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Scandinavian Journal of Management

journal homepage: www.elsevier.com/locate/scajman

Women directors contribution to organizational innovation: A behavioral approach

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ARTICLE INFO

Keywords:

Women directors
Board processes
Organizational innovation
Decision-making culture
Cognitive conflict
Preparation and involvement

ABSTRACT

This paper aims to analyze the relationships between women directors (a demographic characteristic) and organizational innovation (a predictor of firm performance) by considering the mediating role of the board's decision-making culture. To scrutinize board processes and behaviors, we use survey data to test our hypotheses on a sample of 341 Norwegian firms. The results suggest that women directors contribute positively and significantly to organizational innovation. Furthermore, the positive relationship between women directors and the level of organizational innovation is mediated by some decision-making culture dimensions: the degree of cognitive conflict and the degree of preparation and involvement during board meetings. Implications for theory and practice and future research directions are discussed.

1. Introduction

Board diversity is one of the most researched topics in the board of directors literature. Gender diversity, in particular, has largely attracted researchers' attention, and the direct link between gender diversity and firm performance has been investigated. Reviewing the literature, two different views can be observed about the current situation in gender diversity research. One view emphasizes the need to focus on other types of diversity, which, in a way, is implicitly stating that research on gender diversity might be reaching its maturity (e.g., Hillman, 2015). The other view, indicating the mixed results of gender diversity-firm performance research, calls for more research on the variables that moderate and mediate the relationship between gender diversity and firm performance (e.g., Eagly, 2016; Post & Byron, 2015). We follow the latter view for two main reasons: First, gender diversity continues to increase in boardrooms worldwide, and especially in continental Europe, it is clear that the increasing number of women on boards is a target specified in policy makers' agendas (e.g., quota laws in Italy, Spain, Iceland, France, and Germany, and EU 2020 Targets). Second, relatedly, research has yet to better explain how women directors might be affecting competent board work (Huse & Solberg, 2006; Post & Byron, 2015) and, consequently, firm level outcomes (Finkelstein, Hambrick, & Cannella, 2009; Johnson, Schnatterly, Hill, 2013).

Indeed, previous studies have demonstrated that the effect that

gender diversity may have on board tasks and on strategic decisions is complex due to the factors surrounding the effects of gender diversity (Eagly, 2016). For example, a number of studies, applying a social categorization perspective, have indicated that women directors' contribution to board tasks may be limited due to the social barriers (e.g., tokenism, out-group categorization, and unequal membership) they face in boardrooms (e.g., Nielsen et al., 2010; Torchia, Calabrò, & Huse, 2011). Others have shown that women directors' impact on strategic decisions may be contingent on turbulent events or individual power. Some studies have even suggested that women directors (minorities) may have a detrimental influence on board decisions by triggering cognitive biases, such as information processing and decision-making biases (e.g., Kanadli, Torchia, & Gabaldon, 2017).

From this perspective, while previous studies emphasize the fact that gender diversity may have limited or even negative consequences on board task performance or board decision making, interestingly, the question of how these unfavorable effects may be reduced or avoided has remained unclear. Thus, more research is needed on gender diversity specifically to generate solutions to the obstacles that limit women directors' potential. Examining the mediating role of board processes may provide a better understanding of how the complex effects of gender diversity may arise and (Post & Byron, 2015), therefore, shed light on the way to generate solutions in the literature.

The purpose of this study is to examine the influence of gender

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<https://doi.org/10.1016/j.scaman.2018.02.001>

Received 4 January 2017; Received in revised form 15 December 2017; Accepted 7 February 2018
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diversity on organizational innovation by considering the mediating effect of board processes, namely, cognitive conflict and preparation and involvement. We use the behavioral theory of the firm (Cyert, March, & Clarkson, 1963), which is acknowledged as a main perspective for understanding organizational behavior and decision making (Argote & Greve, 2007; Van Ees, Gabrielsson, & Huse, 2009). We focus on two core board processes: a) cognitive conflict and b) preparation and involvement (Forbes & Milliken, 1999). We focus on these concepts because, in the behavioral approach, internal processes are seen as key factors in coping with cognitive biases and, hence, provide a better understanding of decision making (Argote & Greve, 2007) and because they are closely linked to board decision making (Nielsen & Huse, 2010).

According to the behavioral theory perspective, decision makers generate solutions that are “good enough” rather than optimum (satisfying behavior), as the decision makers are limited in their ability to process information and solve complex decision problems (bounded rationality). This results in the routinization of decision making (routinization) and, thus, leads to information processing and decision-making biases during decision making. To avoid or reduce such biases, conflict can be vital and may be inevitable in decision-making groups. According to the behavioral perspective, a firm is seen as a coalition of stakeholders or actors (Cyert et al., 1963), and boards are representatives of those actors who may have conflicting goals (Van Ees et al., 2009). Therefore, a behavioral lens suggests that the more comprehensive the information is that is available and evaluated during the decision-making process, the more innovative a group’s decision will be (Cyert et al., 1963). We argue that due to the different human capital (knowledge, experience, and perspectives) (Hillman, Canella, & Harris, 2002), values and views (Eagly, 2005) that women bring compared to their male counterparts, women directors on boards will positively impact cognitive conflict. Moreover, the minimum acceptable effort level for “directors doing their homework” will be leveraged by women directors’ preparation for and involvement in board discussions. In turn, such processes will result in innovative ideas (Amason, 1996; Hillman et al., 2002; Rindova, 1999), which enhance innovation.

