Top Management Team diversity and high performance: an integrative approach based on Upper Echelons and Complexity Theory

Abstract

This paper analyses Top Management Team (TMT) composition diversity as an antecedent of firm performance in accordance with a recent paradigm based on Complexity Theory. Research into TMT diversity is commonly seen as a double-edged sword because inconclusive results have been achieved in prior studies. This controversy has reinforced the call to employ a more appropriate methodology by moving beyond the reliance on multiple regression analysis and towards the use of fuzzy-set qualitative comparative analysis. The study provides various TMT diversity configurations that lead to high performance. The study therefore contributes towards the TMT diversity literature by utilising asymmetric testing to advance in the understanding of the diversity of TMT attributes as an antecedent of high firm outcome. The paradigm currently facing TMT internal complexity is doubly relevant for managers, to ascertain the best TMT diversity compositions to achieve the best strategic goal and thereby the highest firm outcome, and for new research avenues in the demographic literature, to obtain richer insights from TMT data, which might provide additional information on the complex relations established within these TMTs.

Keywords: TMT composition diversity, High firm performance, Complexity Theory, Fuzzy-set qualitative comparative analysis, Asymmetric testing.

1. Introduction

The highly complex knowledge held by members of Top Management Teams (TMTs) is essential for a firm's success (Chen, Kang & Butler, 2019; Drucker, 1974; Hambrick, 2007; Roh, Chun, Ryou & Son, 2019). However, this knowledge requires an in-depth and valued understanding of the features of the TMT and the way they interact, to achieve the planned goals involved in a managerial process (Díaz-Fernández, González-Rodríguez & Simonetti, 2015 a, b; Hutzschenreuter & Horstkotte, 2013; Lampaki & Papadakis, 2018). The relevance of the managerial role played by TMT members has been recognised as the beginning of the century, and abundant literature has been produced concerning Upper Echelons (Certo, Lester, Dalton & Dalton, 2006; Lin & Kuo, 2007; Crossland & Hambrick, 2011; Wiersema & Bird, 1996). This theory, introduced and developed by Hambrick and Mason (1984), claims that organisations are a reflection of their top managers as the traits of the TMTs are determinants of a firm's strategic choices and thereby of its organisational performance (Crossland, Zyung, Hiller & Hambrick, 2014; Georgakakis, Greve & Ruigrok, 2017; Yohannes & Ayako, 2016).

In addition to the recognition of the major role that the diversity of TMTs plays in firm performance (Akewushola, Elegunde & Saka, 2018; Bach & Lee, 2018; Oduor and Kilika, 2018), a considerable debate and controversy has also emerged around this school of thought, which is widely known as the 'Black box' of the literature on demography (Hope, Eisenhardt & Xin, 1999; Lawrence, 1997; Simons, Pelled & Smith, 1999). In this debate, the mechanism underlying the relationship between demographic and managerial traits and organisational outcomes acquires special relevance (Boone, Lokshin, Guenter and Belderbos, 2019; Buyl, Boone, Hendriks & Matthyssens, 2011; Mohr & Batsakis, 2018; Nielsen & Nielsen, 2013). Despite efforts made by researchers of organisational demography to analyse the influence of TMT diversity attributes on firm performance (Allen, Dawson, Wheatly, & White, 2008; Auden, Shackman, & Onken, 2006; Díaz-

Fernández, González-Rodríguez, & Simonetti, 2015c; Erhardt & Werbel, 2003), the results achieved appear to be contradictory when focusing on different environmental and methodological issues (Pelled, Eisenhardt, & Xin, 1999; Smith, Smith, Sims, O'Bannon, Scully, & Olian, 1994; Tihanyi, Ellstrand, Daily & Dalton, 2000). The controversy, which remains largely unresolved (Bantel & Jackson, 1989; Díaz-Fernández, González-Rodríguez, & Pawlak, 2014; Roh et al., 2018), might have been caused by any of several reasons: The widespread use of an inappropriate methodology (Dainty, 2008; Murray, 1989; Wiersema and Bowen, 2009); the fact that the Upper Echelons conceptualisation remains insufficiently mature to provide practitioners with a comprehensive knowledge of its main purpose (Abatecola & Cristofaro, 2018; Buchanan and Bryman, 2007; Cassell & Johnson, 2006); and the influence of the complex and competitive environment in which the managers of the companies operate (Haleblian & Finkesltein, 1993; Vachon & Klassen, 2008; Yamak et al. 2014).

On the other hand, it is widely recognised that 'Upper Echelons research is increasingly multidisciplinary in nature' (Nielsen, 2010, p. 1). Because of its historically evolving and self-propagating basis, research into Upper Echelons has entered diverse research fields both inside and outside the academic discipline of management (Wren & Bedeian, 2017), which has led to consistent streams of research and theories (Abatecola & Cristofaro, 2018; Carpenter, Geletkanycz & Sanders, 2004; Hambrick, 2007; Dhaouadi, 2018). Furthermore, as Whetten (1989) points out, the most innovative contributions in Upper Echelons research are those regarding demographic literature when combined with other theories from different scientific disciplines. Moreover, the complexity of diversity within TMTs needs to be acknowledged and operationalised accordingly, and the relevance of adopting a multilevel research approach should be stressed (Cannella & Holcomb, 2015), in addition to that of devoting attention to socio-behavioural and cognitive influences (Bromiley & Rau, 2016) within TMTs.

In accordance with the aforementioned arguments, a new approach emerges whereby the Complexity Theory (CT) on the Upper Echelons framework delves more deeply into the complexity of the relationships between TMT composition diversity and high firm performance. In the traditional academic literature, the influence of TMT diversity on firm outcomes has been widely recognised by scholars (Buyl, Boone & Hendriks, 2014; Cannella, Park & Lee, 2008; Nielsen & Nielsen, 2013; van Dijk, van Engen, & van Knippenberg, 2012). However, the results achieved by using multiple regression analysis (MRA) and structural equation modelling (SEM), which assume symmetric relations among the variables, appear to be inconclusive. Although several papers show evidence of positive relationships between certain TMT diversity attributes and performance (Nielsen, 2010), others report negative relationships (O'Relly, Snyder, Boothe, 1993; Simons et al., 1999) and even no relationship at all (Farrell & Hersch, 2005; Nüesch, 2009). These results give rise to the consideration of asymmetric complex relationships between the composition diversity of TMTs and firm outcomes.

