words that made the standard deviation and mean word coverage of the digital orientation dimensions not comparable to each other were removed, resulting in 40 keywords displayed in Table 1.

Table 1, Word dictionary divided per dimension

Digital orientation	**CATA single and composite words**
Digital technology scope	cloud computing, IoT, Internet of Things, blockchain, bot, information management, advanced technology, high-speed, apps, network services
Digital capabilities	artificial intelligence, big data, machine learning, data analysis, data analytics, autonomous, informatics, computing, streaming, user interface
Digital ecosistem configuration	social media, smartphone, API, APIs, network infrastructure, technology platform, ERP, ecommerce, e-commerce, open source
Digital architecture configuration	digitalization, digitization, digitalisation, cyber-security, information technology, cybersecurity, robotics, industry 4.0, digital transformation, digital business

2.4.3. Rules for the scores

Once the word dictionary was created, the individual keywords were entered into Nvivo content analysis software to perform CATA. The CATA resulted in the number of times a given keyword appeared in the annual report of the company being analyzed. Given the difference in the length of the ARs, the number of words found for each dimension of digital orientation was divided by the number of pages in that AR. Subsequently, the result was normalized for 100 pages in order to facilitate reading. In the following step, the scores for each dimension were calculated and then summed to create the digital orientation score for each company and each year. In Table 2 it can be seen that the descriptive statistics for the four dimensions are consistent with each other.

Table 3 shows the distribution of values related to digital orientation in the period 2016-2018 (N= 384). The average score in 2016 is 6.13 and grows through 2018 reaching a score of 8.31, absolute growth is 35.6%. Also the max score grows through the years, indicating an increased focus on digital orientation as the years go by. As regard the dimensions of the construct it's possible to observe a stable mean and a greater max score on the digital technology scope dimension. The ratio between SD and Mean averages 1.89 consistent with the results found in the study by Kindermann et al. (2020) who present an average ratio between the two magnitudes of 1.62.

Table 2, Digital orientation scores by dimension

Dimensions	**Observations**	**Mean**	**SD**	**Min**	**Max**
Digital technology scope	128	1,88	5,51	0	47,80
Digital capabilities	128	1,77	4,51	0	32,60
Digital ecosystem configuration	128	1,84	3,70	0	26,45
Digital architecture configuration	128	1,88	3,51	0	27,67
Digital orientation	128	7,37	14,04	0	95,19

Note: scores are normalized to word count per 100 pages for every annual relation

Table 3, Digital orientation scores by year

Year	**Observations**	**Mean**	**SD**	**Min**	**Max**
2016	128	6,13	11,40	0	67,74
2017	128	7,69	14,56	0	98,40
2018	128	8,31	16,14	0	119,42

Note: scores are normalized to word count per 100 pages for every annual relation

2.4.4. Dictionary additional validation – dimensionality

Following the guidance of Short et al. (2010), an additional examination is recommended to establish the reliability of the dictionary chosen for the CATA. The assessment of dimensionality consists of analyzing the correlation between the CATA results belonging to the dimensions that are part of the construct. For the dictionary to be reliable, a positive correlation is expected, but not a perfect correlation. According to a study by Edwards (2001) in a multidimensional construct, the dimensions should be correlated, but distinct from each other. Table 4 shows the correlation rate between the dimensions under analysis, it can be seen that the correlation moves from a minimum rate of 0.42 (DEC-DTS) to a maximum of 0.61(DC-DTS). The range of correlation 0.42-0.61 indicates positively correlated but distinct dimensions. Regarding the correlation rate between the dimensions and their construct, Mackenzie et al. (2011) indicate a correlation rate r >0.5 to test for dimensionality, as the construct itself includes most of the variance of its dimensions. The correlation between the dimensions and the reference construct (DO) moves in a range from 0.78 to 0.85 testing the construct dimensions as reflective indicators of the construct itself (MacKenzie et al., 2011).

Table 4, Intercorrelations of digital orientation dimension

Dimensions	**DTS**	**DC**	**DEC**	**DAC**	**DO**
DTS	1				
DC	0,61*	1			
DEC	0,42*	0,56*	1		
DAC	0,59*	0,52*	0,51*	1	
DO	0,85*	0,83*	0,78*	0,80*	1

Note: *p < 0.001.

2.4.5. Regression

To test the hypotheses, the dataset was arranged according to the panel data methodology, which allowed us to perform a cross-sectional and longitudinal statistical analysis. The choice of a panel analysis also involves the provision of assumptions that can determine the choice between the methodology fixed and random effects. A chi-square analysis using the Hausman test (chi-square(17) > 36.2927, p = 0.004) a low p-value counts against the null hypothesis that the model with random coefficients is adequate, in favor of the model with fixed effects. Several models were used to test the hypotheses in particular, model 1 takes into consideration only the control variables, model 2 introduces in the regression the dummy variable IT education, and respectively in models 3 and 4 are introduced the dummy variables IT work experience and IT industry background, models 5, 6 and 7 present respectively the variables n° of EDs with IT education, n° of EDs with IT work experience and n° of EDs with IT industry background. Model 8 introduces an aggregate IT involvement variable, and models 9, 10, and 11 include two-factor interactions between IT Involvement and

CEO duality, % of board independence, and board size, respectively. Model 12 and 13 insert dummy year variables for years 2017 (Y_2017) and 2018 (Y_2018).

Finally, model 14 inserts all variables together, except for the independent variables of model group 5-7 in order to avoid problems related to excessive correlation between them and group 2-4.

3. RESULTS

Table 5 shows the descriptive statistics of the predictors. In particular, the mean, minimum, maximum and standard deviation values are represented, as well as the correlations between all the variables considered in the study. The statistics refer to the full sample for the period 2016-2018. All variables show an acceptable correlation index, with the exception of the variable "EDs with IT involvement" as it represents an aggregate measure of three independent variables. The VIF test was performed on SPSS software to verify whether there was collinearity between the variables, and it was found that all variables had a coefficient below the alarm threshold regarding collinearity.

In the sample analyzed, on average, 5.7% of companies have at least one executive with an IT-digital academic background, 27.9% have at least one executive with previous work experience in an IT-digital position, and 11.5% have at least one executive with a position in an IT-digital industry. On the other hand, 32.3% of companies have at least one executive director with at least one of the characteristics described above. Regarding the number of EDs on a board, a maximum of 3 executives with an IT-digital academic education and a maximum of 6 executives with an IT-digital work experience as well as a maximum of 6 executives with industry background were recorded out of a maximum board size of 22 members in the sample.

The results (Table 6a, 6b) confirmed most of the hypotheses presented. Model 2 supports hypothesis 1a by making explicit the positive association between IT education and digital orientation (beta = 0.276, $p < .01$). At the same time, model 3 and 4 also support hypotheses 2a and 3a by confirming respectively the positive influence that IT-digital prior job positions (beta = 0.070, $p < .0$) and IT-digital industry background (beta = 0.239, $p < .01$) have on digital orientation, although model 3 with a lower intensity. Models 5, 6, and 7 support, in order, hypotheses 1b, 2b, and 3b by demonstrating that the number of EDs with IT education (beta = 0.206, $p < .01$), IT work experience (beta = 0.068, $p < .01$), and IT industry background (beta = 0.062, $p < .01$) has a positive effect on the response variable, although it can be seen that the strength with which the number of executives with IT-digital characteristics present within the board is less than that exerted by the corresponding variables indicating the mere presence of EDs with IT-digital characteristics within the board. Model 8 shows a positive effect of the aggregate IT involvement measure on digital orientation (beta = 0.069, $p < .01$), this premise serves to take into analysis the next three models (9, 10, 11) that show the moderating effects that respectively the variables CEO duality, % of board independence and board size have on the interaction of IT involvement on digital orientation. In particular, the model 9, as predicted by hypothesis 4, shows a negative moderation (beta = 0.031, $p > .1$), although is not statistically significant. Model 10 does not confirm hypothesis 5 on the basis of which we expected a positive moderation of board independence on the effects of IT involvement on digital orientation. Model 11 on the other hand confirms hypothesis 6, reporting a negative moderation of the effects of IT Involvement on digital orientation. Finally, thanks models 12 and 13 are not statistically significant although it can be seen that there is a slight but increasing time effect from 2017 (beta = 0.004, $p > .1$) to 2018 (beta = 0.017, $p > .1$), shifting the weight of the effects more to the last year data of

the analyzed sample. Model 14 includes the interactions of all regressors with the response variable with the exception of the regressors in models 5, 6, and 7 as they could have created problems of excessive correlation with the regressors in models 2, 3, and 4. The elimination criterion is based on the performance of the independent variables that demonstrated greater interaction with respect to both direct and moderate interactions. The model 14 thus formed reflects almost all of the results found previously in the analysis of models 2-13. The group of regressors 5-7 was then used to perform a robustness check and examine the core of the regression coefficient estimates by removing or adding regressors to ensure the structural validity of the regression (Wu & White, 2014). We proceeded, starting from the base of model 14, with a forward addition of regressors 5-7, this action did not affect nor the estimates of the regressors in the model neither the r-square of the model. A second check was performed through a backward elimination of regressors 2-4, keeping the regressors 5-7 added in the first check. The second check showed a decrease in the r-square, and a significant change in the coefficient for the IT involvement variable, meaning a higher degree of construct prediction by models 2, 3, and 4.