This study builds on previous studies in several ways. First, it makes a theoretical contribution to board diversity research, applying the behavioral theory of the firm as a novel approach. As proposed by the behavioral perspective, we show that board processes are the key to generating decision outcomes with better creativity. This study also makes a theoretical contribution to gender diversity research by pointing out the importance of enabling women directors’ active participation in boardroom interactions. One solution to coping with obstacles that limit women directors’ contributions to competent board work and innovation might be to create a boardroom environment or to demonstrate a certain leadership efficacy (Gabrielsson, Huse, & Minichilli, 2007; Machold, Huse, Minichilli, & Nordqvist, 2011) that facilitates open constructive interactions in the boardrooms. In reality, with an increasing number of women joining boards, the practical implications of this study are of high relevance, as it improves the understanding of the maximization of outcomes from gender diversity on boards.

Moreover, our results may explain why not all gender diverse boards may be equally innovative. It may be unrealistic to assume that once the number of women on boards is increased, boards will benefit from the women’s talent. Research has provided evidence that this might be difficult to achieve. Examining the effects of women on board processes may shed light on practices and policies to create regulations or best practices to complement the phenomenon of the increasing number of women directors on boards. Our findings draw practitioners’ and policy makers’ attention to two pitfalls: the quality of newly appointed women directors and the number of board appointments they have.

The paper is organized as follows: In the next section, the main theoretical arguments are addressed, and the relationships among

women directors, decision-making culture and firm innovation are highlighted. Moreover, the research model is presented, and the hypotheses are formulated. In section three, our methods are described. The results are presented in section four. A discussion and final remarks are presented in the last sections.

2. Theoretical framework and hypotheses formulation

Several studies link aspects of board demography (e.g., board members’ gender) to firm performance (Bilimoria, 2006; Burke, 2000; Carter et al., 2003) but with inconsistent findings (Burke, 2000; Carter et al., 2003; Erhardt et al., 2003; Rose, 2007; Singh, Vinnicombe & Johnson, 2001; Terjesen, Sealy & Singh, 2009). Indeed, research on boards of directors has failed to establish any clear relation between board demographic characteristics and firm performance. This suggests that the relationship between board demography and firm performance may not be simple and direct but rather complex and indirect (Finkelstein et al., 2009). Therefore, looking at the intervening and mediating variables between board demography and firm performance is a good choice (Post & Byron, 2015; Eagly, 2016). Among these intermediate steps, board processes are expected to play an important mediating role in the relationship between board composition and firm-level outcomes.

There are many intermediate steps that may be analyzed (Torchia, Calabrò, & Morner, 2015), and this study investigates the relationships among women directors (a demographic variable), board processes (cognitive conflict and preparation and involvement) and firm organizational innovation in particular. The focus is on firm organizational innovation rather than on firm performance for many reasons. First, firm innovation is considered a mediating variable between the board of directors and firm performance (Miller & Triana, 2009). Indeed, firm innovation leads the firm to develop certain capabilities that, in turn, enhance its performance (Caves & Ghemawat, 1992; Teece, Pisano, & Shuen, 1997; Zahra & Garvis, 2000). Second, we want to address the need for more research on the relationship between gender diversity and firm innovation (Bantel & Jackson, 1989; Cox, 1991; Miller & Triana, 2009; Torchia et al., 2011).

We consider board processes to be explanatory mechanisms of women directors’ contribution to board decision making (Huse, Gabrielsson, & Minichilli, 2009; Huse & Solberg, 2006; Nielsen et al., 2010; Singh, Terjesen, & Vinnicombe, 2008), which influences strategic decisions (Nielsen & Huse, 2010; Westphal & Milton, 2000). To explain this contribution, we use a behavioral approach. Considering the main concepts of the behavioral approach, we argue that one of the most important challenges decision makers could face is the cognitive biases surrounding decision making.

Indeed, board research has provided support for the idea that diverse boards’ work is under threat from various biases and social barriers. For example, both Nielsen and Huse (2010) and Westphal and Milton (2000) demonstrated that social barriers limit women directors’ influence over board decision making. Moreover, Zhu and Westphal and Bednar (2005) indicated that a failure to present minority perspectives during board decision making may lead to information processing and decision-making biases, which negatively affect decision outcomes. Still, how boards may cope with these obstacles has remained greatly underexplored. From a behavioral perspective, a better understanding of the mechanisms of —board processes— for the utilization of women directors’ contributions to board decision making and strategic decisions can lead to the development of solutions to various obstacles (Groysberg & Bell, 2013) that limit women directors’ potential. The behavioral approach posits that processes that facilitate the comprehensiveness of decision making can be the key to overcoming such biases, leading to decision outcomes with better quality or creativity. We use the degree of cognitive conflict and the degree of preparation and involvement in the boardroom (as it is explained in Section 2.2).

2.1. Behavioral theory perspective

The behavioral theory of the firm is acknowledged as the main perspective for understanding organizational behavior and decision making (Argote & Greve, 2007; Van Ees et al., 2009), although empirical studies adopting this lens remain scarce in the board context (e.g., Miller & Triana, 2009). The behavioral theory of the firm builds on well-known key concepts: bounded rationality, satisficing, problemistic search, the routinization of decision making in standard operating procedures, and the dominant coalition (Argote & Greve, 2007).

A behavioral approach recognizes the cognitive limitations of individuals in upper echelon decision making, positing that decision outcomes are threatened by cognitive biases. Decision makers are limited in their ability to completely understand all the linkages among the variables around them and, therefore, make decisions that are “good enough”. The cognitive bias of decision makers allows only imperfect mapping of the decision-making environment and rather limited and selective information processing (Van Ees et al., 2009). In turn, the bounded rationality and satisficing behavior of decision makers lead to the routinization of decision-making processes until a problem has been faced in attaining current goals. This also creates decision-making biases so that while different perspectives about the task being performed or issues to be evaluated are overlooked during board discussions, a former perspective, which leads to satisfactory results, is preserved (e.g., Westphal & Bednar, 2005). Interactions between decision makers (e.g., conflicts) can be vital to coping with cognitive biases (Van Ees et al., 2009).