Based on the CT, Woodside (2013 a, b; 2014; 2015) advocates a new paradigm in research, by moving from symmetric testing to asymmetric testing of the relationships between variables through fuzzy-set qualitative comparative analysis (fsQCA). Despite fsQCA being originally developed by researchers pertaining to the field of sociology (Ragin, 2008), it has recently gained attention in other scientific and academic areas, such as management (Crilly, Zollo & Hansen, 2012; Misangyi, Greckhamer, Furnari, Fiss, Crilly & Aguilera, 2017; Greckhamer, Misangyi, Elms & Lacey, 2008; Misangyi, Greckhamer, Furnari, Fiss, Crilly & Aguilera, 2017), innovation (Ordanini & Maglio, 2009; Ordanini et al., 2014), organisation science (Fiss, 2007; Fiss, 2011; Meier & Donzé, 2012) and marketing (Chung & Woodside, 2011; Schuchmacher et al., 2013; Woodside

& Zhang, 2012), to delve deeper into the knowledge and understanding of the complex configuration of antecedent conditions that explain an outcome.

The present study contributes towards Upper Echelons by highlighting the asymmetric complex relationship observed between the diversity of TMT attributes and high firm performance, which enhances the understanding of these complex relationships in a company. The study, which bridges Upper Echelons and CT, offers richer insights into how the configurations underlying different TMT internal compositions allow the company to reach high firm performance. Our study strives to shed light on the internal complexity within a TMT, and thereby on its inherent consequence on the company outcome. Hence, this research constitutes the first attempt to integrate Configural Analysis into the demographic literature to explore the diverse configurations in terms of the diversity of TMT attributes leading to a high firm performance.

To address the topic, the paper is structured as follows. In Section 2, a literature review on Upper Echelons and its relation with the CT is presented. In Section 3, the main methodological issues are explained, and the findings are described in Section 4. A discussion of the main implications from the results is offered in Section 5. Suggestions for future research avenues to overcome the limitations of the study are presented in Section 6. Section 7 ends with the general conclusions drawn from the research.

2. Literature Review

Traditionally, papers in the demographic and strategy literature have supported the relationship between TMT diversity and organisational decisions (Barsade et al., 2000; Cannella et al., 2008; Humphrey et al., 2009; Li & Tan, 2013). According to this theory, the managerial decisions are strongly influenced by values, beliefs, perceptions and judgements of top managers (Chi, Huang & Lin, 2009; Horwitz & Horwitz, 2007; Humphrey et al., 2009; Srivastava & Lee, 2008). Hambrick and Mason (1984) considered the use of TMT characteristics as a good proxy for cognition due to the difficulties of access and measurement of the cognitive variables. In this respect, TMT background diversity has been assumed to be a good indicator of cognitive diversity (Bromiley & Rau, 2016; Lin & Kuo, 2007). Managerial decisions, made under conditions of complex, uncertain and ambiguous information, are affected by individual experiences and psychological traits of top managers (Finkelstein & Hambrick, 1990; Schmid & Dauth, 2014). These individual characteristics, which influence organisational outcomes, render top managers as an important part of strategic management (Finkelstein et al., 2009).

Understanding the mechanism through which the combined effect of the TMT composition diversity influences the decision-making process constitutes a difficult task that holds great relevance for the success of the firm (Harrison, Price, Gavin, & Florey, 2002). Most of the studies on TMT diversity and firm performance have used Upper Echelons as the main theoretical perspective, although in combination with other theories, such as Behavioural Theory, Psychological Theory and Organisational Theory (Cyert & March, 1963; Nielsen, 2010). From these frameworks, papers have dealt with the complexity behind the interactions among TMT diversity attributes with the specification of the interaction terms in the linear regression models (Canella, Park, & Lee, 2008; Jackson & Joshi, 2004). Nevertheless, on the one hand, linear regression models adopt very restrictive assumptions, such as linear and symmetric relationships between TMT diversity attributes and firm performance; and on the other hand, the interaction terms in these models fail to include all possible combinations of diversity of TMT attributes for a desired firm outcome due to collinearity issues. Furthermore, inconclusive findings with regard to the influence of TMT diversity composition on a firm's performance have been

observed from those studies (Ferrier, 2001; Finkelstein & Hambrick, 1996; Williams & O'Reilly, 1998). This theoretical controversy, well-known as the demography 'black box', and the inconclusive results achieved in the literature are mostly attributed to the methodological weakness of these studies (Nielsen, 2010). In fact, this research deficiency has already been pointed out by Hambrick and Mason (1984) in their early work, whereby they argue that complexity of the relationships established between individuals and organisations in competitive environments requires multidisciplinary research and sufficiently strong methodologies to capture those complex relations. The vast majority of research in the demographic literature employs MRA and focuses on the main effect of TMT diversity features and on the moderator effect of the environmental variables on the relationship between TMT diversity and firm performance (Bakar & Sheer, 2013; Carpenter & Fredrickson, 2001; Carpenter, 2002). In another context different from that of Upper Echelons, Woodside (2013 a, b) states that the focus of net effects of main and interaction terms in the linear regression model is misleading because, in real life, not all cases in the data support positive or negative relationships between the independent and dependent variables. Rather, in reality, one or more combinations of antecedent conditions give rise to high values in the outcome conditions. It is precisely the presence or absence of attributes that characterises the configuration for an outcome to occur, and hence, the term interaction in linear models cannot be understood as configurations in the way that they are defined in the configural approach (Ragin, 2006; Woodside, 2013 a, b). Dick and Casell (2002) also noted that the underlying reason for the inconclusive results obtained in the demographic literature is due to the fact that Upper Echelons research tends to obfuscate on certain theoretical and methodological issues that are widely used in this field. Hence, a need emerges to apply alternative theories in combination with the Upper Echelons perspectives to find the answer to the fundamental research question (RQ) of whether TMT composition diversity contributes towards the accuracy of a firm's strategic actions and therefore towards a high level of firm performance.