Table 5, Descriptive statistics

	MIN	MAX	MEAN	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ln.(firm size)	2,71	11,81	7,6608	1,77400	--																	
ROA	-35,89	53,44	3,2433	6,72321	-,126*	--																
Firm Age	1,00	546,00	63,8594	60,4172	,236**	-,102*	--															
CEO duality	0,00	1,00	0,5495	0,49819	-,177**	0,068	-,223**	--														
% Board Indep.	0,00	0,94	0,5078	0,16334	,342**	-,104*	0,078	-,265**	--													
Board size	5,00	22,00	11,1042	3,19915	,418**	-0,089	,119*	-,142**	,119*	--												
Leverage	0,10	656,39	93,8320	101,200	0,029	-,118*	-0,012	,201**	0,091	-,173**	--											
Industry	0,00	1,00	0,2344	0,42416	-,150**	,105*	-,132**	,143**	-0,051	-,162**	-0,045	--										
IT Education	0,00	1,00	0,0573	0,23270	-0,002	-0,009	-0,054	,156**	0,021	-,103*	0,029	,181**	--									
IT work experience	0,00	1,00	0,2786	0,44892	-,162**	0,033	-,134**	,189**	-,195**	-0,048	-0,003	,273**	0,072	--								
IT industry background	0,00	1,00	0,1146	0,31893	-,156**	-0,034	-,197**	,145**	-,173**	-,129*	-0,025	,361**	,333**	,451**	--							
IT involvement	0,00	1,00	0,3229	0,46820	-,106*	0,010	-,114*	,189**	-,147**	-0,024	0,036	,302**	,357**	,900**	,521**	--						
N° EDs w/IT education	0,00	3,00	0,0729	0,33878	0,028	0,034	-0,070	,149**	-0,036	-,101*	-0,005	0,099	,874**	,124*	,357**	,312**	--					
N° EDs w/IT work exp.	0,00	6,00	0,4115	0,83493	-,135**	0,041	-,192**	,221**	-,207**	-0,071	-0,061	,155**	,228**	,794**	,597**	,715**	,429**	--				
N° EDs w/IT industry back.	0,00	6,00	0,3099	0,99361	-0,095	0,032	-,184**	,161**	-,195**	-0,095	-0,043	,187**	,307**	,432**	,868**	,452**	,476**	,746**	--			
Y_2017	0,00	1,00	0,3333	0,47202	-0,006	-0,038	0,000	0,007	0,013	0,008	-0,036	0,000	-0,008	0,004	0,006	0,008	-0,005	-0,004	0,013	--		
Y_2018	0,00	1,00	0,3333	0,47202	0,019	0,079	0,012	-0,015	0,063	-0,001	-0,031	0,000	-0,008	0,004	0,006	-0,004	-0,005	0,015	-0,015	-,500**	--	
Digital Orientation	0,00	1,19	0,0713	0,13900	-0,082	0,010	-,175**	0,086	-,106*	-,165**	-0,080	,300**	,502**	,299**	,596**	,304**	,533**	,450**	,503**	0,018	0,052	--

*: $p < 0.05$; **: $p < 0.01$

Table 6a, Regression models for digital orientation

	1	2	3	4	5	6	7
ln.(firm size)	0,006	0,004	0,008*	0,007*	0,001	0,006	0,004
(SD)	**0,005**	**0,004**	**0,004**	**0,004**	**0,004**	**0,004**	**0,004**
ROA	-0,001	-0,001	-0,001	1,347E-05	-0,001	-0,001	-0,001
(SD)	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**
Firm age	0,000***	0,000***	0,000**	0,000	0,000***	0,000*	0,000
(SD)	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
CEO duality	0,003	-0,016	-0,003	-0,002	-0,017	-0,014	-0,007
(SD)	**0,015**	**0,013**	**0,015**	**0,013**	**0,013**	**0,014**	**0,013**
Board independence	-0,070	-0,092**	-0,043	-0,006	-0,062	-0,020	-0,007
(SD)	**0,045**	**0,040**	**0,045**	**0,039**	**0,039**	**0,042**	**0,041**
Board size	-0,007***	-0,005**	-0,007***	-0,005***	-0,004*	-0,006***	-0,006***
(SD)	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**
Leverage	0,000**	0,000**	0,000**	0,000*	0,000*	-9,50E-05	0,000*
(SD)	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Industry	0,089***	0,064***	0,070***	0,028*	0,077***	0,075***	0,067***
(SD)	**0,016**	**0,015**	**0,017**	**0,015**	**0,014**	**0,015**	**0,015**
IT education		0,276***					
(SD)		**0,026**					
IT work experience			0,070***				
(SD)			**0,016**				
IT industry background				0,239***			
(SD)				**0,020**			
N° EDs w/IT education					0,206***		
(SD)					**0,017**		
N° EDs w/IT work exp.						0,068***	
(SD)						**0,008**	
N° EDs w/IT industry back.							0,062***
(SD)							**0,006**
IT involvement							
(SD)							
CEODuality * IT.INVOLVEMENT							
(SD)							
Board Indep. * IT.INVOLVEMENT							
(SD)							
Board Size * IT.INVOLVEMENT							
(SD)							
Y_2017							
(SD)							
Y_2018							
(SD)							
Observations	384	384	384	384	384	384	384
Companies	128	128	128	128	128	128	128
Constant	0,148***	0,153***	0,116***	0,070***	0,146**	0,090***	0,095**
SD Constant	0,040	0,035	0,040	0,035	0,034	0,037	0,036
R^2	0,141	0,342	0,186	0,385	0,380	0,287	0,320
RSS	6,349	4,867	6,019	4,545	4,584	5,270	5,027
F	7,627	21,348	9,390	25,763	25,203	16,569	19,360