From a behavioral approach, diversity can be seen as an important group of demographics working against cognitive biases. The cognitive limitation of an individual decision maker is compensated by other members' different information, knowledge and perspectives. Diversity is suggested as an important group level factor in both the work team and board literature, enhancing the comprehensiveness of decision-making processes, which may lead to decision outcomes with better quality or creativity (De Dreu, Baas, & Nijstad, 2008; Milliken & Martins, 1996; Rindova, 1999; van Knippenberg, De Dreu, & Homan, 2004). However, the presence of different information and perspectives does not mean, per se, that group decision making will benefit from these resources of the group members. For example, Zhu demonstrated that minority perspectives might not be presented during board discussions, which, consequently, suffer from cognitive biases. Zhang showed that only when different knowledge and perspectives are shared and communicated can diversity benefit competent board work.

Several studies in the work team literature have demonstrated that group processes facilitate the sharing of unique information and the evaluation of different perspectives, transmitting the positive impact of diversity on decision outcomes by enhancing the comprehensiveness of group decision making (Amason, 1996; Simons et al., 1999). For example, demonstrating the positive effect of debate, Simons et al. (1999) states that “The conclusion to be drawn from these results is that for diversity to benefit a company's bottom line, there must be a process by which the positive aspects of diversity are brought to bear.” Amason (1996) indicated that cognitive conflict is a factor in transmitting diversity potential to the decision-making process to achieve comprehensiveness.

In the board context, involvement and preparation—effort norms—and cognitive conflict are core board processes. Both practices are theoretically suggested to influence strategic decisions by transmitting diversity's effects on the comprehensiveness of board decision making (Forbes & Milliken, 1999; Rindova, 1999).

2.2. The relationships between gender diversity and organizational innovation

Despite the numerous studies that relate board diversity to firm innovation (Erhardt et al., 2003; Watson, Kumar, & Michaelsen, 1993),

to date, few studies have investigated the effect of gender diversity on innovation (Miller & Triana, 2009). Firm innovation can be defined as a company's commitment to creating and introducing new products, processes and organizational systems (Zahra & Garvis, 2000). However, previous studies (Miller & Triana, 2009; Torchia et al., 2011) in this research stream have yet to investigate the important effects board processes may have on the gender diversity-innovation link.

The behavioral theory of the firm posits that the comprehensiveness of decision-making processes can influence innovation in organizations. During the decision-making process, homogeneous groups tend to focus exclusively on areas in which group members have previous experience (Hambrick & Mason, 1984; Miller & Triana, 2009). Homogeneous groups may actually hamper innovation. Indeed, some authors note that homogeneous boards of directors are more likely to inhibit the critical evaluation of alternatives, and this may negatively impact innovation (Janis, 1972).

In contrast, diverse groups have a greater variety of ideas and different perspectives. Gender diversity allows for a more thorough evaluation of choices because of the increased information available. Indeed, heterogeneous groups produce higher quality decisions (Amason, 1996; Hoffman, 1959; Hoffman & Maier, 1961) and generate more innovative solutions compared to homogeneous groups (Amason, 1996; Chen, Liu, & Tjosvold, 2005).

In this study, we focus on one aspect of firm innovation, though common categorizations of innovation include product, process or organizational innovation (Damanpour & Evan, 1984; Damanpour, 2001). We analyze the contribution of women directors to organizational innovation. The term “organizational innovation” refers to the creation or adoption of an idea or behavior that is new to the organization (Damanpour & Evan, 1984; Damanpour, 1996).

By exploring the effect of gender diversity on organizational innovation, we assume that women have different values (Selby, 2000; Eagly, 2016) and different knowledge and expertise (Hillman et al., 2002; Singh et al., 2008; van der Walt & Ingley, 2003; Westphal & Milton, 2000) compared to their male counterparts. Hence, organizational innovation is more related to cognitive processes than to product and process innovation. Organizational innovation is influenced by learning processes and organizational knowledge (Nonaka & Takeuchi, 1995) and is the output of various intervening mental processes (Hodgkinson, 2003). Indeed, while product and process innovations require specific knowledge and competences (Ettlie, Bridges, & O'Keefe, 1984), organizational innovation is especially influenced by the individual characteristics of people (Kimberly & Evanisko, 1981).

Women directors can bring to the boards different attitudes, opinions and problem solving skills (Bilimoria & Wheeler, 2000; Eagly, 2005). Therefore, women serving the board of directors enhance the level of diversity in the boardroom. Gender diversity may deliver a broad range of perspectives, increase the search for information, enhance the quality of brainstormed ideas, facilitate creativity, and generate more strategic alternatives (Post & Byron, 2015). This, in turn, can be expected to enhance the comprehensiveness of decision-making processes, avoid decision making and information processing biases, and positively impact organizational innovation. Thus, we formulate the following hypothesis:

Hypothesis 1. *There is a positive relationship between women directors (ratio) and the level of firm organizational innovation.*

2.3. The mediating role of board processes

While in the previous section we explored the direct contribution of women directors to organizational innovation (Hypothesis 1), now we investigate how the process unfolds. We expect that women influence organizational innovation through board processes: cognitive conflict and preparation and involvement. To capture the mediating effect of cognitive conflict and preparation and involvement, we argue first that

women directors positively impact it and, second, that organizational innovation benefits from cognitive conflict and preparation and involvement.

Conflict can have potentially contradictory effects on social interactions (Jehn, 1997; Pinkley, 1990). Schweiger et al. (1986) assert that conflict can, on the one hand, improve decision quality and, on the other, threaten decision quality by weakening the ability of individuals to work together. Conflict that has beneficial effects has been referred to as cognitive conflict, while conflict that is dysfunctional is called affective conflict (Amason & Schweiger, 1994).

