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Gender diversity in senior management, strategic change, and firm performance: Examining the mediating nature of strategic change in high tech firms

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Highlights

- Examines senior management gender diversity in the [high tech industries](#).
- Gender diversity and alliance formation intensity foster strategic change.
- Gender diversity and top management educational diversity foster strategic change.
- Strategic change ultimately improves firm performance.
- Cracks in the glass ceiling can result in [competitive advantage](#).

Abstract

Only recently have enough women joined senior leadership positions in high tech firms for research on senior management gender diversity in high tech industries to be possible. We propose that senior management gender diversity fosters strategic change in high tech firms, especially under conditions where alliance formation intensity and top management team (TMT) educational background diversity are high, because the breadth of opportunity and knowledge associated with these conditions facilitates implementation of new ideas. Results show that both inter-organizational strategic alliance formation intensity and TMT educational

background diversity positively moderate the relationship between senior management gender diversity and strategic change. We also find support for a moderated mediation model whereby a gender-diverse senior management positively impacts strategic change, which ultimately improves firm performance when the firm exhibits high alliance formation intensity and has a TMT that is diverse across educational background.

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Keywords

Senior management gender diversity; Upper echelons theory; Strategic change; High tech; Computer industries; Organizational learning

1. Introduction

Only in the last few decades have companies made progress in cracking the glass ceiling—an invisible barrier that prevents women from rising to executive management (Maume, 2004). Moreover, only recently have there been enough women in top leadership positions to study senior management gender diversity. According to Catalyst (2018), women comprise 44.7% of employees in the Standard & Poor's 500 and 36.9% of first- and mid-level managers, but shrink to 26.5% of senior-level managers, 21.2% of board directors, and only 5.2% of chief executive officers (CEOs). Although women have made some gains in leadership roles over the past few decades (Echeverri-Carroll et al., 2018), they are often underrepresented in leadership generally and within the high tech industry specifically (Catalyst, 2018). These statistics allude to persistent barriers that women face in the United States (U.S.). For example, the World Economic Forum publishes a yearly Global Gender Gap Report ranking 144 countries in the world in order (with 1 being the best) of how equally women are treated compared to men with respect to economic participation and opportunity, educational attainment, health and survival, and political empowerment. The U.S. ranked 45 worldwide in gender equality for 2016 but dropped to 49 in 2017 and 51 in 2018 signaling that gender issues are a major issue impacting society (World Economic Forum, 2016, 2017, 2018) and are worthy of investigation.

Because organizations have not had a critical mass of women in top management teams (TMTs) (Andrevski et al., 2014; Hoobler et al., 2009, 2018), research related to the effects of gender diversity have mostly been limited to investigations of the overall management corps (Dwyer et al., 2003; Richard et al., 2004, 2013), with a few instances focusing on the top management team (TMT) (e.g., Ruiz-Jimenez and Fuentes-Fuentes, 2016). Previous research has limited implications as it leaves out the reporting level one step removed from the chief executive officer (CEO) which also contributes to strategic decision-making. Based on upper echelons theory (Hambrick and Mason, 1984), but expanding beyond the top five highest paid executives where women have not achieved notable representation (Gilgoff, 2009; Toegel, 2011), this study focuses

on senior management gender diversity (of individuals within two reporting levels of the CEO) where strategy formulation broadly occurs (Alexiev et al., 2010).

Previous research has investigated the upper echelons by focusing on the CEO, the TMT, or other senior managers to examine their roles in devising strategy (Bromiley and Rau, 2016). We feel that taking a subset approach to investigate only parts of senior management lacks face validity, as all of these high-level executives direct strategy together. In fact, previous research has called for the inclusion of all key players in the strategy formulation process when attempting to study strategic decision-making (Heyden et al., 2017; Ling et al., 2008; Rutherford, 2016). For instance, firms offer managerial discretion to divisional directors who engage in strategic decision-making together with the CEO and TMT. The present study makes a contribution to the upper echelons literature by testing strategic change in the context of gender diversity in a comprehensive senior management group.

We answer a question that has implications for academics and managers: What is the strategic change and financial impact of gender diversity in the upper echelons? We exclude middle- and lower-level managers from our examination, as they are historically part of strategy implementation rather than formulation (Burgelman, 1983) and strategic change emanates from senior level decision-making (Finkelstein and Hambrick, 1990). Following prior research, strategic change is defined as the extent to which a firm changes its resource allocations in key strategic dimensions to maintain a competitive advantage (Hofer and Schendel, 1978; Miller, 1991; Oehmichen et al., 2017; van de Ven and Poole, 2005; Zhang, 2006).

According to upper echelons theory, the characteristics of senior management predict organizational outcomes such as firm innovation and overall organizational effectiveness (Bantel and Jackson, 1989; Hambrick et al., 1996; Hambrick and Mason, 1984; Ruiz-Jimenez and Fuentes-Fuentes, 2016). Although the role of gender is not explicitly ignored in upper echelons theory, most papers using this theory focus on top management teams without making distinctions between genders and thus ignore gender dynamics within TMTs and the associated implications for strategic change. Indeed, we see this as a missing point of inquiry within the upper echelons literature. Furthermore, because some scholars argue that not all types of group characteristics should be treated the same way and that surface-level diversity, such as gender, may have disadvantageous effects on organizational outcomes (Pelled, 1996; Pelled et al., 1999), we believe it is important to develop a framework around gender. Surface-level diversity, such as gender, can trigger both detrimental group outcomes such as conflict (Jehn et al., 1999) and lower cohesion (Webber and Donahue, 2001) as well as beneficial outcomes such as creativity, improved problem-solving, and superior decision-making (Milliken and Martins, 1996; van Knippenberg and Schippers, 2007; Williams and O'Reilly, 1998). Given the mixed findings about the effects of gender diversity on organizational outcomes in the general literature (Joshi and Roh, 2009; van Knippenberg et al., 2004), this study examines these phenomena in the upper echelons of management, where knowledge sharing and dissemination are critical (Hambrick, 2007). Since gender diversity in upper management still represents a rare knowledge-based resource (Jeong and Harrison, 2017; Richard et al., 2013), we assess contexts where senior management gender diversity increases or reduces strategic change.

For example, the present study examines whether inter-organizational [strategic alliance](#) formation positively moderates the impact that senior management gender diversity has on strategic change in high tech industries. Strategic alliances have been suggested as a platform for [organizational learning](#) where firms explore or exploit knowledge from an alliance partner ([Inkpen and Tsang, 2007](#); [Lavie and Rosenkopf, 2006](#); [Rothaermel and Deeds, 2004](#)). Because demographics (e.g., gender diversity) can be related to harmful processes such as conflict and to performance decreases rather than gains ([Nishii, 2013](#); [Richard et al., 2013](#)), a firm with an external learning orientation could be receptive to a senior management corps possessing gender-based knowledge. Thus, it is critical to understand how strategic alliance formation intensity moderates the relationship between senior management gender diversity and strategic change.

Furthermore, we propose that TMT knowledge could play an important role in utilizing the perspectives embedded within a gender-diverse senior management. This logic is consistent with the business case for diversity presented by [Thomas and Ely \(1996\)](#) and [Lozano and Escrich \(2017\)](#), which describes that diversity should help business performance by enhancing knowledge, flexibility, creativity, and decision-making. Specifically, we examine whether TMT educational background diversity positively moderates the senior management gender diversity to strategic change relationship. The present study focuses on educational background because one's training represents knowledge brought to group decision-making. If a TMT is diverse in its educational background, it is more likely to consider, understand, and utilize a broad range of ideas generated by senior management, including ideas from women that might otherwise be underutilized (e.g., [Kanter, 1977](#); [Ridgeway, 2011](#); [Zelechowski and Bilimoria, 2003](#)). In accounting for both moderators (i.e., alliance formation intensity and TMT educational background diversity), this study makes strides in opening the black box to test intervening variables ([Lawrence, 1997](#)) that link characteristics of the upper echelons to firm outcomes ([Hambrick, 2007](#)). We examine under what conditions gender diversity in senior management impacts firm performance by either bolstering or impeding strategic change ([Blanco-Oliver et al., 2018](#)), a question that should be fully understood as corporations observe more gender diversity in senior management ([Hoobler et al., 2018](#); [Rutherford, 2016](#)).