Since the 20th century, the concept of complexity has been integrated into practically all fields encouraging discussions concerning complex reality, the theory of complex systems and the paradigm of complexity (Balandier, 1989). Simon (1965) conceives a complex system as a nested hierarchy of subsystems such as the hierarchy observed from the relation of the entities, industry, firms and TMTs, that interact in a non-simple way. Accordingly, Urry (2005) asserts that CT examines how components of an emergent, dynamic and self-organising system, such as TMTs in a firm, 'spontaneously' develop collective properties and patterns through their interactions. This theory declares that any system formed by interacting entities produces non-linear and positive feedback (Walby, 2007). Regarding CT, Ragin (2008) also admits that, in real life, the symmetric assumption is rather simplistic and hence, asymmetric relationships are often present. Symmetric relationships imply that high (low) values of a vector X of explanatory variables (antecedent conditions, such as diversity of TMT traits) are both necessary and sufficient to obtain high (low) values of Y (outcome condition, such as firm performance). Asymmetric relationships indicate that high values of X (high diversity in TMT traits) are sufficient but not a necessary condition for high values of Y (high performance) to occur. This insight is consistent with the CT proposed by Byrne (2005), who claims that high or low scores of X might lead to high values of Y depending on the configurations along with other antecedent conditions of Y. The same outcome, let's say, high firm performance, might therefore be achieved by a combination of different antecedents (diversity of TMT traits).

Summarising, from the CT, the diversity of certain TMT traits cannot be considered in an isolated way when the influence of the diversity of TMT composition on organisational performance is analysed. Furthermore, the diversity of TMT characteristics interacts in opposite directions with regard to firm decisions. On the one hand, greater diversity encourages teams to share different perspectives and ideas, which positively affects the decision-making process. On the other hand, greater diversity implies the appearance of more conflicts within the team which can be time-consuming and therefore costly for the company in terms of decision quality and, hence, of results. The complexity of the mechanism through which diversity influences company decisions makes it difficult for researchers and practitioners to determine the best combination of demographic characteristics that would lead to the best decision-making outcome for the company and would make it necessary to adopt the CT.

The CT is justified by considering Upper Echelons from the perspective of the theory of complex systems, which can lead to a better understanding of the relationships of TMT composition diversity and high firm performance. The CT and qualitative comparative analysis (QCA) posit several tenets (Woodside, 2013 a, b; Wu et al., 2014) of special relevance to address the inconclusive results derived from methodological weaknesses in the demographic literature. The first tenet states that causal factors rarely lead to an outcome in isolation: Outcomes of interest (such as high firm performance) result from a combination of antecedents and not from a single antecedent. Thus, by focusing on Upper Echelons, the CT does not emphasise the net or marginal effect of each simple condition (age, education, functional, industry and experience diversity) on the outcome (high firm performance) in a configurational model but rather describes and predicts the outcome by complex (two or more) antecedent conditions. The second premise of CT posits that the same antecedent (such as a low score of a single antecedent) might be associated to different outcomes (low or high outcome scores) depending on the other antecedents that form a causal combination of conditions. Such principles imply the concept of 'equifinality', meaning that the same outcome can be achieved through various configurations of causal factors (Ragin, 2000). The CT in Upper Echelons recognises that alternative combinations of antecedents (age, education, functional, industry and experience diversity) will lead to a high score in the outcome (high firm performance). There is more than one combination of the diversity of TMT attributes that explains the outcome condition. Considering that fsQCA is an exploratory method, the following RQ is proposed from these statements:

RQ1: Diverse configurations of complex TMT compositions are equifinal in leading to the achievement of high firm performance.

Because a firm is a hierarchical structure with complex interconnected substructures, both firm and TMT size may influence firm performance. In particular, large companies are often characterised by a greater number of members integrated into their management teams, and therefore, it could be assumed that they are more inclined to have more heterogeneous TMTs in terms of attribute diversity. Likewise, it could be assumed that high TMT diversity appears more frequently in those TMTs with a high number of members and that this combination influences firm performance. The following RQ is adopted:

RQ2. Firm and TMT size influence the configurations of the diversity of the TMT attributes on high firm performance.

The conceptual framework of this paper (Figure 1) puts forward that while high firm performance (outcome) depends on TMT demographic and managerial trait diversity, only the meaningful configurations of these attributes really lead to this outcome. The research model employs Venn diagrams to describe the configurational nature of the antecedent conditions that lead to high firm performance.

[Insert Figure 1]

3. Method

3.1. Data Source

Data were collected from subsidiary companies of multinational high-technology companies pertaining to 8 countries in the G20 group (USA, China, France, Germany, Canada, Italy, the United Kingdom and Spain) with their headquarters in Spain. This selection was chosen due to several factors: 1) Market demands and competitor situations in different geographical markets varied dramatically, due to their presently unbalanced economies (Zhang et al., 2015); 2) The G20 group includes the most powerful countries which drive the most relevant decision-making processes and, hence, attain the most relevant goals and results in business; and 3) Despite the companies being considered as strategically independent units, the current economic situation (globalisation, crisis, proliferation of new technologies, etc.) together with new customer demands has led companies competing in the same market to implement new managerial actions to survive. Consequently, a major vision of this managerial framework needs to be focused on the diverse types of strategic entrepreneurial units.