Cognitive conflict is a disagreement about the content of the tasks performed, for example, differences in viewpoints, ideas and opinions (Jehn, 1995). In the board context, cognitive conflict implies that board members may have different opinions on important board issues, different perspectives and very different ways of arguing and reasoning (Forbes & Milliken, 1999). We follow the arguments of both Adams and Ferreira (2004) and Nielsen & Huse (2010a). Adams and Ferreira (2004) suggest that women serving as board members behave differently than men during board meetings and that their behavior should affect the working style of the board. Having women directors in the boardrooms creates positive environments and cognitive conflicts because they provide alternative viewpoints and exchange positive and negative comments (Watson et al., 1993). Indeed, the level of cognitive conflict may be influenced by women directors' behavior during board meetings. For example, their behavior requires the consideration of more alternatives leading to a broader view and a better understanding of the complexities of the environment (Cox, 1991; Eisenhardt et al., 1997; Jackson, 1992; Milliken & Vollrath, 1991).

Despite the negative impact that cognitive conflict may have on group effectiveness (De Dreu & Weingart, 2003), the theory and several empirical studies support the arguments about its positive effects (Finkelstein & Mooney, 2003; Melkumov, Breit, & Khoreva, 2015; Minichilli, Zattoni, & Zona, 2009; Schweiger, Sandberg, & Ragan, 1986). Evidence supports the view that cognitive conflict encourages a thorough evaluation of the alternative underlying assumptions (Schweiger & Sandberg, 1989; Schweiger et al., 1986) and encourages alternative ideas and approaches (Amason, 1996; Valacich & Schwenk, 1995).

From a behavioral lens, the more comprehensive the information that is available and evaluated during the decision-making process is, the more innovative a group's decision will be (Cyert et al., 1963). A diverse board may possess that variety, through conflict, and can make use of that broad-ranging information and increased number of perspectives in its decision outcomes. In turn, the convergence of different perspectives may lead to greater insights into the issue at hand, leading to creative solutions.

Cognitive conflict is positively related to the quality of group decisions (Amason, 1996). Cognitive conflict (a) makes members more open to new information, (b) results in a deeper understanding of task issues, (c) increases the range of alternatives considered, (d) motivates assumption questioning, and (e) allows assumptions and recommendations to be evaluated systematically (Amason, 1996; Pelled, Eisenhardt, & Xin, 1999; Schweiger et al., 1986; Schwenk, 1990). Jehn (1997) and Woodman, Sawyer and Griffin (1993) explained the task conflict/performance relationship with similar logic.

A variety of determinants that facilitate innovation within an organization have been studied thus far; these determinants include structure, slack resources, technology, and culture (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Damanpour, 1991; Frambach & Schillewaert, 2002; Glynn, 1996). Some studies suggest that cognitive conflict can promote innovation by encouraging members to reassess familiar practices, identify problems within an organization, and come up with creative solutions if the conflict is linked to a challenging task (Leonard-Barton, 1995; Nonaka & Takeuchi, 1995; Jehn, 1995; Amabile et al., 1996). Therefore, considering the previous arguments about the relationships among gender diversity, cognitive conflict and

organizational innovation, we can formulate the following hypothesis:

Hypothesis 2. *Cognitive conflict mediates the relationship between women directors (ratio) and firm organizational innovation.*

Finally, we explore the mediating role of the preparation and involvement of board members in the relation between women directors and organizational innovation.

Board members' preparation before meetings refers to their willingness and ability to participate in board meetings with a deep knowledge of the discussed topics. Board members' preparation is related to the quality of the information they receive, the time they devote to scrutinizing that information, the effort they make collecting further information beyond that provided by managers and, ultimately, the competences they possess (Forbes & Milliken, 1999; Huse, 2007). On the other hand, involvement in board meetings is a strongly related concept. It is not just about attending a meeting, but it is also about the attention given and the activities undertaken during the meeting (Huse, 2007).

Huse and Solberg (2006) suggested that women directors are generally more prepared and involved than men and that the unsatisfactory preparation and involvement of male directors also presented opportunities to women. In fact, when attending board meetings well prepared, women gain the ability to influence the decision making and improve their status as directors. In this way, directors are able to prove their positive influence on board effectiveness. Furthermore, having women on corporate boards may create a positive virtuous circle for improving board behavior and board effectiveness (Huse, 2007; Huse & Solberg, 2006). In fact, during board meetings, the presence of women directors that are more prepared for the board meetings obliges male directors to improve their preparation as well. Indeed, having well-prepared women on corporate boards may create positive competition among board members, stimulating male board members to perform their tasks in the best way. This virtuous circle enhances the general level of preparation and involvement during board meetings.

Having more prepared and involved board members clearly influences the comprehensiveness of information processing and the evaluation of different perspectives, which can be expected to positively influence the board's outcomes (Finkelstein & Mooney, 2003). Indeed, if all board members are prepared and involved during board meetings, they are more able to have discussions during the meeting, are more inclined to present their points of view and are more likely to suggest several creative solutions. The preparation and involvement of all board members during meetings stimulate creative discussions (Huse & Solberg, 2006), new ideas and solutions and have a positive influence on organizational innovation. Therefore, women directors increase the level of preparation and involvement during the board meetings that in turn enhances the level of organizational innovation. Thus, we formulate the following hypothesis:

Hypothesis 3. *Preparation and involvement mediate the relationship between women directors (ratio) and firm organizational innovation.*

3. Methods

3.1. Data collection and sample

To test our hypotheses, we used the value creating boards survey developed in Norway in 2005 and 2006 (Sellevoll et al., 2007). Norway was the first country, in 2003, to pass quota legislation regarding the presence of women on supervisory boards. The fact that this survey was conducted before the regulation was fully implemented helps us to understand the dynamics of the boards without the mandatory perspective but with an already present strong pressure to appoint women. Before implementing a mandatory gender quota on boards, the Norwegian government tried to follow a more voluntary approach, incentivizing companies to increase the representation of women on

boards (Seierstad & Huse, 2018). Therefore, during the period of analysis, we can observe voluntary actions resulting from strong pressure.