The present study makes several contributions. First, this study examines senior management gender diversity which is not fully understood ([Ruiz-Jimenez and Fuentes-Fuentes, 2016](#)). Second, this study tests strategic change as a mediating mechanism ([Blanco-Oliver et al., 2018](#)) while simultaneously testing both alliance formation intensity and TMT educational background diversity as moderators. Third, empirically we go beyond cross-sectional research that has been common in the upper echelons and work group diversity literatures by using a longitudinal design to better assess causality. While recent studies employ [panel data](#) in longitudinal designs, they continue to only examine main effects and moderators (e.g., [Heyden et al., 2017](#); [Opstrup and Villadsen, 2014](#)). Also, designs that introduce mediation still rely on cross-sectional analyses (e.g., [Blanco-Oliver et al., 2018](#)). The present study offers a longitudinal research design with a lag between the independent variable (time 1) and mediator (time 2) and dependent variable (time 3).

Theoretically, this study is important, because the business case for diversity has been questioned due to mixed findings (Kochan et al., 2003) while the ethical case for diversity has been championed (Pless and Maak, 2004; Reimer et al., 2018; Rabl et al., 2018). This study also sheds light on when the characteristics of a diverse senior management team lead to firm performance. This has implications for organizations by demonstrating that providing equal opportunity for men and women to advance (Pless and Maak, 2004) and enhancing business results can be one in the same. Like Ruiz-Jimenez and Fuentes-Fuentes (2016), we test our hypotheses in the technology industries to understand the financial impact that companies can realize when they crack their gender-based glass ceiling.

2. Theory and hypotheses

2.1. Senior management gender diversity and its effect on strategic change

This research differs from scholarship that focuses solely on the TMT since we include all individuals within two reporting levels of the CEO who interact directly with the CEO to help shape strategy. Some studies on TMTs in U.S. public firms define the TMT as the top five highest paid executives because the Securities and Exchange Commission requires firms to report information on these executives and those data are readily available (e.g., Carpenter and Sanders, 2002; Dezsö and Ross, 2012). However, other studies have defined the TMT broadly to include executives holding senior offices such as senior vice presidents (Carpenter et al., 2004). These high-level managers interact not only with the CEO but also with others among the top five highest paid executives and definitively influence the formulation of strategy. Thus, we follow the latter definition.

Scholars have theorized that diversity should benefit organizations if it facilitates a broad range of perspectives from which teams can make better choices (e.g., Cox and Blake, 1991; Heavey and Simsek, 2017; Lozano and ESCRICH, 2017; Richard et al., 2007; Thomas and Ely, 1996). One such decision-making process that senior management teams engage in is strategic change. Strategic change is a problem-solving process (Hofer and Schendel, 1978; Oehmichen et al., 2017), and we expect that a diverse senior management group will exhibit dynamics like those of other diverse groups when implementing strategic change (Kozlowski and Bell, 2003; Nakauchi and Wiersema, 2015). We acknowledge that the senior management cadre of an organization is larger in size compared to TMTs, boards of directors, or other types of lower-level teams. Therefore, we draw from literature examining diversity on TMTs (Lyngsie and Foss, 2017), boards of directors (Triana et al., 2014), other teams/groups (Jehn et al., 1999; Nishii, 2013; Van Knippenberg et al., 2004), and organizational diversity (Richard et al., 2007) to develop a complete picture of the dynamics that can emerge from senior management diversity. Senior management would be considered a specialized type of group because its members are interdependent and they share common goals (Forbes and Milliken, 1999; Kozlowski and Bell, 2003).

Research on diverse groups describes the double-edged nature of diversity, meaning that sometimes it is helpful and other times it is not (Mannix and Neale, 2005; Milliken and Martins, 1996; Nishii, 2013). For instance, diverse groups can generate a broad set of ideas and

information since they represent a diverse body of perspectives and knowledge (Amason and Sapienza, 1997; Heavey and Simsek, 2017; Milliken and Vollrath, 1991; Robinson and Dechant, 1997; Schweiger et al., 1996). However, diversity can also impede group decision-making (Miller et al., 1998; Tanikawa et al., 2017) because it may generate relationship conflict (Jehn et al., 1997; Joshi et al., 2011; Mintzberg, 1983) and cause difficulty in decision-making (Goodstein et al., 1994; Joshi and Roh, 2009).

Research on the upper echelons suggests that senior management diversity may hinder strategic change. Miller et al. (1998) reported that executives' cognitive diversity inhibited long-term planning rather than promoting it. Because diversity resulted in divergent opinions, executives were more prone to disagree and have difficulty reaching decisions, which reduced their ability to catalyze change (Miller et al., 1998). This is in accord with reviews of the group diversity literature which demonstrate that surface-level diversity, such as gender diversity, can reduce group cohesion and cooperation, increase conflict, and ultimately result in slower decision-making and a more difficult process (Joshi and Roh, 2009; Van Knippenberg et al., 2004; Webber and Donahue, 2001; Williams and O'Reilly, 1998). We posit that similar dynamics can operate within a gender-diverse senior management.

However, research over five decades has also shown that diverse groups can generate more creative solutions compared to homogenous groups (Jackson, 1992; Joshi et al., 2011; Triandis et al., 1965). Yet, this diversity of information comes at a cost because the decision-making process will take longer when more perspectives are represented. This might explain why some research finds that it takes diverse teams more time than homogeneous teams before they match and ultimately surpass the performance levels of homogenous teams (Watson et al., 1993). The volume of information and number of perspectives considered by a gender-diverse senior management may slow the group's ability to reach decisions, which could reduce the amount of strategic change such a group could initiate (Triana et al., 2014; Quintana-Garcia and Benavides-Velasco, 2016). Nevertheless, information can also enhance the quantity of viable ideas which may result in more strategic changes (Lyngsie and Foss, 2017). Current scholarship ultimately suggests that absent a moderating mechanism that transforms diversity into a source of information and decision-making advantage (Bromiley and Rau, 2016; Lyngsie and Foss, 2017; Richard et al., 2013; Zhang et al., 2018), there are reasons to expect that gender diversity among senior management could positively impact, negatively impact, or have no impact on strategic change (Triana et al., 2014). Next, we discuss the moderators of the relationship between senior management gender diversity and strategic change, and we formulate hypotheses.

2.2. The moderating role of alliance formation intensity

Diversity scholars have called for research going beyond main effects and investigating contingency factors that explain when knowledge from demographic diversity is more likely to be used, including by the upper echelons (Bromiley and Rau, 2016; Hambrick et al., 1996; Joshi and Roh, 2009; Nishii, 2013; Pieterse et al., 2013; Richard et al., 2007; van Knippenberg and Schippers, 2007). In line with upper echelons theory and gender diversity literature, we propose that gender diversity represents a knowledge-based resource within a firm (Dwyer et al., 2003; Goncalo et al., 2015). However, there is evidence that management-level gender diversity impacts

firm performance both positively and negatively depending upon the organizational context (Dezsö and Ross, 2012; Parola et al., 2015; Richard et al., 2013, 2004).

We offer two important contingencies, alliance formation intensity and TMT educational background diversity, as moderators of the senior management gender diversity to strategic change relationship. **Strategic alliances** represent a mechanism for **organizational learning** because alliances provide a direct interface for participating parties to observe exchanges and absorb knowledge from each other (Inkpen and Tsang, 2007; Koza and Lewin, 2000). The nature of organizational learning through alliances can be further divided into exploration and **exploitation** (March, 1991; Rothaermel and Deeds, 2004). Koza and Lewin (2000) explain that the intent of exploration alliances involves learning new insights and unknown technologies while the purpose of exploitation alliances is to enhance revenue by combining specific assets unique to each alliance partner. Both types of alliances result in organizational learning, thus we focus on overall alliance formation intensity.