Regarding these strategic managerial units, their TMTs play a fundamental role in the decision-making process, and hence in the goal pursued and the results achieved (Hambrick & Mason, 1984). In accordance with the TMT notion that a 'TMT is defined as the hierarchy and composition of the staff (Pegels et al., 2000) and includes all those executives at the highest level of management of an organisation (president, vice-president, senior vice-president, vice-chairman and CEO)', all of these TMT members have been considered in this paper even though other papers have focused on only CEOs or board composition (Crossland et al., 2014; Farrell & Hersch, 2005; Finkelstein, Hambrick & Cannella, 2009). Collecting demographical variables of TMT members is always a difficult task. Primary demographical data collection from true TMTs is unusual as access to demographic and managerial traits is always difficult (Clark and Maggitti, 2012). Basic information concerning the attributes of top managers was obtained from various sources. Although much research on TMTs uses secondary databases to collect demographical variables (Cohen & Bailey, 1997), this study collected the data by using both secondary information and primary information. The secondary sources were related to company websites, yearbooks, the specialist entrepreneurial journal '*Nueva Empresa*' (New Firm) and other similar database sources (including Who's Who in the World, and Who's Who in Finance and Industry, available for various years and countries). In a first stage, the secondary sources allowed us to obtain initial information on TMT members and company variables, which were then updated and completed from primary information, generally from telephone and email interviews, between January 2013 and December 2015.

Data on firm performance were also obtained from two relevant databases, SABI and CNMV, and the annual financial reports of the companies for the years 2013-2015. Data on top managers' demographic and managerial variables were taken from the year 2013.

The sample size resulted in 179 multinational high-technology TMTs. The final size of the sample is justified by the requirement to attain all the demographic and managerial traits selected for all the TMT members, the economic and financial information of the companies, their location, environment, business knowledge and cultural criteria. The aforementioned difficulties encountered in the data collection limited the sample size, as did the restrictions imposed by certain multinational companies on giving information about the company. Observations with missing data at company or industry level were omitted from the data. However, the final sample size can be considered appropriate for an acceptable comprehension of the aim of the paper to be achieved (Jehn, Northcraft, & Neale, 2000; Wiersema & Bowen, 2005). In addition, the choice of the high-technology sector is justified by the following reasons: 1) It is the sector from which the greatest volume of highly representative information was collected; 2) Many researchers and entrepreneurs have recognised the great relevance of this sector, which is well-known as the fourth economic sector, and is responsible for changes at strategic level, and hence for the results achieved in the companies (Aydalot & Keeble, 2018; Thornhill, 2006; van Stel, Carree, & Thurik, 2005). The results derived from this study could therefore be considered both attractive and relevant in the academic and business world.

3.2. Measures

The diversity of top managers' demographic characteristics (educational background, education level and age) and managerial experience diversity (functional, industrial and international experience) were selected as explanatory variables for the analysis. Their measurement was attained following the criteria established in Upper Echelons. The variable on background education was classified into eight categories in accordance with the literature: sciences, engineering, maths, business, economics, law, arts and others (Carpenter & Fredrickson, 2001). The educational level was measured as a categorical variable that indicated the level of education (Wiersema & Bantel, 1992). The education classification has been widely used in the demographic literature (Díaz-Fernández et al., 2015 a, b; Díaz-Fernández et al., 2016; Helfat & Peteraf, 2015). Functional experience was categorised as a dummy variable, whereby the value one is taken if the TMT member has carried out numerous functions within the company, and zero otherwise. Industrial experience was categorised as a dummy variable based mainly on Wiersema and Bantel (1992), depending on whether or not the manager has performed various functions outside the company. International experience was also a dummy variable, whereby the value one is taken if a top manager shows knowledge and expertise in foreign markets and culture.

The majority of research into Upper Echelons uses the term diversity to encompass variations of the commonly broad definition of diversity: the distribution of personal attributes among interdependent members of a work unit (Jackson, Joshi & Erhardt, 2003). Harrison and Klein (2007) stressed that diversity can be defined in three ways: diversity as 'separation', 'variety' and 'disparity'. Diversity as separation is related to differences in opinion or position among team members. This demographic fault-line approach, rather than focusing on a disparity of single attributes, splits the team into homogenous subgroups of knowledge and expertise (Crawford & Lepine, 2013). Diversity as variety refers to differences between group members in attributes, mainly in knowledge or experience. Accordingly, diversity as variety is regarded as a synonym for heterogeneity across different demographic characteristics (Finkelstein & Hambrick, 1996). The two terms are therefore commonly used interchangeably. Diversity as disparity is related to the concentration of valued social assets or resources, such as pay and power, among unit members. Our paper uses the concept of diversity as variety as

does the majority of research in the field of Upper Echelons (Finkelstein et al., 2008; Li & Tan, 2013; Srivastava & Lee, 2008; Wei and Wu, 2013).

To aggregate data at team level for the analysis of TMT composition diversity, the following criteria were applied. Simple ratios were calculated for categorical variables, such as functional, industrial and international experience diversity (dummy variables) as well as for education level and background education diversity. Blau's Index (1977) was applied to measure the diversity for all these categorical variables. Blau's index (1977) is a frequently used diversity measure for categorical variables (Bantel & Jackson, 1989; Keck, 1997; Pegels et al., 2000) with the following expression (=1-$\sum$ (Pi)2), whereby Pi is the percentage of individuals in the i-th category of each of the categorical variables, which take values from 0 to 1, where high values indicate a greater diversity in a particular variable. Allison´s Coefficient of Variation (1978) (=σ/μ) was used for the age diversity.

In the literature, firm performance has been measured by using a variety of ratios: the sales variation rate (Boeker & Goodstein, 1993; Salancik & Meindl, 1984), the average return on assets (ROA) and return on sales (ROS) (Certo et al., 2006; Denis & Denis, 1995). These indicators differ from those standard indicators identified in the literature, such as return on equity (ROE) (Venkatraman & Ramanujam, 1984). The lower volatility of ROA in relation to ROE provides a reason for the final decision to opt for ROA. The ROA provides an appropriate proxy of firm performance, as it measures the firm's operative efficiency in all sectors, and was chosen following the majority of previous studies (Chaddad & Mondelli, 2013; Garcia-Fuentes et al., 2013; Lopez-Valeiras et al., 2016; Nehring, Gillespie, Sandretto, & Hallahan, 2009). The ROA was calculated as net income divided by total assets (Fiss, 2011; Gschwandtner, 2005; Lee, 2009) and was averaged over three years (2013-2015).