In addition, Norway follows the Nordic two-tier board system, with a supervisory board led by the board chairperson and an executive board led by the CEO. Supervisory boards are in charge of overall long-term decision making and the strategic processes of the business—including the innovation strategy—which brings even more importance to the role of each board member and the dynamics among them.

The value creating boards survey is one of the few available surveys exploring board behavior. It was directed at CEOs, chairpersons and board members in large, medium and small Norwegian firms. The aim was to survey 2954 firms (firms on the Oslo Stock Exchange, other publicly limited firms, Ltd. firms with more than 100 employees, Ltd. firms with 50 to 100 employees and a total turnover of more than 5 million NOK, and smaller Ltd. firms including fewer than 50 employees and a total turnover of more than 50 million NOK). The survey includes 265 questions to CEOs, 235 to chairpersons and 215 to other board members, and the answers are organized in seven-point Likert scales (where 1 means disagreement and 7 agreement). The construction of this dataset, and its question about the internal dynamics of boards, allows for the understanding of the interactions in the boardroom and the potential effects of diversity on the decision-making process and, in turn, on firm value creation.

Our choice of medium-sized Norwegian companies is based on two reasons. First, medium-sized companies struggle a great deal to include changes and new diversities in their boards. It will be interesting to observe the dynamic relationship between the increasing representation of women on boards and board dynamics and innovation. Second, this choice guarantees that the sample firms will be influenced but not obligated by the introduction and legislation of the quota. Therefore, medium-sized companies have more freedom to increase the number of women on their boards. However, in this scenario, medium-sized companies might be following the path of larger corporations and trying to aim for potentially better results.

We tested our hypothesis on CEO responses with an overall response rate of 33.0%. We selected 341 medium-sized firms with 51 to 250 employees, which is the European Union's cut-off for medium-sized firms. The responding firms have, on average, 114 employees. Of the firms, 38.0% are high-tech firms. The board size, on average, is 4.04. CEO tenure and board chair tenure are, on average, respectively, 7.08 and 5.62 years. The length of board meetings is, on average, 3.83 h. The boards have, on average, 16% women directors, and in the sample, 44% of the boards have no women directors. Fifty-six percent of the boards have at least one woman director.

3.2. Variables and measurement

3.2.1. Dependent variable: organizational innovation

The dependent variable, organizational innovation, was measured by several items on a seven-point Likert-type scale (7 = fully agree and 1 = fully disagree). The CEOs were asked to value to what extent their firms were characterized as a) being the first firm in the industry to develop an innovative management system, b) being the first firm in the industry to introduce a new business concept and practice, c) considerably changing the organizational structure to facilitate innovation, and d) implementing development programs for personnel to facilitate creativity and innovation. Organizational innovation, the output variable, was built as a mean of the four items. The Cronbach's alpha coefficient is 0.82.

3.2.2. Independent variable: the ratio of women directors

The ratio of women directors' is our independent variable, and it was calculated as the number of women directors divided by the total number of board members. It is important to highlight that in the sample women directors are a minority group; therefore, there are no cases of boards with more female directors than men directors. Hence,

using a ratio of women directors in order to capture the level of the boards' gender diversity seems to be appropriate.

3.2.3. Mediators: cognitive conflict and preparation and involvement

The mediating variables are two dimensions of decision-making culture: cognitive conflict and preparation and involvement.

Cognitive conflict was measured using three items that consider the degree to which board members a) have different views on important board issues, b) contribute with very different perspectives on what is best for the firm, and c) think and reason in different ways. The variable was built as the mean of the items. The Cronbach's alpha coefficient is 0.79

Preparation and involvement were measured using three items that consider the degree to which board members a) prioritize substantial and sufficient time for their assignment as board members in the firm, b) are always available if board activity demands it, and c) are always very well prepared for the board meetings. The variable was built as the mean of the items. The Cronbach's alpha coefficient is 0.78.

3.2.4. Control variables

We control for firm and context features, which are firm size and industrial sector. Firm size was measured as a linear transformation (\ln) of the absolute number of employees. We used the number of employees provided by the CEOs in the survey. Firm size typically comes with some features that may be conducive to attempts at organizational innovation. As Kimberly and Evanisko (1981) argue, firm size necessitates and facilitates the firm's innovative behavior. Indeed, large firms might be more inclined to make changes to their organization as they are generally in a better position, having a higher financial status and more resources.

With regard to the industrial sector, we classified firms as competing in high (coded 1) and low (coded 0) technology industries. In high technology sectors, firm organizational innovation can enhance firm survival and success (Von Glinow & Mohrman, 1990). In these sectors, the high investments in R&D can influence the level of firm organizational innovation (McDougall & Oviatt, 1996). Indeed, in growing industries, organizational innovation strategies are often necessary (Andersson, 2004). Therefore, organizational innovation is more common in high technology industries. We also control for board composition features, which are board size, CEO tenure and board chair tenure.

Board size indicates the number of directors with voting rights. Board size becomes a potentially important determinant of organizational innovation. Indeed, the total number of directors may influence the way they perform their tasks (Fama & Jensen, 1983) and may determine their ability to promote innovation.

CEO tenure is equal to the number of years the CEO has served on the board. CEO tenure, or length of service, is another characteristic of boards of directors that may affect firm organizational innovation. There are two competing perspectives regarding the relationship between CEO tenure and firm organizational innovation (Vafeas, 2003). The first one suggests that longer tenure is related to CEO experience, commitment, and competence, resulting in better firm organizational innovation. In contrast, the second perspective suggests that longer CEO tenure is associated with a management-friendly board. In this last case, boards may lose their objectivity and independence and have difficulty or be unwilling to monitor management, resulting in lower levels of organizational innovation.