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

Table 6b, Regression models for digital orientation

	8	9	10	11	12	13	14
ln.(firm size)	0,007	0,006605	0,00633**	0,007198*	0,006	0,006	0,006700**
(SD)	**0,004**	**0,004326**	**0,004293**	**0,004178**	**0,005**	**0,005**	**0,002914**
ROA	-0,001	-0,000992	-0,000893	-0,001250	-0,001	-0,001	-0,000307
(SD)	**0,001**	**0,000991**	**0,000983**	**0,000955**	**0,001**	**0,001**	**0,000672**
Firm age	0,000**	-0,000276**	-0,000270	-0,0003***	0,000***	0,000***	-0,000157**
(SD)	**0,000**	**0,000113**	**0,000112**	**0,000109**	**0,000**	**0,000**	**7,638427E-05**
CEO duality	-0,004	-0,013759	0,000652	-0,004085	0,003	0,003	-0,003239
(SD)	**0,015**	**0,017066**	**0,014310**	**0,013836**	**0,015**	**0,015**	**0,011623**
Board independence	-0,048	-0,053810	0,024334	-0,044796	-0,070	-0,073	0,002131
(SD)	**0,044**	**0,044056**	**0,051357**	**0,042279**	**0,045**	**0,045**	**0,035266**
Board size	-0,007***	-0,00724***	-0,006994	-0,000377	-0,007***	-0,007***	-0,000488
(SD)	**0,002**	**0,002288**	**0,002272**	**0,002577**	**0,002**	**0,002**	**0,001786**
Leverage	0,000**	-0,0002**	-0,0002***	-0,0002**	0,000*	0,000*	-0,0001
(SD)	**0,000**	**6,841996E-05**	**6,747057E-05**	**6,561011E-05**	**0,000**	**0,000**	**4,623174E-05**
Industry	0,066***	0,06606***	0,06463**	0,0563***	0,089***	0,089***	0,023505**
(SD)	**0,017**	**0,016429**	**0,016315**	**0,015993**	**0,016**	**0,016**	**0,011333**
IT education							0,417485***
(SD)							**0,027454**
IT work experience							0,336339***
(SD)							**0,030327**
IT industry background							0,194336***
(SD)							**0,017485**
N° EDs w/IT education							
(SD)							
N° EDs w/IT work exp.							
(SD)							
N° EDs w/IT ind. back.							
(SD)							
IT involvement	0,069***	0,0496**	0,1827***	0,3151***			-0,2094***
(SD)	**0,015**	**0,023709**	**0,045372**	**0,048688**			**0,061338**
CEODuality*IT inv.		0,031309					-0,0693***
(SD)		**0,029551**					**0,020632**
B.Indep* IT involvement			-0,2325***				-0,080856
(SD)			**0,088076**				**0,062744**
B.size* IT involvement				-0,0220***			-0,004750
(SD)				**0,004169**			**0,003059**
Y_2017					0,004		0,017788*
(SD)					0,014		0,010623
Y_2018						0,017	0,021340**
(SD)						**0,014**	**0,010670**
Observations	384	384	384	384	384	384	384
Companies	128	128	128	128	128	128	128
Constant	0,126***	0,131719***	0,082336***	0,046346	0,146***	0,144***	-0,004904
SD Constant	0,039	0,039220	0,041886	0,040424	0,041	0,040	0,030775
R^2	0,188	0,156	0,170	0,219	0,141	0,144	0,643
RSS	6,001	6,203	6,136	5,773	6,348	6,325	2,671
F	9,543	7,619	8,427	11,542	6,771	6,942	39,261

4. DISCUSSION

Immersed in the context of the literature of corporate governance, executives, and companies' strategic orientations, this study illustrates through deductive reasoning the relationship between executives' skills and knowledge with the intensity of the digital orientation of the companies they manage. Based on the theories that link the attention and behavior of EDs to the strategic choices of companies (Ocasio, 1997), it was possible to deepen and find that in turn the attention and behavior in the workplace are influenced by the cognitive (Patterson, 2012) and experiential (Claes & Ruiz-Quintanilla, 1998; Milliken & Martins, 1996) prior background. Subsequently, thanks to the operationalization of the digital orientation construct theorized by Kindermann et al. (2020), it was possible to make explicit the aforementioned relationship through a statistical regression study.

It has been argued that both the presence and the number of executive directors related to the IT-Digital world contribute to positively influence the degree of digital orientation of a company. In particular, for both presence and number, it was observed whether they had an IT education, IT work experience or IT industry background. As EDs are members of the BoD, we then analyzed how board characteristics can moderate the relationship between executives' characteristics and digital orientation. Three different board characteristics were analyzed, CEO duality, board independence and board size. As for the direct interactions between IT education, IT work experience, IT industry background and digital orientation all recorded a positive interaction and it was observed that, among the three, the feature that most affects digital orientation is IT education, followed by IT industry background and finally IT work experience. Regarding the direct interactions between the numerical measure of the amount of EDs within a board with IT education, work experience or industry background, again all interactions recorded a positive relationship with the degree of digital orientation of the company, in particular a higher number of EDs with IT education favors the development of digital orientation to a greater extent than the number of EDs with IT work experience, as well as the latter performs better on the number of EDs with industry background. From the analysis of direct interactions, it's possible to understand how EDs with an academic background in IT-Digital have a greater ability to influence the strategic orientation of the company towards a digital solution and that their mere presence affects more than the number of EDs with this characteristic present within the board.

The moderating effect of board characteristics on interactions between the aggregate IT involvement measure and digital orientation all show a negative effect of the former on the latter. In particular, an executive characterized by IT involvement has a much lower power of influence when he is in contexts where there is a high number of total members of the board and when there is a high percentage of independent non-executive directors. The presence of duality in the figure of CEO and Chairman also leads to a decrease in the effects of the interaction between IT involvement and digital orientation, although this decrease is slight. Finally, as expected a time effect was observed showing the growth in digital orientation of companies from 2017 to 2018.

These results demonstrate consistency in the measures adopted in measuring the characteristics of executive directors and support the hypotheses advanced regarding the positive effect that the EDs' previous knowledge and experience in IT-digital have on the digital orientation of the company they manage; equally consistent are the arguments advanced regarding the negative moderating effects that CEO duality and board size have on the interaction between EDs' overall IT-digital involvement and the analyzed construct. The hypothesis concerning the positive moderating effects of the percentage of independent non-executive directors on the interaction between IT involvement - digital orientation is not demonstrated.

4.1. Implications for future research and practice

This research has several implications for studies regarding governance and the influence of executives on corporate strategic directions. First of all, thanks to the results, Ocasio's (1997) attention-based view is extended, bringing to the forefront the coherence of the link between strategic moves and the prior experience and knowledge of decision makers. Second, the construct of digital orientation (Kindermann et al., 2020) is challenged and its theoretical use is broadened. Rather than being used as a measure of the degree of digital attention of the executives, in this study the construct takes the form of an output resulting from the decision-making processes and the context within which they take place. It is therefore interpreted as a measure that changes as the people who make up the governance of the company change, and even more precisely as the skills and knowledge they possess change.

This paper also has implications for practice. The market environment over the years has become increasingly digital, and this trend is expected to grow in the future as well, with the advent of technologies such as 5G that will enable the exploitation of the Internet of Things, robotics, and cloud computing. With a view to the complexification of technologies and their management, the debate on the relationship between governance and innovation is becoming increasingly lively. Dealing with the specific theme of digital transformation, this study represents a theoretical in-depth analysis of the governance-innovation connection, useful for companies to understand the key characteristics that can foster the effective development of digital transformation. In particular, the findings of previous scholars (Goodstein et al., 1994; Jeremias, 2007; Blibech & Berraies, 2018) that have made known the negative effect of board size and CEO duality on innovation implementation and adaptation to changes in the strategic environment. Starting from these statements, it was possible to verify how these board characteristics are an unfavorable element to the implementation of digital transformation. Finally, specifying which of the characteristics related to executives' knowledge and skills is most influential on digital output allows companies to select the right profiles to lead a digital transition.

Through the development of a theoretical framework linking the prior experience and knowledge of decision-makers to the strategic orientation of the firm the study has the potential to lay the foundation for subsequent research in the area of strategic orientations such as market and technology orientation (Zhou et al., 2005), learning orientation (Mavondo et al., 2005), or performance orientation (Matzler & Mueller, 2011) by investigating when EDs' knowledge and experience can influence different constructs. Performing further

studies that consider how education, work experience, and industry background are able to influence a firm's strategic orientation would provide an empirical indication of the degree to which these characteristics of executives are able to generate in the strategic orientations of the firm.

4.2. Limitations of the study

The study presented so far also has some limitations. First, the analysis developed takes into account a sample of Italian listed companies, which limits the applicability of the findings to unlisted companies or companies from other countries. In fact, the results, all things being equal, could change depending on the regulations or funds allocated by the country for digital development or for a digital transformation culture with deeper roots. In this sense, it would be useful for the purposes of research that other studies focus on the study of the relationship between IT characteristics of executives and the degree of digital orientation of the company. A second limitation is related to the use of an aggregate variable such as "IT involvement", although the set of variables did not show values above the threshold values of the VIF test, this variable, being composed of the regressors IT education, IT work experience and IT industry, has a high Pearson correlation rate. This could result in the same information being expressed by two different variables and the regression model could assign an inaccurate meaning in the full model. A third factor relates to the time period analyzed; although the three-year time period analyzed is solid for confirming the results, it may not be explicative of the early stages of implementation of the digital revolution. This poses a problem with the applicability of this study's findings for research that will want to analyze a future construct in its early stages of development, such as a strategic direction that points to carbon neutrality might be.