The size of the TMT, measured as the number of TMT members, was also included, as was the firm size measured in terms of the number of employees.

3.3 Data analysis

Longest and Vaisey (2008) highlighted that, in contrast to MRA, fsQCA is a set-theoretical method that explains cases by identifying configurations of causal conditions, based on the assumption that several solutions can be equally effective in achieving the final effect (Fiss, 2007; Ragin, 2008). By using Boolean algebra, FsQCA performs a systematic cross-case analysis that models relationships between variables in terms of set membership. To this end, the application of QCA involves the following sequential stages: 1) definition of the property space; 2) calibration of causal conditions and outcome; and 3) construction and refinement of the truth table, consistency and logical deduction (Fiss, 2011; Ragin, 2008).

The definition of the property space consists of specifying all causal conditions underlying an outcome, by identifying the attributes of cases exhibiting that outcome. The selection of causal conditions should be guided by the theory and the researchers' knowledge on the topic of interest (Fiss, 2011). Our study employs the drivers identified by the demographic literature to achieve high firm performance. Accordingly, the property space consists of the presence or absence of the diversity of TMT attributes.

Calibration constitutes a fundamental stage of fsQCA and refers to the transformation of construct measures, or variables, into fuzzy-set membership scores. In management studies, fuzzy-set calibration makes use of external information based on theoretical and extant empirical knowledge. This knowledge specifies three thresholds in fuzzy-set calibration: full membership (value 1.00), full non-membership (value 0.00) and the

crossover point (value 0.5) (Ragin, 2000; Ragin, 2008). The continuum between full non-membership and full membership values reflects varying degrees of membership in a fuzzy-set, ranging from 'more out' of a set (closer to zero) to 'more in' of a set (closer to one). The crossover point indicates the maximum membership ambiguity (fuzziness) in the assessment of whether a case is more in or out of a set (Ragin, 2008, p. 30). In this study, all variables were transformed into fuzzy-sets using the fsQCA software program (www.fsQCA.com) for calibration.

As recognised by Ragin (2008), *calibration* in Social Sciences is still in its infancy and little knowledge can be found to calibrate firm outcome. In this paper, theoretical knowledge and the empirical research by Fiss (2011), which uses ROA as a proxy of firm performance in the high-technology manufacturing sector, have been employed to calibrate this outcome. The ROA has therefore been calibrated by 'benchmarking' it to the average performance of the high-technology sector in Spain. Data on average performance in the Spanish high-technology sector come from the SABI database covering the period 2013-2015. The average ROA for this sector in that period was 7.15 per cent (also about the 50th percentile for this sector in Spain: 7.08 per cent). The membership in the set of firms with high performance was coded 0 if the firm shows average or below average ROA (ROA $\leq$7.15) and coded 1 if the firm presents high performance (ROA $\geq$15.02, in the 75th percentile or higher). For the crossover point, the midpoint between the 50th and 75th was chosen at approximately 11.09. The fuzzy-set for the diversity of TMT attributes was based on the degree of relative variability measured by the dispersion coefficient (Blau's index and Coefficient of variation) (Newbold, Carlson & Thorne, 2012). The membership in the set of firms with high variability in an attribute was coded 0 if the dispersion coefficient was equal to or less than 0.1, and was coded 1 if the dispersion coefficient was equal to or greater than 0.5. The crossover point was taken at 0.3, as accepted in the scientific literature. The calibration for firm size was carried out in accordance with the recommendations of the European Commission of 6 May 2003 (Official Journal of the European Union, L. 124, 20 May 2003). The membership in the set of large firms was coded 1 if the number of employees was equal to or greater than 250, coded 0 if the number of employees was less than or equal to 50 and the crossover point was located at 150 employees. The calibration for TMT size was based on data from financial annual reports of the technological industry sector with respect to organisational structure and organisational hierarchy. The membership in the set of large TMTs was coded 1 if the team executives numbered over 10, coded 0 if the top managers numbered below 4 and 7 members was chosen as the crossover point.

After calibration, the truth table needs to be constructed and refined. The truth table lists all possible combinations of causal conditions. To perform a fuzzy-set analysis, the truth table needs refinement, based on the criteria of consistency, and on the elimination of redundant elements. First, an evaluation is required of which configurations of attributes can act as sufficient conditions for the relationship of diversity of TMT attributes with performance. Consistency assesses the degree to which the cases sharing a specific causal condition, or combination of causal conditions, agree in displaying the outcome in question (Ragin, 2008). According to Wu et al. (2014), consistency is analogous to a correlation in statistical analysis. Consistency is calculated by dividing the number of cases sharing a specific combination of causal conditions for the outcome by the number of cases that exhibit the same combination but not the outcome of interest. The final step for truth table refinement is to deplete the sufficient configuration by eliminating redundant elements. For each final sufficient causal configuration, a coverage measure is calculated. Coverage indicates the importance of the connection between

causal configurations and outcomes. Coverage is analogous to R^2 in statistical analysis (Wu et al., 2014). In fsQCA, and quoting Wu et al. (2014), 'a consistency index above 0.80 with a coverage index of 0.45 indicates high membership scores in the outcome condition for nearly all high scores in the antecedent statement and a substantial share of the cases fitting an asymmetric sufficiency condition'.