Board chair tenure is equal to the number of years he/she has served as a chair on the board. This measure indicates the board's ability to access information from within the organization. According to Tainio, Lilja and Santalainen (2003), the board's ability to access information is crucial to organizational innovation, and the chairperson may help accomplish this task. In this regard, adequate access to information during board meetings can support the board's role in enhancing feedback related to organizational innovation choices.

The length of board meetings is the duration of the information exchange in board meetings. It is measured as the duration, in hours, of an ordinary board meeting transformed into its natural logarithmic function. The amount of time directors work together can substantially determine the degree to which boards fulfill their tasks (Forbes & Milliken, 1999). An effective board requires time for preparation and influences the board task involvement (Huse, 2007) that in turn may influence the level of innovation. Spending time together in board meetings is important to maintaining effective boardroom dynamics and creating innovative board behavior (Nordqvist & Minichilli, 2009).

Finally, directors' knowledge of the firm was measured by six items on a seven-point Likert-type scale (7 = fully agree, 1 = fully disagree). The CEOs were asked to value the board members' a) knowledge of the firm's main operations; b) knowledge of the firm's critical technology and key competences; c) knowledge of the firm's weaknesses and its products and services; d) knowledge of the development of the firm's customers, markets, products and services; e) knowledge of the firm's suppliers and customer negotiation powers; and f) knowledge of threats from entrants and new products and services. The variable output of directors' knowledge of the firm was built as a mean of the items. The Cronbach's alpha coefficient is 0.87. Boards require a high degree of specialized knowledge and competences to function effectively (Forbes & Milliken, 1999). Boards, as elite and strategic-issue-processing groups, must have members who possess knowledge and competences useful for problem solving (Ancona & Caldwell, 1988). Boards of directors need to have knowledge and competencies in order to deal effectively with strategic issues (Forbes & Milliken, 1999) and then influence the level of innovation. However, this measure refers to directors' knowledge of the firm and not to the personal knowledge and competences of each board member with relation to their background. It is possible that because women more often occupy staff positions and are generally younger than their male counterparts, women do not contribute significantly to the knowledge of the firm, especially at the moment they are appointed (Singh et al., 2008). A lag time should be necessary in order to acquire the necessary experience related to firms' operations.

3.3. Analyses

Multiple linear regression analysis was used in order to test the influence of women directors (ratio) on the level of organizational innovation while also considering the mediating roles of cognitive conflict and preparation and involvement (decision-making culture dimensions). In Model I, we tested the direct relationship between women directors (ratio) and the level of organizational innovation.

To analyze the mediating effect of the decision-making process variables, we tested three models, which is consistent with the recommendations for testing mediating effects (Baron & Kenny, 1986). Accordingly, three conditions should be met to support a mediating relationship. First, the independent variable (the ratio of women directors) must be significantly associated with the mediator (cognitive conflict and preparation and involvement). We tested this as models II (a) and II(b). Second, the independent variable (the ratio of women directors) must be significantly associated with the dependent variable (organizational innovation). This condition is tested in Model I.

Finally, in Model III, once the mediator(s) is entered (cognitive conflict and preparation and involvement), the relationship between the independent variable (the ratio of women directors) and the dependent variable (organizational innovation) should either disappear (full mediation) or significantly diminish (partial mediation).

4. Results

The correlations of all the variables are reported in Table 1. Inter-correlations among the independent variables were generally low, thereby minimizing the problem of unstable coefficients (because of

collinearity) in the linear regression models. In addition, the variance inflation factors (VIF) test suggests that multicollinearity does not create a defect in the results. We also conducted various residual analyses with log-linear transformation of firm size and length of board meetings. These transformations did not significantly change the results.

The results of the multiple linear regressions are presented in Table 2.

In Model I, we tested the direct relationship between the independent (the ratio of women directors) and the dependent (organizational innovation) variables. The results show that there is a significant and positive relationship between the ratio of women directors and the level of organizational innovation (1.08; $p < .05$). The adjusted R^2 is 0.12. Thus, Hypothesis 1 is supported.

Hypothesis 2 and 3 are also supported, suggesting that cognitive conflict and preparation and involvement mediate the relationship between women directors and organizational innovation. Specifically, in models II(a) and II(b), we tested the mediating effect as suggested by Baron and Kenny (1986). We found that all three conditions for the mediating effects were satisfied. In fact, in models II(a) and II(b), we found a positive and significant relationship between the independent variable (the ratio of women directors) and both mediators (cognitive conflict and preparation and involvement) (1.60; $p < .001$ and 0.97; $p < .05$). The adjusted R^2 for models II(a) and II(b) are, respectively, 0.14 and 0.16. Finally, in Model III, we tested for the mediating effects of cognitive conflict and preparation and involvement on the relationship between women directors and organizational innovation. Both cognitive conflict and preparation and involvement behave as mediators between the presence (ratio) of women directors and organizational innovation. In particular, when both mediators are entered, the relation between the independent variable and the dependent variable (Model I) disappears and the mediators are related significantly to the dependent variable. Hence, we may argue that there is full mediation by both decision-making culture dimensions. The adjusted R^2 for the last model is 0.23.

5. Discussion and conclusion

Seen as a main theoretical perspective in explaining organizational behavior and decision making (Argote & Greve, 2007), this paper applies a behavioral approach to explore the contribution of women directors to the level of organizational innovation. The behavioral approach proposes that board processes play a vital role in addressing the cognitive biases surrounding board decision making, which otherwise would have detrimental effects on the quality and creativity of decision outcomes (Van Ees et al., 2009). Therefore, following the call of scholars (Post & Byron, 2015), we consider the mediating role of board processes, namely, cognitive conflict and preparation and involvement, to better understand and explain the influence women directors may have on the level of organizational innovation.

The analysis was divided in two main steps. First, we explored the direct contribution of women directors to the level of organizational innovation. Consistent with the research showing positive effects of gender diversity on firm innovation (Miller & Triana, 2009; Torchia et al., 2011), we found a positive effect of gender diversity on the volume of organizational innovation. However, these results, related to women directors' influence on decision outcomes, should be considered within the larger research demonstrating mixed results from women directors' influence on decision outcomes.