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Course of Corporate Strategy

Do Board IT Competencies Influence the Digital Orientation of the Firm? Thesis Summary

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SUMMARY

The purpose of this thesis is to understand how much the key players, the decision-makers, who have the role of managing the adherence of a company's strategic orientation to the external market environment can influence the degree of its digital orientation. In this study the executive directors are recognized as decision makers (Ocasio, 1997) and in particular we intend to identify how much the presence of prior knowledge and experience acquired by executives in the digital-IT field can influence the digital orientation of the company they manage. In order to achieve this result in a coherent manner, it is necessary to follow a logical scheme capable of linking the two extremes of reasoning. First we discuss the literature review, after an introduction of the Italian situation in terms of digital transformation, the review is developed in two sections, the theoretical background, which analyzes the impact of digital transformation on the organization and on the board of directors, and the development of the theoretical model and its hypotheses. Second, we present the method used in the analysis of this study. An explanation of the sample chosen for the research and the data collection, the dependent variable entered into the study - the digital word coverage - and the independent and control variables. Following, the construct validation and operationalization techniques used by previous scholars introduce the central analysis carried in this paper. In the latter are described: the use of CATA, vocabulary selection, the rules for interpreting the results of computer-aided text analysis and the regression study used for hypothesis validation. Finally, we explain the regression results and their interpretation. We close the paper by describing future implications for practice and theory and the limitations of this study.
This work can be located in the literature regarding the effects for innovation and digital transformation caused by the corporate governance characteristics.

Over the past decade, digital transformation has been a process and a goal that for some companies has been an opportunity for growth and for others a force to be tamed. In 2016, Italy implemented the "Piano Nazionale Industria 4.0" with the aim of creating opportunities for all companies that are going through an internal transformation given the increasing presence of digital technologies. Italy's national plan for Industry 4.0 is part of the broader Digitising European Industry strategy being pursued at EU level. In the context of the DEI strategy, two different measurement indices can be observed: a Digital Transformation Enablers' Index (DTEI) and a Digital Technology Integration Index (DTII). In terms of DTII and DTEI, it is possible to understand that Italy is below the average of the 28 EU countries in both the indices.
The process of digital transformation implies very deep changes within society and markets due to the use of digital technologies (Majchrzak et al., 2016). Digital transformation also affects the company from a strategic point of view, in fact, it was discussed by Hess et al. (2016) that companies must find a way to establish innovative strategies, through the use of digital technologies, in order to bring better operational performance to the company.
From the companies' point of view, the transition to a digital business implies different impacts on the organization and the board of directors (Bankewitz, Aberg and Teuchert, 2016). The effects of digital

transformation on the organization can be divided into five main points: 1. transformation of the strategic context; 2. ease of searching and sharing of informations; 3. more data to process (big data); 4. short-term strategy; 5. disappearance of organizational boundaries.

The digital transformation also appears to have effects at the level of the board of directors, in particular, there are two changes that the transition to digital is able to induce (Bankewitz, Aberg & Teuchert, 2016). The first effect is the transition from boards to network, in a digital environment, information is shared across organizational boundaries, the people outside the company generate information in form of opinions, comments that are publicly accessible. Orlikowski and Scott (2014) found that these comments and opinions can influence the way an organization and its executive members behave. It can be concluded that the easier it is for the people outside the company to access firm information, the more power they will be able to exercise, indirectly, over the management of the organization.

Previous literature (Valentine and Stewart, 2013; Schwab, 2016; Huse 2007) regarding the composition and tasks of board members suggested that, in a digital environment, boards should operate as virtual networks in which the concept of static roles has to be forgotten and instead there has to be an abandonment of the typical formal constraints that characterize organizations in order to be more flexible to align the behavior to the external environment. The second effect consist in the replacement of the board tasks with the board agenda. Digitalization brings with it an extremely dynamic environment in which companies must evaluate decisions in the short term. The short-term decision-making leads to a change of the tasks of boards. Boards should change the way they behave by shifting the focus from tasks to perspectives of action that are based on a board agenda (Nicholson & Newton, 2010). Boards should therefore, in their role as decision-making bodies, align their agendas with changes in the market environment by taking greater account of short-term decisions. In this view, knowledge management is one of the main drivers to enable the company to improve the ability to adapt to market changes (Bankewitz, Aberg, Teuchert, 2016). A consequence of adopting knowledge management is the creation of a committee. As it is intended to be a center of creation and management of new knowledge, a committee is usually proposed when there is a need to apply specific knowledge and skills to a particular business sector. A ITGI research proposed by the organization Isaca (2011) found the presence of a technology committee in less than 25% of the companies studied. In 2016 the same company through the work of Lankton, CISA, CPA & Price, (2016) found an increase of 10% of technology committees being present in 35% of the companies in the sample, giving the evidence for a emerging trend.

Following this view, it is becoming increasingly necessary to use a strategic orientation suited to reap the greatest benefits from the market environment. Practitioners have defined different dimensions of strategic orientation as market and technology orientation (Zhou et al., 2005), learning orientation (Mavondo et al., 2005), or performance orientation (Matzler & Mueller, 2011). Today, however, the exponential growth of digital technologies and their increasing presence in most choices affecting both supply and demand puts previous strategic orientations to the test supposing a low degree of consistency between existing policy guidance and the market. Along these lines, Quinton et al. (2016) observed that the companies that were able

to take the greatest advantage of the opportunities created by digital technologies were those companies with a combination of different strategic orientations: entrepreneurial, market and learning orientation. Quinton et al. (2016) called this combination the digital orientation. However Schweiger et al. (2019) noticed that the digital orientation construct defined by Quinton et al. (2019) did not properly address the issue of digitization. This lack is later corroborated by a new digital orientation construct presented by Kindermann et al. (2020). The work of these latter researchers is based on previous studies (Nambisian et al.,2019; Henderson & Venkatraman, 1999) that gave a strong importance to the relation between internal and external components in addition to the strategic connection of the organizational and technological components and their need to be coordinated.

In particular, in the new definition of digital orientation there are four domains of strategic intersection (Kindermann et al., 2020): 1. *digital technology scope* (external/technological): the set of digital technologies available to the company to ensure that there is an opportunity to create value for consumers; 2. *digital capabilities* (internal/organizational): defines the process of absorbing learning routines regarding digital technologies; 3. *digital ecosystem coordination* (external/organizational): defines the concept that the coordination of the various elements, in order to create digital platforms, has the potential to exploit the idiosyncratic effect and bring enhanced value; 4. *digital architecture configuration* (internal/technological): the development of an architecture dedicated to the digital branch and the consequent configuration of decision-making processes, of responsibilities related to the execution of technological changes, as well as the digitalization of internal processes.

The four dimensions described are interconnected and related. A firm that develops the four dimensions in an inconsistent and unrelated way, e.g., by not developing one of them, is more likely to miss the full benefits of an innovation initiative and indeed increases the likelihood of failure. The need for coordination cannot be ignored by board members and executives who, in the guise of decision makers, must be prepared, in terms of knowledge and skills, to address this challenge.

Knowledge and skills developed during the university period have power to influence behavior and attitude toward a particular field (Patterson, 2012). Similarly, previous work experiences also have a positive influence towards individuals' behavior (Claes & Ruiz-Quintanilla, 1998) as well as industry background (Milliken & Martins, 1996). Knowing this, it is possible to assume that the behavior and attitude of decision-makers is influenced by the knowledge and skills previously assimilated as well as previous work and industry experiences. In this sense, a study by Ocasio (1997) is useful for the purposes of analysis. The study demonstrates that the behavior of a company is the result of the focus of attention of its executives. The end result of the attentional and decision-making inputs are the strategic moves and behavior of the company, including both implicit and explicit decisions.