Organizational learning is a source of **competitive advantage** and positively relates to firm performance both theoretically (Blettner et al., 2015; Chadwick and Raver, 2015; Martinez-Costa and Jimenez-Jimenez, 2009) and empirically (Jiang and Li, 2008). For example, Martinez-Costa and Jimenez-Jimenez (2009) suggest that organizational learning increases the likelihood that firms can sense trends in the environment which will improve market share. We propose that if a firm is equipped to learn externally through alliance learning as well as internally through a gender-diverse senior management, the firm will possess superior knowledge-based advantages. Thus, this study tests the joint effects of strategic alliance intensity and gender diversity in senior management on firm performance through strategic change.

Upper echelons theory predicts that managers' demographic characteristics are associated with cognition and preferences (Hambrick and Mason, 1984). Although research has shown that diverse work groups embrace new ideas and search for new alternatives (Cox and Blake, 1991; Joshi and Roh, 2009; Nielsen and Nielsen, 2013), firms that have formed exploration and/or exploitation alliances should be well-positioned to execute strategic changes when they have a gender-diverse senior management with knowledge to convert such alliance activities into a competitive advantage. Therefore, senior management gender diversity should have a positive impact on strategic change for organizations that have initiated strategic alliances. In other words, we propose that it would be most evident for senior management diversity to positively impact levels of strategic change in firms that have formed an abundance of strategic alliances, because this external knowledge and these commitments to alliance partners provide them with the ability and motivation to initiate more strategic change consistent with their gender-diverse senior management knowledge base. Furthermore, in the presence of intense alliance learning, we propose that the gender-specific characteristics of senior managers have more opportunity to make a beneficial difference. Without strong organizational learning externally, we expect senior management gender diversity to remain a capability that is not fully exploited, resulting in less strategic change. The following hypothesis is posited:

Hypothesis 1

The relationship between senior management gender diversity and strategic change is moderated by a firm's alliance formation intensity. The relationship between senior management gender diversity and strategic change is positive (negative) for organizations with more (less) alliance formation intensity.

Next, we discuss TMT educational background diversity as a moderating factor.

2.3. The moderating role of TMT educational background diversity

The next prediction is that a gender-diverse senior management representing a variety of perspectives will most likely lead to strategic change when the TMT that interacts with them is diverse with respect to educational backgrounds. Education represents knowledge and the ability to understand and use information while TMT educational background reflects a broader range of skills and information sources used for strategic decision-making (Joshi et al., 2011; Williams and O'Reilly, 1998). Having a variety of educational backgrounds represented in a TMT should maximize the chances that the TMT will solicit knowledge and be able to process and assimilate information from the many different perspectives they encounter among a gender-diverse senior management group. A TMT with different educational backgrounds can enact routines that allow for the knowledge embedded in a gender-diverse senior management group to be more fully utilized because they embrace strategic thinking (Finkelstein and Hambrick, 1996).

Research shows that educational diversity in TMTs is most valuable in facilitating organizational success when the environment is complex. For example, Carpenter and Fredrickson (2001) found that TMT educational diversity predicted firm global strategic posture, particularly under conditions of environmental uncertainty. That study provided evidence that educational diversity is most likely to facilitate strategic actions that lead to firm success when there is some amount of complexity in the environment. However, we offer an important caveat that has not been considered before. Instead of focusing on the external environment's complexity, we consider the internal environment in terms of the complexity of the human capital pool from which the TMT may draw. We propose that a gender-diverse senior management group can offer the complexity of ideas and perspectives that would be sought after by a TMT diverse in educational background. Indeed, research suggests that TMT educational background diversity affords the broad-based experiences and beliefs (Tihanyi et al., 2000) that we argue are compatible with a gender-diverse senior management. Also, a gender-diverse management group may share more knowledge with an open-minded TMT that represents various educational backgrounds (Opstrup and Villadsen, 2014).

Consistent with upper echelons theory, which suggests that a manager's demographic characteristics could be utilized as proxies for their psychological patterns, preferences, and cognitions (Hambrick and Mason, 1984), a gender-diverse senior management should generate more perspectives than a gender-homogenous senior management. These perspectives then need to be considered by the TMT. A TMT with educational diversity will be more adept at filtering and assimilating information from the senior management group because such a TMT knows more and is in a better position to try new ideas (Li and Lo, 2017; Wiersema and Bantel, 1992).

Therefore, when TMT educational background diversity is high, we predict the most positive relationship between senior management gender diversity and strategic change, because the TMT will have the knowledge to process and be receptive to a variety of ideas and perspectives from a gender-diverse senior management. Such a dynamic can also encourage a gender-diverse senior management group to communicate more ideas to the TMT, thereby facilitating more strategic change. This is consistent with research showing that [employee](#) feelings of social inclusion are positively and significantly associated with participation, idea contribution, and job performance ([Pearce and Randel, 2004](#); [Triana et al., 2012](#)). When TMT educational background diversity is low, that is less likely to be the case and the TMT will be less able to absorb new information from a gender-diverse senior management because they have less knowledge and information processing capacity themselves. This could also make a gender-diverse senior management less willing to offer new information to the TMT, which facilitates fewer strategic changes. We offer the following hypothesis.

Hypothesis 2

The relationship between senior management gender diversity and strategic change is moderated by TMT educational background diversity. The relationship between senior management gender diversity and strategic change is positive (negative) for firms with TMT educational background diversity (homogeneity).

2.4. Strategic change as a mediating mechanism

Diversity is a human resource that may confer a competitive advantage ([Ely et al., 2012](#)), yet one of the uncertainties in the upper echelons literature that remains is by what processes do diverse managers impact firm performance ([Hambrick, 2007](#)). Research has relied on cross-sectional designs and methodological issues that limit confidence in the findings ([Murray, 1989](#)), suggesting that scholarship must adopt more robust research designs ([Plümper and Troeger, 2007](#)) to account for mediating processes and explain mechanisms by which executive demography impacts firm performance. Consistent with recent research that considers mediating factors ([Blanco-Oliver et al., 2018](#)), we propose that strategic change is one mechanism by which the effect of senior management gender diversity is transmitted to firm performance. Strategic change involves allocating firm resources in a way that will provide a competitive advantage in the future ([Nakauchi and Wiersema, 2015](#)). For example, a company may invest in advertising, research and development, or equipment ([Triana et al., 2014](#)) to adjust its capacity to meet the future demands of consumers. These changes may pay off in the long-term because investors may react well and see promise in the firm's strategic actions. Consumers may also respond well to changes that better meet their demands, thereby voting with their purchasing power and allowing the firm to make up the costs of strategic change in the long-run (as reflected in market-based measures such as Tobin's q). Although change does not always work, firms always make strategic changes with the intention of improving performance. The literature on the relationship between strategic change and performance reveals many studies that report a positive effect of strategic change on performance ([McDougall and Oviatt, 1996](#); [Zajac et al., 2000](#); [Zhang and Rajagopalan, 2010](#)).

Therefore, it is proposed that senior management gender diversity also affects firm performance indirectly through strategic change, but we emphasize the critical nature of our two moderators

in fully understanding this mediation. As Fig. 1 illustrates, we ultimately suggest a moderated mediation model. We describe our theoretical model in detail below.

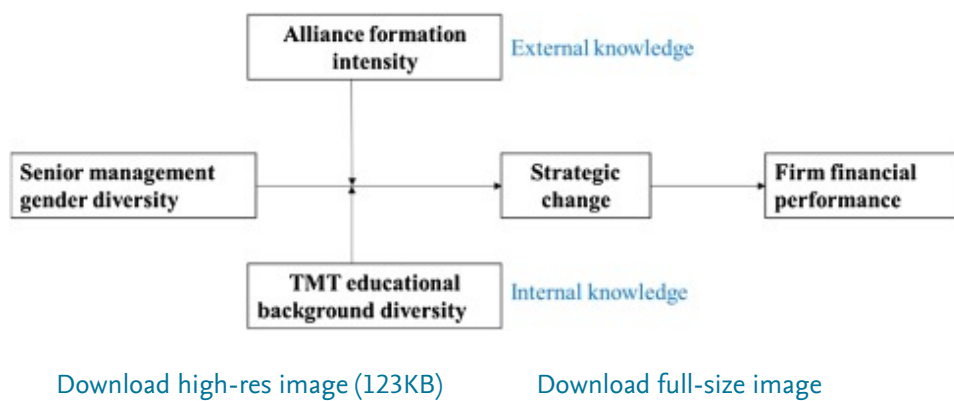


Fig. 1. Conceptual model of senior management gender diversity effects.