With a particular focus on the effects of gender diversity on strategic decisions, research, for instance, has demonstrated that the social barriers (e.g., out-group categorization) women minorities face in boardrooms may limit their influence on board decision making (Nielsen & Huse, 2010; Westphal & Milton, 2000) and strategic decisions as well as on board tasks. Others have shown that women minorities may fail to present their perspectives in male-dominated boards and that, as a

Table 1
Correlation matrix (341 firms).

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. Organizational innovation	4.22	1.30	–										
2. Firm size (employees)	114	52.22	–.01	–									
3. Industry (high-tech/low-tech)	0.38	0.49	0.08	–.04	–								
4. Board size	4.04	1.70	0.01	.15 ^(b)	.14 ^(a)	–							
5. CEO tenure	7.08	6.80	0.02	–.02	0.05	–.07	–						
6. Board chair tenure	5.62	6.51	–.09	–.09	–.08	–.11	.28 ^(b)	–					
7. Length of board meetings (in h)	3.83	4.30	–.02	0.01	0.05	–.10	0.08	0.01	–				
8. Directors' knowledge of the firm	5.08	1.08	.19 ^(b)	–.08	–.01	–.16 ^(b)	–.01	–.15	.12 ^(a)	–			
9. Women directors (ratio)	0.16	0.17	0.05	–.01	0.05	.20 ^(b)	–.04	0.03	0.01	–.20 ^(b)	–		
10. Preparation and involvement	4.87	1.15	.17 ^(b)	–.05	–.01	–.10	.13 ^(a)	0.02	0.08	.38 ^(b)	0.01	–	
11. Cognitive conflict	3.88	1.25	.17 ^(b)	.13 ^(a)	.13 ^(a)	0.10	–.08	–.02	.14 ^(a)	–.08	.12 ^(a)	–.12 ^(a)	–

^a Correlation is significant at the 0.05 level (2-tailed).

^b Correlation is significant at the 0.01 level (2-tailed).

Table 2
Multiple linear regression analyses (341 firms).

	Model I	Model II (a)	Model II(b)	Model III
	Organizational Innovation	Cognitive Conflict	Preparation and Involvement	Organizational Innovation
Firm size (em- ployees)	0.17 (.19)	0.26 (.18)	–.08 (.15)	0.17 (.18)
Industry (high- tech/low- tech)	0.24 (.17)	0.30 (.16)	–.01 (.13)	0.20 (.17)
Board size	–.20 (.31)	0.14 (.30)	–.26 (.25)	–.17 (.31)
CEO tenure	0.07 (.11)	–.14 (.10)	.17** (.09)	0.06 (.11)
Board chair tenure	0.02 (.11)	–.06 (.10)	–.05 (–.09)	0.04 (.11)
Length of board meetings (in h)	0.05 (.25)	.54*** (.24)	0.02 (.20)	–.07 (.25)
Directors' knowledge of the firm	.25*** (.08)	.15* (.08)	.36*** (.06)	0.15 (.08)
Women directors (ratio)	1.08** (.50)	1.60*** (.47)	.97** (.39)	0.59 (.50)
Cognitive conflict				.17*** (.07)
Preparation and involvement				.19** (.08)
Adjusted R ²	0.12	0.14	0.16	0.23
F Change	2.02**	3.74***	5.17***	6.18***

Standard errors are in parentheses. The levels of significance are * < 0.1, ** < 0.05, and *** < 0.01.

result, critical board decisions suffer from decision-making and information-processing biases (Westphal & Khanna, 2003; Westphal & Bednar, 2005). Considering this extent literature, to move the field forward, scholars have called for more research on the mediating or moderating variables of the relationship between gender diversity and decision outcomes (e.g., Eagly, 2016; Post & Byron, 2015).

While previous studies have taken a step forward in gender diversity research and have largely investigated the contingencies to utilizing women's talent on boards, the question of how or through which mechanisms women directors may influence strategic decisions has remained unclear. Indeed, very few studies have gone under the surface (e.g., Nielsen & Huse, 2010) and investigated women directors' impact on board processes, which may better explain this influence (Post &

Byron, 2015). Instead, previous studies mainly explored the effects board processes may have on board performance (e.g., ; Minichilli et al., 2009; Zona & Zattoni, 2007). A better understanding and explanation of the mechanisms through which women directors influence decision outcomes may shed light on an important question that has been greatly neglected in the literature: "How do boards cope with obstacles that limit women directors' influence?" (for an exception see Kanadli et al., 2017).

For this reason, in the second step, we go beyond the surface of this relation to explore *how* women influence the level of organizational innovation. From a behavioral lens, board processes may be vital to coping with the cognitive biases surrounding decision making. For instance, the resolution of task-related disagreements (cognitive conflicts) may enrich the information available and increase the number of different perspectives to be evaluated during board decision making. In turn, board decision making can be characterized as comprehensive (Simons et al., 1999). The behavioral approach proposes that the comprehensiveness of decision-making processes may lead to more creative decision outcomes. From this perspective, we argue that due to their different knowledge, experience and values, women directors may enrich task-related arguments and directors' preparation and involvement in board discussions, which may lead to more creative decision outcomes by avoiding cognitive biases surrounding board decision making.

The results of our mediation analysis suggest that women directors influence the levels of cognitive conflict and preparation and involvement in the boardrooms, which, in turn, influence organizational innovation. Our results show that a greater presence of women on boards positively influences organizational innovation. This positive effect on organizational innovation comes from two sources: the greater presence of women on boards introduces different perspectives and views to the decision-making process and increases the level of preparation and involvement of all directors in the board meetings. In both cases, more gender diversity on boards results in a very positive outcome. These results are in line with previous studies that emphasize the important effects of women directors on board processes (Huse & Solberg, 2006) and the processes' impact on organizational innovation (Chen et al., 2005).