4. Results

Table 1 presents the means and standard deviations of the core variables and the bivariate correlations among the variables. As observed in Table 1, all significant correlations between the explanatory variables and performance are below 0.30 except for educational background, at 0.43. Following Cohen (1992), significant correlations above 0.8 indicate symmetric relationships, whereas correlations in the range 0.30–0.70 indicate asymmetric relationships. From Table 1, the low or moderating correlations clearly indicate asymmetric relationships and reveal the complexity of the phenomenon as high/low values of the explanatory variables do not always lead to high/low values of the dependent variables (Berg-Schlosser, De Meur, Rihoux & Ragin, 2009; Woodside, 2011; Woodside & Zhang, 2012). The asymmetric relationships support the convenience of using a configural comparative method.

[Insert Table 1 about here]

This paper explores the antecedents of TMT composition diversity of high firm performance by conducting an fsQCA. An analysis of the configurations that lead to high performance or absence of the outcome (low performance) could be conducted. However, the study from a managerial perspective is an attempt to shed light on the causal relationships between the configural conditions and high performance. Table 2 summarises the results from the fsQCA. The study has adopted the consistency level of 0.80 (Berg-Schlosser, De Meur, Rihoux & Ragin, 2009). The results of the fsQCA reveal six solutions or configurations of causal conditions (in terms of age, education and managerial experience) leading to high firm performance. Table 2 presents the intermediate solutions according to the recommendation by Ragin (2008). The findings enable us to answer the two RQs formulated according to the literature review.

[Insert Table 2 about here]

RQ1. Diverse configurations of complex TMT compositions are equifinal in leading to the achievement of high firm performance.

Table 2 shows six equifinal paths leading to high firm performance. As QCA results are case-oriented (Ragin, 2000), the configurations allow for an informed typology to be built (Fiss, 2011), where each configuration describes a segment of firms with heterogeneous or homogeneous TMTs. Table 2 presents a description of TMT typology based on QCA. Configurations 2 and 6 correspond to those firms with *heterogeneous TMTs*. Those configurations are characterised by diversity in both demographic and managerial experience. Configuration 6 describes those firms whose TMTs are characterised with diversity in all types of managerial experience (functional, industrial and international) and diversity only in age. Configuration 2 describes TMTs characterised by diversity in the demographic attributes (age and education) in combination with managerial experience. As can be observed in Table 2, diversity in

demographic attributes exerts a positive influence on high performance depending on how they appear in combination with the diversity of other TMT traits. Configurations 1 and 5 depict those firms with *homogeneous TMTs.* These routes correspond with TMTs characterised by an absence of diversity in both demographic traits and managerial experience. Finally, paths 3 and 4 correspond to the segments of firms whose TMTs could be labelled *Mixed TMTs* and which can be distinguished by the presence or absence of diversity in certain combinations of demographic and managerial experience. Summarising, more than one combination of the diversity of TMT attributes are equifinal towards high firm performance.

The attribute age diversity (presence or absence) appears in five of the six configurations, and it is irrelevant in the third configuration in Table 2. The absence of age diversity is present in three of the six configurations. Furthermore, either the presence or absence of diversity in age by itself remains insufficient to achieve high firm performance because diversity of other TMT attributes has to occur in combination with age. The diversity in education background appears in only two configurations (second and third configurations) and it is required to achieve high firm performance in conjunction with diversity in managerial experience (international and industrial experience). However, the absence of education background diversity occurs with no diversity in age and no diversity in managerial experience (first configuration), thereby configuring homogenous TMTs regarding the attributes considered. No diversity in education level leads to high firm performance with the absence of age diversity (no generational conflict), diversity in managerial experience acquired in the firm itself (functional diversity) and with the absence of international experience (configuration 4). Education diversity (either in background or in level) is not present in most configurations in Table 2 as, in the technological sector, highly specialised training is required. The presence or absence of diversity in background experience in the firm itself (functional diversity) leads to high firm performance depending on the presence (configurations 2 and 6) or absence (configurations 1, 4 and 5) of diversity in demographic attributes. International experience diversity always appears in conjunction with TMT managerial experience (industrial and functional experience) and demographic diversity (configurations 2 and 6), whereas the absence of international experience diversity leads to high performance with different combinations of demographic and other managerial experience diversity (configurations 1, 4 and 5). Although the absence of diversity in industry influences high performance in homogeneous TMTs in terms of demographic and other managerial experience diversity (configuration 1), the presence of diversity in industrial experience leads to high firm performance either with heterogeneous TMTs with respect to demographic and managerial experience (configurations 2 and 6) or with TMTs, characterised by an absence of diversity in international experience and diversity in education background, where other attributes are irrelevant (configuration 3).

RQ2. Firm and TMT sizes influence the configurations of the diversity of the TMT attributes on high firm performance.

Our findings show a complex trade-off between the diversity of TMT attributes in the different configurations from Table 2. However, TMT size constitutes an integral part of only configuration 2 where maximum diversity in terms of demographic and managerial experience is observed. However, TMT size does not appear as a necessary condition for heterogeneity to exist in executive teams, as can be observed from Table 2. Furthermore, firm size appears to be irrelevant in any of the configurations. Hence, this finding partially supports proposition 3. It could be assumed that the selection of the TMT composition

may be influenced both by internal factors of the firm (organisational culture, market culture, firm missions and beliefs, growth orientation, etc.) and external factors of the firm (legal and political aspects; competitive environment) rather than TMT and firm size.

From Table 2, and regarding the coverage values, the overall solution consistency is 0.93, meaning that the six causal configurations explain 93% of the cases with high performance. The coverage score for the six solutions ranges from the smallest score of 0.45 for Model 4 to the highest score of 0.84 for Model 6. Model 4 results indicate that high firm performance can be achieved without diversity in functional and international experience and age. However, in Model 6, diversity in all three managerial tasks (functional, industrial and international experience) with the absence of age diversity presents empirical relevance to the attainment of high performance.