Alliance formation intensity and TMT educational background diversity moderate the effect of senior management gender diversity on strategic change. Strategic change transmits the effect of senior management gender diversity to firm performance across these two moderators. More specifically, senior management gender diversity's indirect effect on firm performance, through strategic change, will vary at different levels of both alliance formation intensity and TMT educational background diversity. Given that senior management gender diversity increases strategic change when alliance formation intensity is high and TMT educational background diversity is high, we expect an overall positive effect on subsequent firm performance. In contrast, since we expect senior management gender diversity to limit strategic change when alliance formation intensity is low and TMT educational diversity is low (i.e., homogeneous), we expect to observe a performance decline. Thus, the following comprehensive hypothesis is offered:

Hypothesis 3

The mediating role of strategic change in the relationship between senior management gender diversity and firm performance will be simultaneously moderated by alliance formation intensity and TMT educational background diversity.

3. Empirical analysis

3.1. Sample and data collection

The hypotheses were tested in a sample of the U. S. computer industries with variables ranging from 2007 to 2017. The computer industries include software sectors (SIC codes 3571, 3572, 3575, and 3577) and hardware sectors (SIC codes 7371, 7372, 7373, and 7374). The computer technology industry has a history of underrepresenting women (Williams, 2014), but as female managers are emerging recently into senior management levels, it provides a natural setting to investigate how increasing senior management gender diversity affects companies. In addition,

computer industries are suitable for testing the hypotheses since they include a diverse population of firms in terms of size, scope, and alliance activities (Yang et al., 2011). Moreover, the computer industries provide a sample size that is large enough to assure sufficient power to detect effects (Murray, 1989). Also, because it is important to account for industry differences within the [high tech](#) sector, we include industry dummy variables (Murray, 1989).

Data on senior managers' gender were gathered from the [Equal Employment Opportunity Commission \(EEOC\)](#) as documented in the Equal Employment Opportunity-1 (EEO-1) Report.

Employers with 100 or more [employees](#) in private sectors are required to file an annual EEO-1 report in order to disclose information about their workplace gender composition. Since information from the EEO-1 report is disclosed at a unit/store level, we aggregated EEO-1 subunit data to the firm level and matched it with corresponding Compustat financial information. We collected gender demographics between 2007 and 2011. We started with the year 2007 because it is the first year that the EEOC split the [management category](#) into executive/senior level officials and middle level managers. The mean size of senior management groups in our sample is 134, and the median is 55. (The average number of employees for companies in our sample is 6626; the median number of employees is 1954). Data on alliances were collected from the Securities Data Company (SDC) Platinum database that includes information such as the partners' identities, the alliance announcement date, the deal of the alliance, and the activities in which the alliance engages. After merging data from different databases and discarding records with missing values, our sample contained 566 firm-year observations.

4. Measures

4.1. Dependent variable

4.1.1. Firm performance

Firm performance is measured at time $t + 2$ by Tobin's q . Tobin's q is a proxy for a firm's market value that captures the intangible premium of [workforce](#) diversity (Richard et al., 2007; Wang et al., 2008). Tobin's q is calculated as the sum of the market value of the firm's equity, book value of long-term debt, and book value of short-term liabilities divided by total assets (Chung and Pruitt, 1994).

4.2. Independent variables

4.2.1. Senior management gender diversity

Firms must report the gender of employees to the U.S. government's [Equal Employment Opportunity Commission \(EEOC\)](#) annually in the EEO-1 form. The EEOC defines executives/senior level officials as those:

"who plan, direct and formulate policies, set strategy and provide the overall direction of enterprises/organizations for the development and delivery of products or services, within the

parameters approved by [boards of directors](#) or other governing bodies. Residing in the highest levels of organizations, these executives plan, direct or coordinate activities with the support of subordinate executives and staff managers. They include, in larger organizations, those individuals within two reporting levels of the CEO, whose responsibilities require frequent interaction with the CEO. Examples of these kinds of managers are: chief executive officers, chief operating officers, [chief financial officers](#), line of business heads, presidents or executive vice presidents of functional areas or operating groups, chief information officers, chief human resources officers, chief marketing officers, chief legal officers, management directors and managing partners."

We used only these senior level positions as defined by the EEOC to calculate senior management gender diversity. We calculated senior management gender diversity using [Blau's index of diversity \(1977\)](#) at time t . Blau's index is appropriate for and commonly used to measure diversity for categorical variables ([Harrison and Klein, 2007](#)). For gender, Blau's index is based on two categories, and the theoretical range is from 0 to 0.5. For senior management gender diversity, we have a mean of 0.26 and a [standard deviation](#) of 0.14, implying that females occupy roughly one quarter of these management positions. To stay within the limits of the sample, all interpretations will be restricted to the range of the data. For details about the demographics of the sample broken down by gender and race, see the Appendix. Although women make up 44.7% of the U.S. workforce ([Catalyst, 2018](#)), they comprise 31% of the workforce in the [high tech industries](#), and this number narrows at higher organizational levels (27% of management overall, 28% of middle managers, and 15% of top managers).

4.3. Mediator

4.3.1. Strategic change

Strategic change is the extent to which a firm changed its resource allocations in key strategic dimensions ([Zhang, 2006](#)). Some literature suggests utilizing changes in the product scope of a firm to measure strategic change at the corporate level ([Wiersema and Bantel, 1992](#)), but this approach is not feasible in our study since a majority of computer companies have only one primary SIC code ([Stettner and Lavie, 2014](#)). Therefore, we followed [Finkelstein and Hambrick \(1990\)](#) and [Zhang \(2006\)](#) and chose strategic resource indicators to measure the magnitude of strategic change. The indicators are advertising intensity (advertising expenses/sales), R&D intensity (R&D expenses/sales), inventory levels (inventories/net sales), plant and equipment newness (net plant and equipment/gross plant and equipment), nonproduction overhead (selling, general, and administrative expenses/sales), and [financial leverage](#) (total debt/total assets).

We calculated the one-year lagged differences in these ratios (a one-year difference between year t and year $t + 1$) consistent with previous research ([Zajac et al., 2000](#)). We adopted the absolute value of these values because the absolute value is indifferent to the direction of the change. We then created a z-score so we could aggregate these six resource indicators into a single value that captures the amount of strategic change.

4.4. Moderators

4.4.1. Alliance formation intensity

Firms may form alliances with different motivations and for various purposes (Koza and Lewin, 1998). Some may form alliances to develop new products; some may form alliances to enter new foreign markets. It is subjective, or arbitrary, to evaluate which types of alliances are more exploratory or exploitative compared to others. Therefore, we measure a firm's alliance formation intensity as the number of alliances the firm formed in the previous three years (sum of number of alliances at year t , $t-1$, and $t-2$).

4.4.2. TMT educational background diversity

TMT educational background was also divided into six categories: arts, sciences, engineering, business/economics, law, and other. We calculated TMT educational background diversity for the five highest paid executives using Blau's index (1977). The measure was taken at time t .

4.5. Control variables

We controlled for several firm characteristics in order to account for their effects on the dependent variables. These include *firm size*, measured as the log value of the number of employees, as well as *slack*, calculated as current assets divided by current liabilities, because larger companies with more resources may perform better. *Firm age*, computed as the years after initial public offering, was taken into account. Also, firms located in the same geographic area may generate a cluster effect that affects firm strategy. To capture such a location effect, we included a dummy coded variable (California *headquarters*) coded 1 if the corporate headquarters were in California and 0 otherwise. In addition, we included three conventional TMT background variables to control for TMT effects. A firm's top management team includes the CEO, chairman, chief operating officer, chief financial officer, and other C-level executives that firms document in their annual reports. We identified those top managers and their functional backgrounds. Following prior literature (Wiersema and Bantel, 1992), we divided *TMT functional background* into six categories: marketing/sales, production/operating, R&D/technology, finance/accounting, law, and general. We used Blau's index to calculate TMT functional background diversity. We also calculated *TMT average age* and *TMT average tenure* as control variables. Lastly, we included within-industry dummy variables to control for hardware versus software differences and year dummies to control for temporal effects. These variables were omitted from the tables for brevity. All controls were measured at time t .