This allow us to present our first set of hypotheses based on theories that explain the power that the executive members of a company's governing bodies have over the methodologies in which digital skills and knowledge are introjected (Valentine & Stewart, 2013) and that state that the strategic moves and outcomes of a company

are affected by how the attention of their executive directors is distributed (Ocasio, 1997). Additionally, an in-depth look at behavioral sciences has shown how knowledge and skills developed during college have the power to influence an individual's attitude toward a particular field (Patterson, 2012), as well as previous work experience (Claes & Ruiz-Quintanilla, 1998) and industry background (Milliken & Martins, 1996). These latter theories allow us to advance the first set of hypotheses, which aims to measure the impact that the presence of digital knowledge, skills or experience among executive directors has on the digital orientation of the company which they manage.

H1a: The presence of executive directors with an educational path towards the world of IT or digital positively influences a company's digital orientation.

H1b: The greater the number of EDs with IT education within a board the greater the company's digital orientation;

H2a: The presence of executive directors with previous work experience in an IT-digital related role positively influences a company's digital orientation.

H2b: The greater the number of EDs with IT work experience within a board the greater the company's digital orientation;

H3a: The presence of executive directors with previous work experience in a field particularly focused on or inherent to innovation or IT-digital positively influences a company's digital orientation.

H3b: The greater the number of EDs with IT industry background within a board the greater the company's digital orientation.

On the other hand, also the board of directors has a central role in influencing the company's strategy. The role and central position that this management body holds within the organizational structure of a company has made scholars question how much power of influence it can exercise on the strategic orientation of a firm. One of the most relevant categories of research conducted in recent years on board influence relates to firm innovation and digitization (Umrani et al., 2017; Chen et al., 2016; Asensio-Lopez & Cabeza-Garcia, 2019; Aberg et al., 2017). An essential aspect of the board is its composition. A key part of the board is made up of outside directors who play an important role as their independence allows the company to collage to interest groups it would otherwise have difficulty reaching (Adams et al., 2008). Outside directors serve as acquisition points for external resources and consequently have the ability to facilitate strategic change and innovation within the company (Kim & Kim, 2015). This latter theory has been corroborated by Shapiro et al. (2015) that demonstrated a positive relationship between the presence of outside directors and the strategic moves related to innovation. Another important aspect regarding the characteristics of the board is its size. The size of a board is positively related to inefficient and slow decision-making processes (Cheng, 2008). Larger boards can make the firm's adaptation to changes in the strategic environment in which it operates uncertain and less responsive (Goodstein et al., 1994); these attitudes are especially true when the firm is faced with particularly complex and turbulent changes in the strategic environment (Meyer, 1982) as are an innovative and digital

environment. Within a board, another feature capable of influencing its efficiency is the duality of the functions of chief executive officer and chairman, this feature is called CEO duality. A combination of the roles of the two figures can lead to an increased risk of opportunistic behavior by the CEO that could lead to a decrease in the efficiency of the board. This statement finds validity in the demonstration given by the study of Jeremias (2007) which confirms the correlation between the presence of CEO duality and a worse company performance both in financial terms and in terms of innovation. In the context of this study, we analyze a trend, that of digital, which has disrupted the way in which firms have had to adapt their relationships with each other and in their relationships with clients and suppliers, characteristics such as the tendency to innovate and the ability to adapt to changing external factors is of extreme importance in understanding how these factors influence the degree of digital orientation in the firm. What is at issue is whether BoD characteristics have the ability to moderate the level of influence on the firm's digital orientation that the EDs' overall knowledge and skills are able to exert. These previous observations give us the opportunity to propose the second set of hypotheses.

H4: The degree of influence on the digital orientation of the company that an ED is able to exert is positively related to the percentage of non-executive independent board directors.

H5: The degree of influence on the digital orientation of the company that an ED is able to exert is negatively related to the board size.

H6: The degree of influence on the digital orientation of the company that an ED is able to exert is negatively related to the duality of the chief executive director and chairman role.

In order to test our hypotheses, we had to start the analysis by choosing the sample to study.

Data on executives, boards and annual relations have been collected for Italian public listed companies on the FTSE MIX index. Data on executives have been hand-collected from curriculum vitae and non-financial business documents while the data on boards were collected through the BoardEx database. The ARs were hand-collected from the companies' corporate websites. The sample is composed of Italian companies listed on the FTSE MIB index, starting from a sample of 174 firms. The process of creating the sample of firms, for which the ARs will be analyzed, began by checking the data availability by country and year on the BoardEx platform, searching for companies whose executive directors had a reference to the studies and whose board data were consultable on the platform. The output of this process leads to 128 companies. As a result, the sample consists of 384 annual reports from 128 companies, covering the years from 2016 to 2018. The sample is a balanced panel as all the data were available in that period.

After the selection and refinement of the sample we selected the dependent, independent and control variables to test our hypotheses.

The dependent variable is the digital word coverage. The word coverage is a measure that has been widely used by previous scholars in the context of interpreting a strategic orientation operationalized for computer-aided text analysis of firm documents (McKenny, 2018; Short et al., 2010; Kindermann et al., 2020) and that measures the frequency of one or more words divided by the pages of the document or words within the

document. The digital word coverage in this study is a measure that describes the number of words in annual reports that refer to digital orientation divided by the number of pages that a particular AR counts. This measure will be normalized per 100 pages. For the CATA we used NVivo software and for the page count the Adobe Acrobat software.

We used three different independent variables to test the hypotheses 1a, 2a and 3a. The variables are respectively IT education, IT work experience e IT industry background and are all dummy variables. The variables were operationalized by analyzing resumes and non-financial company documents that pertained to executives' prior knowledge, work experience or industry background related to a IT-digital context. Three additional independent variables were then considered to test the hypotheses 1b, 2b, 3b. The three added variables are treated as absolute measures and consider the number of EDs within a board that respond positively and non-conjointly to IT education, work experience and industry background. These independent variables take are "n° of total EDs with IT education", "n° of total EDs with IT work experience", "n° of total EDs with IT industry background". Finally, an aggregate variable called “IT involvement” was created, this variable represents the presence within it of at least one response equal to 1 of the dummy variables IT education, IT work experience, IT industry background.

The control variables used include firm size level measurement as practiced in other studies that analyzed the impact of corporate governance on firm outputs (Haynes et al., 2019; Kindermann et al. 2020). To examine whether independent variables predict firm digital orientation, a control with firm age was conducted, as younger firms are found to be more dynamic in adapting to digital contexts (Sebastian et al., 2017). It was then checked with firm profitability (ROA) as the size of this index is positively correlated with the digital orientation construct (Kindermann et al., 2020). Then we checked by firm size by placing the number of employees in the firm as a variable as a research by Mithas & Rust (2016) explains how firm size affects the resources needed to develop digital orientation. Further control variables have been added regarding the level of indebtedness of companies, financial leverage ratio and whether a company belongs to a specific industry in order to determine if there is the presence of an endemic reflection of the construct in this variable. Following the elaborations proposed by previous scholars (Belkhir, 2009; Ahmed, 2006) regarding corporate governance, it was decided to introduce control variables regarding this dimension: board size, percentage of board non-executive independent members and CEO duality. The data were collected via Bureau VanDijk's Orbis and BoardEx database.

Once we have collected the data needed to conduct the study, we proceed by defining the previous analysis theories that made the base for our research, the construct validation through CATA and the operationalization of the digital orientation construct by Kindermann et al. (2020).

Construct validity refers to the evaluation of inferences based on the concepts of interest while considering the degree to which the measure succeeds in representing the focal construct (Cronbach, 1971). One methodology by which it is possible to capture focal constructs that are difficult to measure is that of content analysis. A technique related to content analysis is called computer-aided text analysis (CATA) it is particularly interesting

because it is able to process a large amount of data in a quick and rigorous way for scientific research purposes. Evaluating a construct begins with defining the construct's main concept. Short et al. (2010) recommend an approach to analysis using computer-aided text analysis that considers single words as units of measurement. There is a recommended procedure by Short et al. (2010) to enhance construct validity when it is used CATA as a method of analysis. The procedure is composed first by a deductive content validation to be then followed by an inductive content analysis.