4.1 Sensitivity Analysis

Furthermore, *sensitivity analysis* has been conducted to examine whether the findings drawn from the analysis are robust to the use of alternative specifications in calibration. The calibration criteria used are based on external knowledge and follow the general calibration guidelines for all the variables involved in the study (Ragin, 2000; Schneider & Wagemann, 2012). However, for firm performance measured by ROA, we are aware that there is insufficient academic knowledge regarding the calibration mechanism without the subjective judgment of a certain researcher. For this reason, additional threshold levels for inclusion or exclusion of a case in the set are employed to check the robustness of the findings achieved with alternative calibrations. In addition to the 75th percentile (Fiss, 2011), the 80th and 90th percentiles have been used as cut-off points. For the first two calibration thresholds, fsQCA provide the same configurations as in Table 2, whereas the 90th percentile provides a lower number of configurations with lower overall consistency. In conclusion, we have decided to use the 75th percentile in accordance with Fiss (2011). Additionally, the crossover point has varied by ± 25 per cent for all measures. No significant changes were observed in the configural solutions, and hence, the results and interpretations remain unchanged regarding the calibration choices.

5. Discussion

CT and Comparative quantitative analysis are being increasingly employed in the Political and Social Sciences although their applicability in management studies is still in its infancy and remains mainly focused on macro-level issues (Fiss, 2011; Meier & Donzé, 2012). This study is an attempt to advance in the academic literature to fill this gap by integrating CT into Upper Echelons in the context of firms at micro-level (TMT members). Furthermore, this paper examines all members in the TMTs, which is in contrast to most Upper Echelons research, which analyses these TMTs by using only one member (generally by means of the CEO).

The integration of CT and QCA in Upper Echelons also responds to a recent call in the academic literature to adopt a paradigm shift from symmetric to asymmetric thinking in data analysis (Woodside, 2013 a, b) to achieve a deeper and richer perspective regarding the internal complexity of TMTs and their influence on strategic decisions of firms and thereby on firm outcomes. Hitherto, no studies could be found in the literature to shed light on the combined effects of top managers' demographic and managerial characteristics on performance by using CT and QCA.

The relevance of the paper also lies in the usefulness of examining different combinations of antecedent conditions that lead to high firm performance by applying the

exploratory method, fsQCA. This tool enables a better understanding of the importance of the interplay of the diversity of TMT characteristics by looking into asymmetric relationships between antecedents (TMT trait diversity) and the outcome (high firm performance). The results of this study reveal clearly asymmetric relationships between the diversity of TMT demographic and managerial traits and high firm performance as shown by the correlation coefficients, which are mostly lower than 0.3. Therefore, the asymmetric testing generates new findings in Upper Echelons research by bringing CT into Upper Echelons and through the suitability of the application of the fsQCA to this theory. This approach is consistent with Carpenter et al. (2004), who warned about 'the need and opportunity for additional research into how TMT internal complexity inherent to demographic variables interact, and how these combinations influence individual and entrepreneurial outcomes', as well as about adopting an alternative methodological mechanism to find the real relationship between TMT diversity and high firm performance.

In particular, the configurations obtained by applying fsQCA reveal how TMTs might be formed in terms of the diversity of demographic and managerial traits to achieve high firm performance. The findings of the study reveal that there is not just one unique combination of TMT diversity traits that is feasible to achieve high firm performance, in fact, various TMT profiles (homogeneous, heterogeneous and mixed TMTs) regarding the diversity the TMT traits have been obtained. These results do not concur with most of the findings in the traditional demographic literature, where the diversity of demographic traits appears to exert a negative influence on high firm performance Pegels, Song, & Yang, 2000; Van Dijk, van Engen & van Knippenberg, 2012; Wiersema & Bantel, 1992). However, in our study, the diversity of the TMT demographic traits appear to exert a positive influence on high performance depending on how they appear in combination with the diversity of other TMT traits. These results can be explained through the nature of the method used, the fsQCA and the misunderstandings that arise from the interpretation of the results derived from linear regressions. Although the linear regression models offer the net or marginal effect of each TMT trait diversity (age, education, and international, functional and industry experience) on firm performance, the fsQCA provides a variety of combinations of the diversity of TMT traits (antecedents) leading to high firm performance. Thus, from our study, different combinations of antecedents that lead to high firm performance are possible: 1) For heterogeneous TMTs, the diversity in both demographic and managerial TMT traits appears to have a positive influence on high performance, as shown in configurations 2 and 6 from Table 2. 2) The homogeneous TMTs are characterised by the absence of diversity in both TMT demographic and managerial traits as appear in configurations1 and 5 from Table 2. However, the mixed TMTs are characterised by both the absence and the positive influence of certain combinations of TMT traits (configurations 3 and 4). Thus, our study contributes to the literature of Upper Echelons because the act of putting together the marginal effects, derived from linear regression models, as has been used in traditional literature for the analysis of TMT diversity, cannot be interpreted as a combination of the possible antecedents leading to a specific outcome. Hence, fsQCA, as a methodological approach in its infancy applied to Management literature, offers a new perspective towards explaining the influence of TMT composition diversity on firm outcome under the umbrella of Upper Echelons. The insights from fsQCA contribute towards a better understanding of the complexity inherent in the entire management phenomena.

Summarising, this study is an attempt to advance in the literature by offering a new approach to Upper Echelons research. The recognition of firms as complex systems that comprise complex and interconnected structures and practices (Clegg, Hardy & Nord,

2003; Fiss, 2011), together with the limitations of linear methods (Greckhamer, Misangyi, Elms & Lacey, 2008), have encouraged the exploration and employment of other research methods, such as that of fsQCA. Rather than focus on net effects or interaction terms in the traditional linear models, CT and QCA provide a relevant framework to obtain all possible complex antecedent conditions leading to the outcome of interest.

The findings also provide practitioners with relevant knowledge regarding TMT internal complexity and its influence on high firm performance. Accordingly, the six configurations achieved suggest: 1) The diversity of TMT attributes can be either present, absent or irrelevant in reaching high firm performance; and 2) the presence or absence of diversity in TMT demographic and managerial attributes (antecedents) appear in combination with other TMT traits leading to different configurations of these antecedents to achieve high firm performance. Thus, diversity of TMT attributes leads to high performance depending on how it is configured with the diversity of other attributes in the TMT. Furthermore, the results achieved in the analysis confirm that the assumption regarding the ability of net or marginal effects of each explanatory variable in explaining an outcome is 'misleading and insufficient' (Di Benedetto, 1999; Woodside, 2014).