4.6. Analyses

Time series cross-sectional, generalized least squares regressions (GLS) were conducted to test the hypotheses. We chose random-effects models over fixed-effects models for three reasons. First, the result of the Hausman (1978) test suggested the preferred model was random effects ($p > 0.05$). Second, fixed-effects models reduce degrees of freedom and may generate biased estimates (Wooldridge, 2002). Third, since senior management gender changes quite slowly over short time periods, using a fixed-effects model may severely constrain our analyses (Plümper

and Troeger, 2007). We employed a two-year lag on the dependent variable to avoid endogeneity derived from reverse causality.

5. Results

Table 1 presents descriptive statistics and correlations. No correlation value among the variables is higher than 0.60, suggesting the chance of multicollinearity is low. Moreover, we computed the variance inflation factors (VIF) which are $1/\text{Tolerance}$ to further assess multicollinearity. The econometrics textbook written by Wooldridge (2013, 94) states: “Setting a cutoff value for VIF is arbitrary and not especially helpful. Sometimes the value 10 is chosen” meaning VIF should be under 10. The values of VIFs in our main models for our explanatory variables are all below 2, except for industry dummies. The highest VIF for an industry dummy is 8.2 (which is the prepackaged software dummy, SIC = 7372). Although there is one high VIF in our industry controls, the remaining VIFs of our main explanatory variables are well below the cutoff value of 10. Multicollinearity concerns are, therefore, low.

Table 1. Descriptive statistics.

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--|-------|------|--------|--------|-------|-------|-------|--------|--------|-------|---|----|
| 1. Firm performance (Tobin's q) | 0.98 | 0.33 | 1 | | | | | | | | | |
| 2. Strategic change | 0.01 | 0.23 | 0.07 | 1 | | | | | | | | |
| 3. Firm size | 1.16 | 1.05 | -0.05 | -0.10* | 1 | | | | | | | |
| 4. Slack | 2.23 | 1.74 | 0.10* | -0.10* | -0.07 | 1 | | | | | | |
| 5. Firm age | 12.36 | 7.39 | -0.19* | -0.17* | 0.53* | -0.06 | 1 | | | | | |
| 6. California headquarters | 0.32 | 0.47 | 0.06 | -0.02 | -0.05 | -0.04 | -0.06 | 1 | | | | |
| 7. TMT functional background diversity | 0.61 | 0.10 | 0.10* | -0.05 | -0.04 | 0.04 | -0.05 | 0.08 | 1 | | | |
| 8. TMT average age | 49.48 | 2.81 | -0.11* | 0.01 | 0.10* | -0.06 | 0.10* | -0.06 | -0.09* | 1 | | |
| 9. TMT average tenure | 10.00 | 4.44 | 0.00 | -0.05 | 0.06 | 0.01 | 0.06 | -0.09* | 0.10* | 0.29* | 1 | |

| | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|--|------|------|-------|-------|--------|--------|-------|-------|-------|--------|-------|-------|
| 10. Senior management gender diversity | 0.26 | 0.14 | 0.06 | -0.07 | 0.03 | -0.18* | 0.03 | 0.00 | -0.01 | 0.01 | 0.00 | 1 |
| 11. Alliance formation intensity | 1.75 | 2.62 | -0.05 | -0.07 | 0.29* | -0.12* | 0.17* | 0.10* | 0.12* | -0.05 | -0.04 | -0.07 |
| 12. TMT educational background diversity | 0.51 | 0.21 | 0.21* | -0.00 | -0.17* | -0.07 | -0.05 | 0.25* | 0.33* | -0.23* | 0.08* | 0.03 |

California [headquarters](#) is coded as 1 if the corporate headquarters are in California and coded as 0 otherwise.

N = 566;

*

$p < 0.05$.

Table 2 reports the results of GLS estimations. Hypothesis 1 predicts that alliance formation intensity positively moderates the relationship between senior management gender diversity and strategic change. Model 4 of Table 2 provides the results for the moderation effects. The Senior management gender diversity \times Alliance formation intensity interaction term is significant ($b = 0.04$, $p < 0.001$). We plotted the interaction effect in Fig. 2 to further examine the relationships visually. In Fig. 2, we generally observe that there is a positive association between senior management gender diversity and strategic change for firms with high alliance formation (i.e., alliance numbers = 6) but a negative association for firms with low alliance formation (i.e., alliance numbers = 0). Therefore, Hypothesis 1 is supported.

Table 2. Results of GLS models for senior management gender diversity on strategic change.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|-----------|---------|--------------|---------|----------|
| Firm size | -0.01** | -0.02** * | -0.01** | -0.01*** |
| | (0.00) | (0.00) | (0.00) | (0.00) |

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---------------------------|---------------------------|---------------------------|---------------------------|
| Slack | -0.01 ^{**} * | -0.01 ^{**} * | -0.01 ^{***} | -0.01 ^{***} |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Firm age | -0.00 ^{**} * | -0.00 ^{**} * | -0.00 ^{***} | -0.00 ^{***} |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| California headquarters | -0.00 | -0.01 | -0.01 | -0.01 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| TMT functional background diversity | -0.07 [*] | -0.06 [†] | -0.09 ^{**} | -0.05 |
| | (0.03) | (0.03) | (0.03) | (0.03) |
| TMT average age | -0.00 | 0.00 [†] | -0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| TMT average tenure | -0.00 | -0.00 [†] | -0.00 | -0.00 |
| | (0.00) | (0.00) | (0.00) | (0.00) |
| Senior management gender diversity | | -0.16 ^{**} * | -0.13 ^{***} | -0.38 ^{***} |
| | | (0.02) | (0.02) | (0.08) |
| Alliance formation intensity | | | -0.00 [*] | -0.01 ^{***} |
| | | | (0.00) | (0.00) |
| TMT educational background diversity | | | 0.03 | -0.09 [*] |
| | | | (0.02) | (0.04) |
| Senior management gender diversity × Alliance formation intensity | | | | 0.04 ^{***} |
| | | | | (0.01) |
| Senior management gender diversity × TMT educational background diversity | | | | 0.45 ^{**} |
| | | | | (0.15) |
| Constant | 0.21 ^{**} | 0.22 ^{**} | 0.22 ^{**} | 0.21 ^{**} |
| | (0.07) | (0.07) | (0.07) | (0.08) |
| Wald Chi-square | 173.77 [*] ** | 364.85 [*] ** | 452.02 [*] ** | 280.42 [*] ** |
| N | 566 | 566 | 566 | 566 |

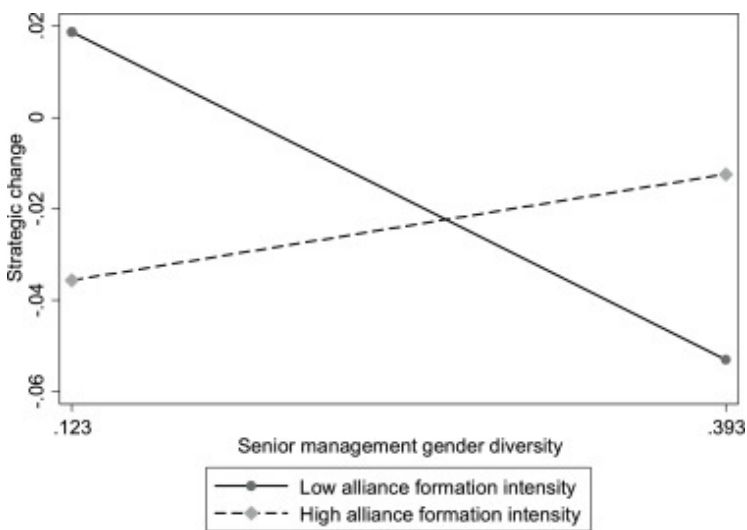
Note: 4-digit industry dummies and year dummies are included. Standard errors are reported in parentheses. Two tailed tests.