In operationalizing the construct of digital orientation Kindermann et al. (2020) performed the CATA methodology through the CAT Scanner software. The software is capable of extracting various measurements such as: single words, multiple words, and stem words. In selecting the reference sample, Kindermann et al. (2020) have chosen shareholder letters from companies listed on the S&P 500. Specifically, shareholder letters from 643 companies were considered, in the years 2001 to 2016, for a total of 6498 letters. The theoretical link that gives the possibility to create a pathway between the analysis of shareholder letters and the measurement of strategic orientations - in particular digital orientation - is based on three research works (Sapir, 1954; Whorf, 1944; Ocasio, 1997). These works allowed Kindermann et al. (2020) to theorize that the "digital words" within the letters to shareholders indicate an increased interest in the digital topic. Entering into the practice of the research conducted by Kindermann et al. (2020), the scholars divided the process of operationalizing the construct of digital orientation into the following steps: 1. creation of a preliminary word dictionary for CATA; 2. refinement of the word dictionary; 3. definition of a measurement scale to interpret the results of the text search queries.

On these bases we have outlined our analysis.

In order to operationalize the construct taken into analysis in this study, we used computer-aided text analysis, this tool is able to make contextual information explicitly available from other context sources. Using CATA software it is possible to run text search queries, this feature consists in searching for certain words in a given text and receiving as a result the number of times these words are found in the search performed. There are important benefits to choosing this method over surveys, human-performed content analysis, or interviews. computer-aided text analysis does not suffer from subjective bias, allows for replicability of the model used by other studies (Morris, 1994), and allows for analysis of a much larger amount of content in a smaller amount of time (Short et al. 2010). The software chosen to perform the CATA is NVivo.

In order to proceed with the selection and refining process of the dictionary constructed to perform the CATA analysis, the recommendations of Short et al. (2010) and McKenny et al. (2018) on the deductive and inductive approach to constructing vocabulary relevant to the study of the construct were followed. First, the analysis of two documents, one of which analyzed the most used keywords in the context of digital transformation (Reis et al., 2018) and the other listed the main digital transformation activities that the new European digitalization plans envisaged for the time frame 2016-2023 (EU Digital Transformation Scoreboard, 2018), lead to a preliminary dictionary composed of 27 keywords able of capturing the digital orientation construct. This first

step was then followed by three rounds of keyword skimming. The first round of skimming eliminated words that had an overly generalist meaning or indicated activities that could only be pursued in a few industries. The second round eliminated keywords that were redundant with each other or obsolete and the third round eliminated keywords that were found with a low frequency within the annual reports of the companies in the sample through a text word query on NVivo software. The resulting dictionary after the third round of skimming was then expanded by adding keywords that were synonyms or alternative ways to define a word already in the dictionary, resulting in 14 keywords. Next, the vocabulary used by Kindermann et al. (2020) in a study on the digital orientation was analyzed. From the Kindermann's dictionary, 35 keywords were chosen after re-running the three skimming rounds proposed previously, resulting in 49 keywords. Following the experience of Kindermann et al. (2020) about 10% of the results were analyzed manually and keywords that reflected the digital orientation construct less than 7 out of 10 times were removed, resulting in 45 keywords. Finally, words were assigned to the digital orientation dimensions following the definition of each dimension and once the descriptive statistics were calculated, words that made the standard deviation and mean word coverage of the digital orientation dimensions not comparable to each other were removed, resulting in 40 keywords displayed in Table 1.

Table 1, Word dictionary divided per dimension

Digital orientation	**CATA single and composite words**
Digital technology scope	cloud computing, IoT, Internet of Things, blockchain, bot, information management, advanced technology, high-speed, apps, network services
Digital capabilities	artificial intelligence, big data, machine learning, data analysis, data analytics, autonomous, informatics, computing, streaming, user interface
Digital ecosistem configuration	social media, smartphone, API, APIs, network infrastructure, technology platform, ERP, ecommerce, e-commerce, open source
Digital architecture configuration	digitalization, digitization, digitalisation, cyber-security, information technology, cybersecurity, robotics, industry 4.0, digital transformation, digital business

Once the word dictionary was created, the individual keywords were entered into Nvivo content analysis software to perform CATA to find the frequency in which a given word appeared in the AR of the firm analyzed. The number of words found for each dimension of digital orientation was divided by the number of pages in that AR. Subsequently, the result was normalized for 100 pages.

In Table 2 it can be seen that the descriptive statistics for the four dimensions are consistent with each other.

Table 2, Digital orientation scores by dimension

Dimensions	**Observations**	**Mean**	**SD**	**Min**	**Max**
Digital technology scope	128	1,88	5,51	0	47,80
Digital capabilities	128	1,77	4,51	0	32,60
Digital ecosystem configuration	128	1,84	3,70	0	26,45
Digital architecture configuration	128	1,88	3,51	0	27,67
Digital orientation	128	7,37	14,04	0	95,19

Note: scores are normalized to word count per 100 pages for every annual relation

Table 3 shows the distribution of values related to digital orientation in the period 2016-2018 (N= 384).

Table 3, Digital orientation scores by year

Year	**Observations**	**Mean**	**SD**	**Min**	**Max**
2016	128	6,13	11,40	0	67,74
2017	128	7,69	14,56	0	98,40
2018	128	8,31	16,14	0	119,42

Note: scores are normalized to word count per 100 pages for every annual relation

Following the guidance of Short et al. (2010), an additional examination is recommended to establish the reliability of the dictionary chosen for the CATA. So, we tested the construct for dimensionality. According to a study by Edwards (2001) in a multidimensional construct, the dimensions of the same construct should be correlated, but distinct from each other. After we studied the correlation between the dimensions, we could observe that the correlation moves from a minimum rate of 0.42 to a maximum of 0.61. The range of correlation 0.42-0.61 indicates positively correlated but distinct dimensions. Regarding the correlation rate between the dimensions and their construct, Mackenzie et al. (2011) indicate a correlation rate r >0.5 to test for dimensionality, as the construct itself includes most of the variance of its dimensions.

Once we have tested for the validity of the construct taken into analysis, we have set up the dataset for our regression study to accept or reject the hypotheses. the dataset was arranged according to the panel data methodology, which allowed us to perform a cross-sectional and longitudinal statistical analysis. The choice of a panel analysis also involves the provision of assumptions that can determine the choice between the methodology fixed and random effects. A chi-square analysis using the Hausman test (chi-square(17) > 36.2927, p = 0.004) a low p-value counts against the null hypothesis that the model with random coefficients is adequate, in favor of the model with fixed effects.

Several models were used to test the hypotheses in particular, model 1 takes into consideration only the control variables. Models 2, 3 and 4 introduce respectively the independent variables IT education, work experience and industry background. Models 5, 6 and 7 the variables n° of EDs with IT education, n° of EDs with IT work experience and n° of EDs with IT industry background. Model 8 present the aggregate variable IT

involvement and models 9, 10, and 11 include two-factor interactions between IT involvement and CEO duality, % of board independence, and board size. Finally, model 14 inserts all variables together, except for the independent variables of model group 5-7 in order to avoid problems related to excessive correlation between them and group 2-4.

We have then runt our regression study in order to validate our hypotheses.

Table 4 shows the descriptive statistics of the predictors.