From this perspective, as long as women directors have the chance to actively participate in board discussions and present their perspectives, boards may benefit from their women directors' talent in making strategic decisions. Moreover, such talent contributes to firm organizational innovation. Relatedly, solutions should be in place to cope with obstacles that limit women directors' potential and may focus on facilitating or encouraging women directors' active, open, and free participation in board discussions. Indeed, several scholars have mentioned the importance of board openness and the leadership role a chairperson may play (Bailey & Peck, 2013; Machold et al., 2011; Gabrielsson et al., 2007) in fully benefiting from the resources directors

may possess.

As a matter of fact, a recent study, which can be seen as a complementary study, is to the best of our knowledge, the first one to introduce board-level solutions to cope with social barriers limiting women directors' influence on board decision making. Kanadli et al. (2017) suggest that under a board atmosphere of openness and with the lead of a chairperson who encourages the active participation of each director in board discussions, women directors might have the chance to demonstrate their expertise and knowledge to their male counterparts. In turn, this may result in the recategorization of women directors as in-group members by the majority male directors, avoiding or reducing the negative consequences of the out-group categorization that women directors face. Our results further explain that to demonstrate their expertise and knowledge women directors may disagree with the task-related perspectives generated during board decision making, and to be able to do that, women directors should be well prepared for the board meetings.

The number of women on boards has been increasing, and it seems that this is still an important item on policy makers' agendas, particularly in continental Europe (EU 2020 Targets). One main reason for this increase is the quota regulations that have been spreading among European countries (Øystein Strøm, 2015). Quota legislations have been trying to compensate for the low level of gender diversity on boards. Although we focus on the "business case" reasons to include more women on boards in this article, some other countries have been driven by alternative rationales, such as social justice or equality arguments (e.g., Kotiranta, Kovalainen, & Rouvinen, 2010; Seierstad, 2016).

This study demonstrated, however, that policy makers should be alert to two pitfalls. First, the literature on women on boards has extensively researched the potential barriers for women to access boards (Gabaldon, De Anca, Mateos De Cabo, & Gimeno, 2016; Terjesen et al., 2009; Van Den Brink, Holgersson, Linghag, & Deé, 2016; Van den Brink & Stobbe, 2014). These barriers include reduced pipelines due to a lack of family-friendly policies or equal opportunities for women and the biased decisions by boards to include new profiles (homophily or statistical discrimination). It should also be acknowledged that there might not be enough women director candidates in the labor market with the knowledge, skills, and experience that would complement the quota regulations. Therefore, appointing women directors who might lack the knowledge and skills needed to actively participate in board discussions and communicate alternative perspectives or disagree with peers' perspectives may not lead to favorable results for firms.

Second, with relation to the limited number of competent women director candidates, it might be highly possible that women directors in the market or those who already serve on a board might be appointed to multiple boards (Seierstad & Opsahl, 2011). This will not be surprising, as directors may also be willing to serve on multiple boards due to the prestige, learning opportunities and networking opportunities (Useem, 1982; Withers, Hillman, & Cannella, 2012). Having multiple board appointments may severely hinder women directors' preparation and involvement, and once again, increasing the number of women may not lead to favorable results for firms. Taken together, policy makers might face criticism from corporate leaders about imposing these gender quotas on their firms. As solutions to these two pitfalls, policy makers may consider providing a longer transition period for fully adopting the quota regulation and issue complementary regulations or best practices to limit the multiple board appointments of directors.

As for practitioners, this study indicates the importance of women directors' contribution to strategic decisions (organizational innovation) given that an open board atmosphere or supporting activities are provided. If gender diversity on boards leads to organizational innovation through women's contribution to cognitive conflict and greater preparation and involvement, the contribution of diversity to organizational innovation can easily be reinforced on boards. In particular, supporting activities should consider efficient ways of sharing

board meeting agendas and of course providing necessary documents and information prior to board gatherings. Information about the firm is possessed and controlled by the CEOs, who might not be willing to share this information with particularly new directors, to preserve his or her power on the board. It might be important for firms to have third parties, for instance, a board committee, to facilitate the flow of all required information to directors before board meetings. Likewise, to facilitate open and free task-related debates, corporate leaders might consider separating the chairperson and CEO positions, as powerful CEOs may be willing to demonstrate his or her power by opposing the directors' perspectives, ideas, opinions, etc. (Haynes & Hillman, 2010).

The paper allows us to reflect on future research directions. In this paper, we focused on the ratio of women directors and assumed that differences exist with their male counterpart. As in any research where socio-demographic traits are used, categorizing women and men can have limitations, as gender is multifaceted (Huse, 2012). Future investigations may focus on the actual differences between women and men directors by looking at their different backgrounds, levels of knowledge, and expertise and analyzing their impact on firm innovation. The paper focuses on one type of firm innovation – organizational innovation. However, other types of innovations exist within firms. Further investigations may explore women directors' contribution to these other types of innovation (product and process innovation), which are more related to technical issues and thus require specific knowledge and expertise. Our results demonstrate that cognitive conflict is a beneficial type of conflict. However, previous studies have indicated mixed results from cognitive conflict regarding board tasks (Minichilli et al., 2009; Zona & Zattoni, 2007) and group performance (De Dreu & Weingart, 2003). Conflict in boards deserves more research attention, with a particular focus on conflict management. Finally, the focus of the paper is on the Norwegian context. Hence, the Norwegian aspects have to be considered. In fact, Norway is different from other countries because of the high ratios of women directors, which is mainly due to the Norwegian quota law; Norway was the first country in the world to implement a mandatory gender quota. However, it may be useful to perform cross-country analyses in order to investigate how women directors contribute to innovation in different political and institutional contexts.

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