†
 $p < 0.10.$

*
 $p < 0.05.$

**
 $p < 0.01.$

 $p < 0.001.$

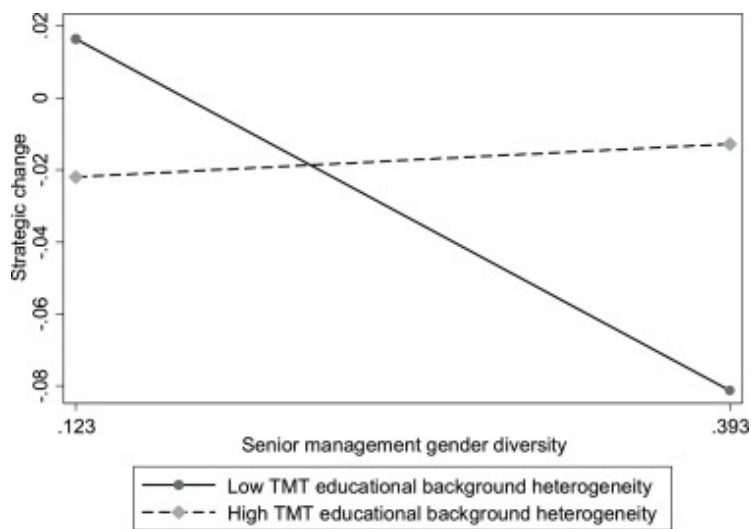


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Fig. 2. Interaction effect between senior management gender diversity and alliance formation intensity on strategic change.

Hypothesis 2 predicts that TMT educational background diversity has a positive moderating effect on the relationship between senior management gender diversity and strategic change. Model 4 of Table 2 provides results for this moderation test. The Senior management gender diversity \times TMT educational diversity background interaction term is significant ($b = 0.45, p < 0.01$). Fig. 3 graphically shows the interaction effects. In Fig. 3, we observe that in firms with a high level of TMT educational background diversity, strategic change increases as senior management gender diversity increases, but in firms with a low level of TMT educational background diversity, strategic change decreases as their senior management gender diversity increases. Hypothesis 2 is, therefore, supported.



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Fig. 3. Interaction effect between senior management gender diversity and TMT educational background diversity on strategic change.

Hypothesis 3 states that the mediating role of strategic change in the relationship between senior management gender diversity and firm performance will be moderated by both alliance formation intensity and TMT educational background diversity. In order to conduct a comprehensive test of our entire model, we ran the Hayes PROCESS Model 9 macro (Hayes, 2015) in SPSS for moderated mediation including both moderators (alliance formation intensity and TMT educational background diversity) in the model. While structural equation modeling is a popular choice for testing mediation when research papers use latent constructs (e.g., Boswell et al., 2012), we opted to use regression with the Hayes PROCESS macro because we do not have latent constructs. Thus, the Hayes PROCESS macro is appropriate for our data (Hayes et al., 2017; Hayes and Preacher, 2013), and this technique provides statistical output that can be easily interpreted by end users.

Table 3 reveals that strategic change mediates the senior management gender diversity to firm performance relationship (coefficient = $-.101$; standard error = $.044$; lower level of the 95% confidence interval = $-.211$ and upper level of the 95% confidence interval = $-.031$), and the relationship is significant and negative when alliance formation intensity and TMT educational background diversity are both low. This shows the market does not respond as well under these circumstances due to the lack of strategic change because firm performance declines. However, findings show that senior management gender diversity increases firm performance via an acceleration of strategic change when alliance formation intensity is high and TMT educational background diversity is high (coefficient = $.056$; standard error = $.035$; lower level of the 95% confidence interval = $.001$ and upper level of the 95% confidence interval = $.141$). In sum, Hypotheses 1 through 3 are supported.

Table 3. Moderated-mediation results presenting 2 way interaction effects of senior management gender diversity \times alliance formation intensity and senior management gender diversity \times TMT educational background diversity on performance through strategic change.

| | Alliance Formation Intensity | TMT Educational Background Diversity | Firm Performance (Tobin's q) | | | |
|--|------------------------------|--------------------------------------|------------------------------|--------------|---------------|---------------|
| | | | Indirect Effect | SE | LL 95% CI | UL 95% CI |
| Senior Management Gender Diversity Effects Through Strategic Change | Low | Low | -0.101 | 0.044 | -0.211 | -0.031 |
| | Low | Moderate | -0.054 | 0.025 | -0.116 | -0.012 |
| | Low | High | -0.008 | 0.022 | -0.06 | 0.029 |
| | High | Low | -0.037 | 0.042 | -0.115 | 0.059 |
| | High | Moderate | 0.009 | 0.031 | -0.032 | 0.105 |
| | High | High | 0.056 | 0.035 | 0.001 | 0.141 |

Note: N = 566. Bootstrap sample size = 10,000.

Values for the moderators are the mean (moderate) and +1 SD (high)/ -1 SD (low) from the mean.

LL = lower level and UL = Upper level bias-corrected CI (confidence interval).

Values in bold indicate statistical significance at $p < .05$.

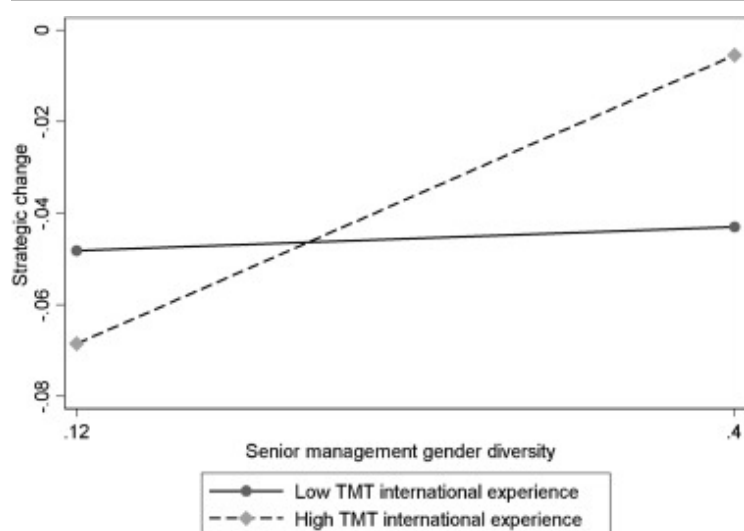
5.1. Supplemental analyses

We examined whether our moderated mediation results would be consistent if we distinguished between exploration alliance formation and **exploitation** alliance formation instead of using our combined alliance formation measure. We analyzed each alliance from the SDC database to categorize whether an alliance was exploratory based on [March \(1991\)](#) and counted the number of exploration alliances a firm formed in each year. Following [Lin et al. \(2009\)](#); [Rothaermel \(2001\)](#), and [Yang et al. \(2011\)](#), we coded *exploration alliance* if the purpose was to discover or to experiment with new technology such as R&D and **software development**. Next, we counted the number of exploitation alliances a firm formed in each year. If the purpose of the alliance was to utilize resources between alliance partners such as marketing, finance, and transportation, we coded it as an *exploitation alliance*. The pattern of results was similar across exploration, exploitation, and the combined measure of alliances.

Some may wonder whether internal knowledge could come from other experiences such as TMT functional background diversity, TMT non-computer industry experience, and TMT international work experience. Therefore, we investigated these variables as alternative sources of internal knowledge. Regarding TMT functional background diversity, results show that there

is no significant moderating effect of TMT functional background diversity on the relationship between senior management gender diversity and strategic change, but the moderating effect of alliance formation intensity remains significant. The lack of moderation may suggest that executives in their functions spend most of their time operating within their own routines (Bermiss and Murmann, 2015; Fligstein, 1987; Ocasio and Kim, 1999). Because each function develops its own set of techniques and processes, functional executives tend to become rivals rather than cooperate across each function (Connelly et al., 2014).