Table 4, Descriptive statistics

	MIN	MAX	MEAN	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ln.(firm size)	2,71	11,81	7,6608	1,77400	--																	
ROA	-35,89	53,44	3,2433	6,72321	-,126*	--																
Firm Age	1,00	546,00	63,8594	60,4172	,236**	-,102*	--															
CEO duality	0,00	1,00	0,5495	0,49819	-,177**	0,068	-,223**	--														
% Board Indep.	0,00	0,94	0,5078	0,16334	,342**	-,104*	0,078	-,265**	--													
Board size	5,00	22,00	11,1042	3,19915	,418**	-0,089	,119*	-,142**	,119*	--												
Leverage	0,10	656,39	93,8320	101,200	0,029	-,118*	-0,012	,201**	0,091	-,173**	--											
Industry	0,00	1,00	0,2344	0,42416	-,150**	,105*	-,132**	,143**	-0,051	-,162**	-0,045	--										
IT Education	0,00	1,00	0,0573	0,23270	-0,002	-0,009	-0,054	,156**	0,021	-,103*	0,029	,181**	--									
IT work experience	0,00	1,00	0,2786	0,44892	-,162**	0,033	-,134**	,189**	-,195**	-0,048	-0,003	,273**	0,072	--								
IT industry background	0,00	1,00	0,1146	0,31893	-,156**	-0,034	-,197**	,145**	-,173**	-,129*	-0,025	,361**	,333**	,451**	--							
IT involvement	0,00	1,00	0,3229	0,46820	-,106*	0,010	-,114*	,189**	-,147**	-0,024	0,036	,302**	,357**	,900**	,521**	--						
N° EDs w/IT education	0,00	3,00	0,0729	0,33878	0,028	0,034	-0,070	,149**	-0,036	-,101*	-0,005	0,099	,874**	,124*	,357**	,312**	--					
N° EDs w/IT work exp.	0,00	6,00	0,4115	0,83493	-,135**	0,041	-,192**	,221**	-,207**	-0,071	-0,061	,155**	,228**	,794**	,597**	,715**	,429**	--				
N° EDs w/IT industry back.	0,00	6,00	0,3099	0,99361	-0,095	0,032	-,184**	,161**	-,195**	-0,095	-0,043	,187**	,307**	,432**	,868**	,452**	,476**	,746**	--			
Y_2017	0,00	1,00	0,3333	0,47202	-0,006	-0,038	0,000	0,007	0,013	0,008	-0,036	0,000	-0,008	0,004	0,006	0,008	-0,005	-0,004	0,013	--		
Y_2018	0,00	1,00	0,3333	0,47202	0,019	0,079	0,012	-0,015	0,063	-0,001	-0,031	0,000	-0,008	0,004	0,006	-0,004	-0,005	0,015	-0,015	-,500**	--	
Digital Orientation	0,00	1,19	0,0713	0,13900	-0,082	0,010	-,175**	0,086	-,106*	-,165**	-0,080	,300**	,502**	,299**	,596**	,304**	,533**	,450**	,503**	0,018	0,052	--

*: $p < 0.05$; **: $p < 0.01$

The statistics refer to the full sample for the period 2016-2018. All variables show an acceptable correlation index, with the exception of the variable "EDs with IT involvement" as it represents an aggregate measure of three independent variables. The VIF test was performed on SPSS software to verify whether there was collinearity between the variables, and it was found that all variables had a coefficient below the alarm threshold regarding collinearity. In the sample analyzed, on average, 5.7% of companies have at least one executive with an IT-digital academic background, 27.9% have at least one executive with previous work experience in an IT-digital position, and 11.5% have at least one executive with a position in an IT-digital industry. On the other hand, 32.3% of companies have at least one executive director with at least one of the characteristics described above. The results (Table 6a, 6b) confirmed most of the hypotheses presented. Model 2 supports hypothesis 1a by making explicit the positive association between IT education and digital orientation (beta = 0.276, $p < .01$). At the same time, model 3 and 4 also support hypotheses 2a and 3a by confirming respectively the positive influence that IT-digital prior job positions (beta = 0.070, $p < .0$) and IT-digital industry background (beta = 0.239, $p < .01$) have on digital orientation, although model 3 with a lower

intensity. Models 5, 6, and 7 support, in order, hypotheses 1b, 2b, and 3b by demonstrating that the number of EDs with IT education (beta = 0.206, p < .01), IT work experience (beta = 0.068, p < .01), and IT industry background (beta = 0.062, p < .01) has a positive effect on the response variable, although it can be seen that the strength with which the number of executives with IT-digital characteristics present within the board is less than that exerted by the corresponding variables indicating the mere presence of EDs with IT-digital characteristics within the board. Model 8 shows a positive effect of the aggregate IT involvement measure on digital orientation (beta = 0.069, p < .01), this premise serves to take into analysis the next three models (9, 10, 11) that show the moderating effects that respectively the variables CEO duality, % of board independence and board size have on the interaction of IT Involvement on digital orientation. In particular, the model 9, as predicted by hypothesis 4, shows a negative moderation (beta = 0.031, p > .1), although is not statistically significant. Model 10 does not confirm hypothesis 5 on the basis of which we expected a positive moderation of board independence on the effects of IT involvement on digital orientation. Model 11 on the other hand confirms hypothesis 6, reporting a negative moderation of the effects of IT involvement on digital orientation. Finally, models 12 and 13 are not statistically significant although it can be seen that there is a slight but increasing time effect from 2017 (beta = 0.004, p > .1) to 2018 (beta = 0.017, p > .1), shifting the weight of the effects more to the last year data of the analyzed sample. Model 14 includes the interactions of all regressors with the response variable with the exception of the regressors in models 5, 6, and 7 as they could have created problems of excessive correlation with the regressors in models 2, 3, and 4. The model 14 thus formed reflects almost all of the results found previously in the analysis of models 2-13.

To check the eligibility of the structure of our regression model we runt a robustness test. We proceeded, starting from the base of model 14, with a forward addition of regressors 5-7, this action did not affect nor the estimates of the regressors in the model neither the r-square of the model. A second check was performed through a backward elimination of regressors 2-4, keeping the regressors 5-7 added in the first check. The second check showed a decrease in the r-square, and a significant change in the coefficient for the IT involvement variable, meaning a higher degree of construct prediction by models 2, 3, and 4.

Table 6a, Regression models for digital orientation

	1	2	3	4	5	6	7
ln.(firm size)	0,006	0,004	0,008*	0,007*	0,001	0,006	0,004
(SD)	**0,005**	**0,004**	**0,004**	**0,004**	**0,004**	**0,004**	**0,004**
ROA	-0,001	-0,001	-0,001	1,347E-05	-0,001	-0,001	-0,001
(SD)	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**	**0,001**
Firm age	0,000***	0,000***	0,000**	0,000	0,000***	0,000*	0,000
(SD)	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
CEO duality	0,003	-0,016	-0,003	-0,002	-0,017	-0,014	-0,007
(SD)	**0,015**	**0,013**	**0,015**	**0,013**	**0,013**	**0,014**	**0,013**
Board independence	-0,070	-0,092**	-0,043	-0,006	-0,062	-0,020	-0,007
(SD)	**0,045**	**0,040**	**0,045**	**0,039**	**0,039**	**0,042**	**0,041**
Board size	-0,007***	-0,005**	-0,007***	-0,005***	-0,004*	-0,006***	-0,006***
(SD)	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**	**0,002**
Leverage	0,000**	0,000**	0,000**	0,000*	0,000*	-9,50E-05	0,000*
(SD)	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**	**0,000**
Industry	0,089***	0,064***	0,070***	0,028*	0,077***	0,075***	0,067***
(SD)	**0,016**	**0,015**	**0,017**	**0,015**	**0,014**	**0,015**	**0,015**
IT education		0,276***					
(SD)		**0,026**					
IT work experience			0,070***				
(SD)			**0,016**				
IT industry background				0,239***			
(SD)				**0,020**			
N° EDs w/IT education					0,206***		
(SD)					**0,017**		
N° EDs w/IT work exp.						0,068***	
(SD)						**0,008**	
N° EDs w/IT industry back.							0,062***
(SD)							**0,006**
IT involvement							
(SD)							
CEODuality * IT.INVOLVEMENT							
(SD)							
Board Indep. * IT.INVOLVEMENT							
(SD)							
Board Size * IT.INVOLVEMENT							
(SD)							
Y_2017							
(SD)							
Y_2018							
(SD)							
Observations	384	384	384	384	384	384	384
Companies	128	128	128	128	128	128	128
Constant	0,148***	0,153***	0,116***	0,070***	0,146**	0,090***	0,095**
SD Constant	0,040	0,035	0,040	0,035	0,034	0,037	0,036
R^2	0,141	0,342	0,186	0,385	0,380	0,287	0,320
RSS	6,349	4,867	6,019	4,545	4,584	5,270	5,027
F	7,627	21,348	9,390	25,763	25,203	16,569	19,360