We also collected data on TMT executives' non-computer industry experience and international experience. We hand collected this information for the 1370 TMT executives in our sample by conducting a search of their LinkedIn profile, their Bloomberg profile, or a general Google search of information about them at their company web page or other sources. Specifically, we checked each manager's prior work experience. If the manager had work experience outside the U.S., we coded 1, otherwise we coded 0. We also examined all prior jobs the manager had and whether any of them were outside of the computer industry (coded 1 if they had experience outside of the computer industry, 0 otherwise). We then aggregated these data to the firm level and divided by the number of top management team members. In sum, we created two additional TMT background variables: TMT international experience and TMT prior non-computer industry experience. We did not find any significant effects of senior management gender diversity \times TMT prior non-computer industry experience predicting strategic change. However, we did find a significant moderating effect of senior management gender diversity \times TMT international experience predicting strategic change ($b = 0.81, p < 0.05$). The interaction effect shown in Fig. 4 is similar to the moderating effects of TMT educational background diversity and alliance formation intensity. The famous American writer, Mark Twain, once said that: "travel is fatal to prejudice, bigotry, and narrow-mindedness, and many of our people need it sorely on these accounts" (Twain, 1884, reprinted in 2012: 310). It appears that TMT international experience is another TMT characteristic (like TMT educational background diversity) that triggers open-mindedness and embracing of new ideas from a gender-diverse senior management, thereby leading to more strategic change.



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Fig. 4. Interaction effect between senior management gender diversity and TMT international work experience on strategic change.

Lastly, we conducted an additional test lagging the dependent variable more years. Specifically, we changed our firm performance measure (Tobin's q) to $t + 5$, which corresponds to the year 2017. The results were consistent with our main findings.

6. Discussion

Previous upper echelons research has often focused on the top five highest paid executives, neglecting individuals within two reporting levels of the CEO who interact with the CEO and are executive decision-makers. Our goal is to offer a comprehensive study using a broader definition of the upper echelons that not only aligns with the upper echelons perspective theoretically and practically but also possesses robust predictive validity on strategic change above and beyond previously studied top management team characteristics (e.g., TMT functional background). People within two reporting levels of the CEO are considered senior executives by the [Equal Employment Opportunity Commission](#) because they interact with the highest paid executives to shape strategy. We propose that the [knowledge-sharing](#) associated with increased senior management gender diversity can be more adequately captured when one defines the upper echelons as the TMT (the top five highest paid executives including the CEO), together with other senior executives who are involved in executive decision-making such as (but not limited to) presidents or executive vice presidents of functional areas or operating groups, chief human resources officers, chief information officers, and chief marketing officers. Our expanded scope regarding who impacts strategic change and firm performance beyond the TMT has research implications for upper echelons theory.

6.1. Theoretical implications

The present study expands upper echelons research. From a theoretical perspective, there is a need to integrate other research streams with upper echelons theory ([Hambrick and Mason, 1984](#)) to more fully determine the mechanisms that explain how diversity contributes to or detracts from firm performance. Hence, we sought to merge the [organizational learning](#) literature related to [strategic alliance](#) formation and learning with upper echelons theory to provide a more comprehensive framework for studying senior management gender diversity. This study joins macro-level [scholarship](#) that places gender at the focal point ([Dezsö and Ross, 2012](#); [Nishii, 2013](#); [Triana et al., 2014](#)). The present study utilized a large, longitudinal sample of U.S. computer technology companies as a backdrop to study gender in senior management and find support for the hypotheses. Specifically, results show that senior management gender diversity relates to firm performance through the mechanism of strategic change. Senior management gender diversity is negatively associated with strategic change. Further, both alliance formation intensity and TMT educational background diversity not only moderated the relationship between senior management gender diversity and strategic change but also moderated the mediating effect of strategic change on the senior management gender diversity to firm performance relationship.

Upper echelons theory maintains that a firm's actions are the result of its top executives applying their own filters to environmental stimuli to interpret the environment (Hambrick and Mason, 1984). Per upper echelons theory, this process of filtering information involves the top executives using their cognitive base, values, selective perception, and interpretation to make strategic choices. Hambrick and Mason (1984, 1996) focused on characteristics including "age, tenure in the organization, functional background, education, socioeconomic roots, and financial position." In this study, we support and extend upper echelons theory by showing that senior management gender diversity, and the company's level of strategic change influence firm performance. This more detailed look at upper echelons theory supports the original theory since the characteristics of the senior managers influence the firm's outcomes, such as strategic change and firm performance. It also extends upper echelons theory by taking a more nuanced approach to explain how and under what conditions (i.e., alliance formation intensity, TMT educational background diversity) those senior managers' characteristics impact firm outcomes in accordance with our theoretical model (see Fig. 1).

The present investigation concentrated on gender diversity because of the ambiguity in the diversity literature regarding whether or not it hampers performance, as reviews of the literature predict (Menz, 2012; Williams and O'Reilly, 1998), or bolsters performance, as the value in diversity hypothesis predicts (Cox and Blake, 1991; Richard and Shelor, 2002). Indeed, scholars have characterized gender diversity as a double-edged sword dimension of diversity (Milliken and Martins, 1996; Pieterse et al., 2013). Our integration of the strategic alliance and upper echelons literatures to explain diversity effects may have implications for other visible dimensions of diversity, especially national culture diversity (Pieterse et al., 2013).

Our findings reiterate that gender diversity effects in the upper echelons are nuanced rather than straightforward (Triana et al., 2014). Results show that gender diversity in senior management facilitates strategic change under conditions of high alliance formation intensity, which promotes organizational learning, and in situations where the TMT has a diversity of educational backgrounds from which to draw when making decisions. Thus, upper echelons theory can be extended to describe that gender diversity in senior management may most positively affect strategic change and firm performance when the organization is predisposed to building alliances and when the TMT has a diverse educational background which may facilitate listening to and learning from a variety of perspectives.

6.2. Managerial implications

The present findings challenge the assumption that demographic diversity represents a problem to be managed rather than a resource to be used for competitive advantage. With the steady increase of women within senior management, gender represents a diversity attribute worthy of investigation for research and practice. Our findings are consistent with research supporting the business case for diversity which found that gender diversity among the upper echelons is associated with more innovation (Miller and Triana, 2009) and weakly but positively associated with firm performance (Jeong and Harrison, 2017; Post and Byron, 2015). The findings suggest that it may be good to have a balance of women and men in firms because

gender diversity improves market-based performance by bolstering strategic change when alliance formation intensity is high and the TMT possesses educational background diversity.

We sought to investigate whether firms with varying levels of senior management gender diversity are in a better or worse position to strategically change when they have particular alliance structures and TMTs of different educational backgrounds. Findings show that senior management gender diversity was related to firm performance (Tobin's q) through strategic change and that this mediation effect was moderated by both alliance formation intensity and TMT educational background diversity. Furthermore, senior management gender diversity appears to be related to firm performance through strategic change in a different manner when considering high versus low levels of the moderators which highlights the critical need to understand the context in which this diversity operates. Taken together, the present findings suggest that cracking the glass ceiling may not only be ethical but also good for business. Senior manager gender diversity has the most positive impact on the future amount of strategic change and firm performance in complex, information-rich environments (i.e., with alliance formation intensity; with TMT educational background heterogeneity).

In sum, results support the business case for diversity (Cox and Blake, 1991; Pless and Maak, 2004; Thomas and Ely, 1996), because they suggest that diverse individuals who represent multiple perspectives can be positively associated with organizational performance. The present findings show that gender diversity in senior management is associated with more strategic change when firms have more alliances and the TMT has educational diversity. This supports the notion that diversity makes the most difference when the environment is receptive and able to utilize the knowledge that diversity has to offer. These findings are consistent with Lozano and Escrich's (2017) ethics theory, which maintains that being tolerant of minority groups is not good enough. Instead, full respect and integration of minority groups into organizations comprised of mostly majority group members needs to be achieved in order for organizations to perform their best. While tolerance is intended to facilitate peace between different groups (like passengers who sit together on a train), if perspectives from different groups of people are not utilized for learning and well integrated into the organization, tolerance does not result in positive interactions with full respect (Lozano and Escrich, 2017). Our findings suggest that organizations may lose an important source of competitive advantage from diverse employees who can help the organization perform better if they do not have an inclusive culture to achieve integration of the various demographic groups in their workforce.