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

Table 6b, Regression models for digital orientation

	8	9	10	11	12	13	14
ln.(firm size)	0,007	0,006605	0,00633**	0,007198*	0,006	0,006	0,006700**
(SD)	**0,004**	**0,004326**	**0,004293**	**0,004178**	**0,005**	**0,005**	**0,002914**
ROA	-0,001	-0,000992	-0,000893	-0,001250	-0,001	-0,001	-0,000307
(SD)	**0,001**	**0,000991**	**0,000983**	**0,000955**	**0,001**	**0,001**	**0,000672**
Firm age	0,000**	-0,000276**	-0,000270	-0,0003***	0,000***	0,000***	-0,000157**
(SD)	**0,000**	**0,000113**	**0,000112**	**0,000109**	**0,000**	**0,000**	**7,638427E-05**
CEO duality	-0,004	-0,013759	0,000652	-0,004085	0,003	0,003	-0,003239
(SD)	**0,015**	**0,017066**	**0,014310**	**0,013836**	**0,015**	**0,015**	**0,011623**
Board independence	-0,048	-0,053810	0,024334	-0,044796	-0,070	-0,073	0,002131
(SD)	**0,044**	**0,044056**	**0,051357**	**0,042279**	**0,045**	**0,045**	**0,035266**
Board size	-0,007***	-0,00724***	-0,006994	-0,000377	-0,007***	-0,007***	-0,000488
(SD)	**0,002**	**0,002288**	**0,002272**	**0,002577**	**0,002**	**0,002**	**0,001786**
Leverage	0,000**	-0,0002**	-0,0002***	-0,0002**	0,000*	0,000*	-0,0001
(SD)	**0,000**	**6,841996E-05**	**6,747057E-05**	**6,561011E-05**	**0,000**	**0,000**	**4,623174E-05**
Industry	0,066***	0,06606***	0,06463**	0,0563***	0,089***	0,089***	0,023505**
(SD)	**0,017**	**0,016429**	**0,016315**	**0,015993**	**0,016**	**0,016**	**0,011333**
IT education							0,417485***
(SD)							**0,027454**
IT work experience							0,336339***
(SD)							**0,030327**
IT industry background							0,194336***
(SD)							**0,017485**
N° EDs w/IT education							
(SD)							
N° EDs w/IT work exp.							
(SD)							
N° EDs w/IT ind. back.							
(SD)							
IT involvement	0,069***	0,0496**	0,1827***	0,3151***			-0,2094***
(SD)	**0,015**	**0,023709**	**0,045372**	**0,048688**			**0,061338**
CEODuality*IT inv.		0,031309					-0,0693***
(SD)		**0,029551**					**0,020632**
B.Indep* IT involvement			-0,2325***				-0,080856
(SD)			**0,088076**				**0,062744**
B.size* IT involvement				-0,0220***			-0,004750
(SD)				**0,004169**			**0,003059**
Y_2017					0,004		0,017788*
(SD)					0,014		0,010623
Y_2018						0,017	0,021340**
(SD)						**0,014**	**0,010670**
Observations	384	384	384	384	384	384	384
Companies	128	128	128	128	128	128	128
Constant	0,126***	0,131719***	0,082336***	0,046346	0,146***	0,144***	-0,004904
SD Constant	0,039	0,039220	0,041886	0,040424	0,041	0,040	0,030775
R^2	0,188	0,156	0,170	0,219	0,141	0,144	0,643
RSS	6,001	6,203	6,136	5,773	6,348	6,325	2,671
F	9,543	7,619	8,427	11,542	6,771	6,942	39,261

d

Immersed in the context of the literature of corporate governance, executives, and companies' strategic orientations, this study illustrates through deductive reasoning the relationship between executives' skills and knowledge with the intensity of the digital orientation of the companies they manage. Based on the theories that link the attention and behavior of EDs to the strategic choices of companies (Ocasio, 1997), it was possible to deepen and find that in turn the attention and behavior in the workplace are influenced by the cognitive (Patterson, 2012) and experiential (Claes & Ruiz-Quintanilla, 1998; Milliken & Martins, 1996) prior background. As EDs are members of the BoD, we then analyzed how board characteristics can moderate the relationship between executives' characteristics and digital orientation. The operationalization of the digital orientation construct theorized by Kindermann et al. (2020), made it possible to make explicit the aforementioned relationship through a statistical regression study.

As for the direct interactions between IT education, IT work experience, IT industry background and digital orientation all recorded a positive interaction and it was observed that, among the three, the feature that most affects digital orientation is IT education, followed by IT industry background and finally IT work experience. Regarding the direct interactions between the numerical measure of the amount of EDs within a board with IT education, work experience or industry background, again all interactions recorded a positive relationship with the degree of digital orientation of the company, in particular a higher number of EDs with IT education favors the development of digital orientation to a greater extent than the number of EDs with IT work experience, as well as the latter performs better on the number of EDs with industry background. The moderating effect of board characteristics on interactions between the aggregate IT involvement measure and digital orientation all show a negative effect of the former on the latter. In particular, an executive characterized by IT involvement has a much lower power of influence when he is in contexts where there is a high number of total members of the board and when there is a high percentage of independent non-executive directors. The presence of duality in the figure of CEO and chairman also leads to a decrease in the effects of the interaction between IT involvement and digital orientation, although this decrease is slight. These results demonstrate consistency in the measures adopted in measuring the characteristics of executive directors and support the hypotheses advanced regarding the positive effect that the EDs' previous knowledge and experience in IT-digital have on the digital orientation of the company they manage; equally consistent are the arguments advanced regarding the negative moderating effects that CEO duality and board size have on the interaction between EDs' overall IT-Digital involvement and the analyzed construct. The hypothesis concerning the positive moderating effects of the percentage of independent non-executive directors on the interaction between IT involvement - digital orientation is not demonstrated.

This research has several implications for studies regarding governance and the influence of executives on corporate strategic directions. First of all, thanks to the results, Ocasio's (1997) attention-based view is extended, bringing to the forefront the coherence of the link between strategic moves and the prior experience and knowledge of decision makers. Second, the construct of digital orientation (Kindermann et al., 2020) is challenged and its theoretical use is broadened. Rather than being used as a measure of the degree of digital

attention of the executives, in this study the construct takes the form of an output resulting from the decision-making processes and the context within which they take place. It is therefore interpreted as a measure that changes as the people who make up the governance of the company change, and even more precisely as the skills and knowledge they possess change.

This paper also has implications for practice. The market environment over the years has become increasingly digital, and this trend is expected to grow in the future as well, with the advent of technologies such as 5G that will enable the exploitation of the Internet of Things, robotics, and cloud computing. With a view to the complexification of technologies and their management, the debate on the relationship between governance and innovation is becoming increasingly lively. Dealing with the specific theme of digital transformation, this study represents a theoretical in-depth analysis of the governance-innovation connection, useful for companies to understand the key characteristics that can foster the effective development of digital transformation. In particular, the findings of previous scholars (Goodstein et al., 1994; Jeremias, 2007; Blibech & Berraies, 2018) that have made known the negative effect of board size and CEO duality on innovation implementation and adaptation to changes in the strategic environment. Starting from these statements, it was possible to verify how these board characteristics are an unfavorable element to the implementation of digital transformation. Finally, specifying which of the characteristics related to executives' knowledge and skills is most influential on digital output allows companies to select the right profiles to lead a digital transition.

The study presented so far also has some limitations. First, the analysis developed takes into account a sample of Italian listed companies, which limits the applicability of the findings to unlisted companies or companies from other countries. A second limitation is related to the use of an aggregate variable such as "IT involvement", although the set of variables did not show values above the threshold values of the VIF test, this variable, being composed of the regressors IT education, IT work experiene and IT industry, has a high Pearson correlation rate. This could result in the same information being expressed by two different variables and the regression model could assign an inaccurate meaning in the full model. A third factor relates to the time period analyzed; although the three-year time period analyzed is solid for confirming the results, it may not be explicative of the early stages of implementation of the digital revolution. This poses a problem with the applicability of this study's findings for research that will want to analyze a future construct in its early stages of development.

Through the development of a theoretical framework linking the prior experience and knowledge of decision-makers to the strategic orientation of the firm the study has the potential to lay the foundation for subsequent research in the area of strategic orientations such as market and technology orientation (Zhou et al., 2005), learning orientation (Mavondo et al., 2005), or performance orientation (Matzler & Mueller, 2011) by investigating when EDs' knowledge and skills can influence different constructs. Performing further studies that consider how education, work experience, and industry background are able to influence a firm's strategic orientation would provide an empirical indication of the degree to which these characteristics of executives are able to generate in the strategic orientations of the firm.