6.3. Limitations and future research directions

Future research may further investigate the practical impact of gender as well as other types of diversity within an alliance and social network context. For instance, the rationale for increasing task-based diversity has dominated the upper echelons literature while surface-level categories, such as gender, have not been considered to represent knowledge and differences in perspectives (Williams and O'Reilly, 1998). However, the basic tenets of upper echelons theory suggest that all of a manager's demographic characteristics could be utilized as proxies for their psychological patterns, preferences, and cognitions (Hambrick and Mason, 1984). Furthermore, van Knippenberg et al. (2004) suggest that scholars not put salient traits in a different box than

deep-level traits (e.g., values, personality) and propose that future research disentangle when various diversity measures have similar or different effects on outcomes of interest.

Future research should also consider other mediating factors that may link senior [management diversity](#) to firm performance ([Phelps et al., 2012](#)). For example, [Andrevski et al. \(2014\)](#) found that a firm's competitive actions mediated the relationship between overall management diversity (aggregate of lower level, mid-level, and top level) and financial performance. Other process variables such as information elaboration and innovation also offer promise as internal firm mechanisms ([Miller and Triana, 2009](#); [Pieterse et al., 2013](#)).

In addition, research should consider other moderating factors. For example, one could consider aspects of relational network ties including structural holes, network tie strength, network tie diversity, and network partner diversity ([Phelps et al., 2012](#)) which could offer new insight into senior management diversity effects on performance outcomes. Hence, we call for future scholarship to examine the moderating effects of social network properties. Additional contextual considerations might be aspects of the external environment such as [board of director](#) composition ([Miller and Triana, 2009](#)). For example, would it be more effective for the senior management demography to mirror that of the board of directors or should they complement one another by having a different demographic composition between the two entities? Women have been consistently under-represented on boards of directors for many decades ([Campbell and Mínguez-Vera, 2008](#); [Chapple and Humphrey, 2014](#); [Joecks et al., 2013](#); [Wahid, 2018](#)). Might achieving gender representation on boards proportional to the representation of men and women in workplaces help supplement knowledge gaps for firms where women are under-represented in senior management? Future research may investigate these questions.

Research also needs to go beyond investigating inter-organizational strategic alliances to examine intra-organizational networks. Dynamics among executives and the individual ties they have within and outside the firm can have implications for both senior management and their collaborations ([Wang et al., 2014](#)). One limitation of our study is that we do not have demographic data from each firm with which the focal firm has formed an alliance. The degree of similarity between the demographics of senior managers at a given firm and those of the senior managers at a firm with which they create alliances may be telling if there are homophily, or similarity-attraction effects, facilitating alliance formation ([Ibarra, 1992, 1993](#)). [Cummings \(2004\)](#) explains that demographic diversity should be most valuable when it exposes members to unique sources of knowledge. [Westphal and Milton \(2000\)](#) also report that demographic minority directors on boards are most influential on a given board when they have network ties to majority members on that same board from an association where those two directors serve together on a different board. It is possible that alliances are most fruitful when senior managers have a diverse group of acquaintances at other firms and use those connections to provide an influx of information and many alliance partners from which to choose.

We also suggest that human resource management systems, or diversity management practices, might be an important component to include in future research exploring diversity effects. For example, human resource practices such as appraisal and reward systems can be tailored to

contribute to job security, promote [risk-taking](#), and foster innovation, which would seem to be important moderators ([Patel et al., 2013](#)). Furthermore, human resource management systems that include participation programs and decentralized decision-making will allow more collaboration, inclusion in decision-making, and, ultimately, more elaboration of task-relevant information among executives within management ([Nishii, 2013](#); [Richard et al., 2013](#); [van Knippenberg and Schippers, 2007](#)). Such elements are critical in fostering a climate for inclusion which has been shown to reduce the potential negative processes associated with diversity ([Nishii, 2013](#)). In our case, a climate for inclusion could positively moderate the senior management gender diversity to strategic change relationship.

Furthermore, the present study investigates the computer technology industry, so the results best generalize to similar [knowledge-intensive industries](#). Although this allowed us to more adequately test our hypotheses by ruling out industry differences, we sacrificed the potential to make predictions about other traditional industries (e.g., the textiles industry). Thus, future research should test whether our findings generalize to other industries. Moreover, it would be ideal to consider effects that occur not only at the corporate level but also at the subsidiary level. We focused exclusively at the corporate level of analysis because financial data are readily available, but a multi-level approach would account for diversity effects from the subsidiary level to the regional level and up to the corporate level. It could be that one institutional level drives diversity effects more so than another, depending upon the industry.

Additionally, senior management gender diversity effects can be investigated across nations. [Hambrick \(2007\)](#) noted that because executives have more managerial discretion in the U.S., companies in the U.S. are more likely to observe effects in line with our predictions. However, scholars exploring senior management diversity across national cultures should consider power distance, [collectivism](#), and other cultural dimensions when crafting their hypotheses ([Rabl et al., 2014](#)). Then we may fully understand when upper echelons demographic effects are generalizable.

7. Conclusion

Although challenges remain in fully breaking the glass ceiling in the U.S. ([Catalyst, 2018](#); [Hoobler et al., 2011](#)), the present study reveals that cracks in the glass ceiling pertaining to senior management gender diversity allow firms to realize a [competitive advantage](#) from their diversity through strategic change. This study goes beyond the naive approach to understanding diversity effects, which assumes diversity is always good or always bad. Instead, we offer a more sophisticated, holistic approach which examines the influence of senior management gender diversity within the context in which the firm operates ([Joshi and Roh, 2009](#)). Developing the role of inter-organizational learning and other organizational features as contexts in which the senior [management diversity](#) to firm performance relationship unfolds appears to be a fruitful path for future [scholarship](#). Such a research path can help answer calls from academics and practitioners regarding the impact of gender diversity in the upper echelons, defined broadly and more holistically. Importantly, results support that providing equal opportunity for advancement of both men and women to senior management can also be good for business.


Declaration of interests

None.

Appendix A. The Composition of Gender and Race in the Computer Industries Sample

| Rank | Composition ratio | Mean | S.D. | Rank | Composition ratio | Mean | S.D. |
|---------------------------|------------------------------|------|------|-----------------|------------------------------|------|------|
| Top managers | White male ratio | 0.73 | 0.17 | Middle managers | White male ratio | 0.56 | 0.14 |
| | Black male ratio | 0.01 | 0.02 | | Black male ratio | 0.02 | 0.02 |
| | Hispanic male ratio | 0.02 | 0.05 | | Hispanic male ratio | 0.03 | 0.04 |
| | Asian male ratio | 0.09 | 0.13 | | Asian male ratio | 0.11 | 0.14 |
| | Native American male ratio | 0.00 | 0.01 | | Native American male ratio | 0.00 | 0.00 |
| | White female ratio | 0.14 | 0.10 | | White female ratio | 0.22 | 0.11 |
| | Black female ratio | 0.00 | 0.02 | | Black female ratio | 0.01 | 0.02 |
| | Hispanic female ratio | 0.00 | 0.03 | | Hispanic female ratio | 0.01 | 0.02 |
| | Asian female ratio | 0.01 | 0.03 | | Asian female ratio | 0.04 | 0.04 |
| | Native American female ratio | 0.00 | 0.00 | | Native American female ratio | 0.00 | 0.00 |
| Management overall | White male ratio | 0.58 | 0.13 | Firm overall | White male ratio | 0.48 | 0.13 |
| | Black male ratio | 0.01 | 0.02 | | Black male ratio | 0.03 | 0.03 |
| | Hispanic male ratio | 0.02 | 0.02 | | Hispanic male ratio | 0.03 | 0.04 |
| | Asian male ratio | 0.11 | 0.13 | | Asian male ratio | 0.13 | 0.13 |
| | Native American male ratio | 0.00 | 0.00 | | Native American male ratio | 0.00 | 0.00 |
| | White female ratio | 0.22 | 0.10 | | White female ratio | 0.21 | 0.10 |
| | Black female ratio | 0.01 | 0.02 | | Black female ratio | 0.02 | 0.03 |
| | Hispanic female ratio | 0.01 | 0.02 | | Hispanic female ratio | 0.02 | 0.03 |
| | Asian female ratio | 0.03 | 0.03 | | Asian female ratio | 0.06 | 0.04 |
| | Native American female ratio | 0.00 | 0.00 | | Native American female ratio | 0.00 | 0.00 |

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