The equifinal solutions achieved by applying fsQCA provide managers with a better comprehension of the existence of alternative ways in which the diversity of TMT characteristics can be combined to increase the likelihood of adopting the best strategic actions and, hence, the accomplishment of better levels of high firm performance. This approach supplies managers with in-depth knowledge and an accurate diagnostic regarding their strategic decision-making on the composition of TMTs and its influence on firm performance. Unlike the traditional belief that either homogenous or heterogeneous TMTs favour high firm outcome, our results reveal that it is *the combinations of attributes* in terms of diversity or its absence that lead to firms accomplishing high firm performance. Hence, for each firm, in accordance with their internal and external environment, managers can also identify which TMT compositions increase the level of firm performance. Furthermore, the fsQCA as an exploratory methodological approach can offer firms new insights into the potential typologies of TMTs that favour high firm performance, and, as a consequence, show what makes their TMT internal composition more attractive and to whom.

6. Limitations and Future Research

The results achieved in the study are supported through the study of a large group of multinational subsidiary companies of different nationalities, whose headquarters are located in Spain. In this respect, the companies analysed are operating in a different managerial and cultural context from that of their own country. These multinationals have to adapt to, compete in, and survive with the business and managerial requirements in the specific Spanish cultural context. Acting under these circumstances can result in repercussions not only on their organisational behaviour but also on the achievement of their aims and their performance. This reasoning leads us to propose a replication of the study as a future line of research, where TMTs in multinationals are considered subject to the cultural and managerial guidelines in their country of origin.

Compared with other studies, the sample size used herein appears to be suitable for the purpose of this research (Jehn et al., 2000; Wiersema & Bowen, 2005). However, a more ambitious project would involve broadening the sample analysed in such a way that the most accurate and real analysis possible could be carried out on the antecedents of high firm performance with respect to the demographic variables. This knowledge would be itemised in terms of the activity sector and by integrating Upper Echelons and CT.

ROA is used here as a proxy for firm performance as it is widely employed in the strategic management literature (Blažková, & Dvouletý, 2017; Garcia-Fuentes, Ferreira, & Kennedy, 2013; López-Valeiras, González-Sánchez, & Gómez-Conde, 2016). However, alternative dimensions of firm performance might have been considered, such as ROE, ROS, and sales growth (Díaz-Fernández, 2015 a,b). In future research avenues, the performance could be measured through a latent variable which would include its various dimensions. The scores of the construct obtained by using an SEM approach could therefore be used as the performance measures.

Our study focuses on various configurations of the diversity of TMT attributes in addition to TMT size and firm size. However, we are aware that other internal and external environmental factors may take part in these configurations that lead to high firm performance. This limitation digresses from the main purpose of this paper and might be considered in future research.

Additionally, it must be borne in mind that the application of calibration thresholds in fsQCA in social science is still in its infancy (Ragin, 2008). As a consequence, ROA calibration has focused on only management research, and therefore, verification of robustness of the outcomes across different thresholds has been necessary for the calibration of firm performance. Furthermore, although QCA has been primarily used for cross-sectional analyses, methods have recently been developed for their application in longitudinal studies (Schneider & Wagemann, 2012; Thygeson, Peikes, & Zutshi, 2013). To the best of our knowledge, no temporal QCA has yet been applied in longitudinal studies, and this constitutes an excellent opportunity to investigate the relationship of TMT composition diversity and high firm performance through the use of longitudinal data.

7. Conclusions

The increasing complexity and uncertainty in the competitive environment in which companies operate make it necessary for companies to comprehend the internal mechanisms where the TMT members' attributes are combined to bring about company success, in terms of performance and competitiveness. The main assumption of this study is that the diversity of TMT attributes should be conceived as interconnected elements, and consequently, given this complexity, multiple paths to high organisational outcome may exist. The new approach used in the present study of TMT composition diversity has combined the CT and that of Upper Echelons. The CT enables TMTs to be recognised as complex structures, where the diverse attributes of TMT members are combined in various ways to achieve optimum decision-making. As a complex structure, the demographic attributes of TMT members interact and adapt to certain mechanisms to reveal that even contrarian cases might lead to a successful company outcome. Tenets of CT have been applied in the TMT diversity literature by formulating two RQs based on the assumptions of the possible set of TMT composition diversity antecedents that lead to high firm performance. The findings achieved by conducting fsQCA support the assumption of complex causality and reveal six configurational paths that lead to high firm performance, which, in turn, describe TMT typologies. The results show that no single TMT composition diversity leads to high firm outcomes, but instead that various solutions in terms of TMT diversity antecedents are achieved. Furthermore, while paths 1 and 5 represent homogeneous TMTs with low variability in the diversity of the TMT attributes, configurations 2 and 6 highlight TMTs of a more diverse nature in terms of demographic characteristics leading to high performance (heterogeneous TMTs). The remaining configurations describe those TMTs with different combinations of attributes

as being either those present or those absent (Mixed TMTs). The antecedent conditions obtained for TMT diversity appear to be more reliable and valuable for organisations regarding the best composition of TMT members. The findings of this paper point out that CT and fsQCA are useful tools for the comprehension of how different combinations of attributes relate to high firm performance.

Summarising, to advance in the understanding of TMT diversity composition, a study of the interdependencies is required between the diversity of TMT demographic characteristics and of how these combinations may affect strategy adoption and, hence, high firm performance. The use of fsQCA and configurational logic captures the complexities underlying TMT internal composition to adopt strategies, and identifies the ways in which TMT characteristics should be aligned to design the best TMT internal composition. These findings also help to explain why, to date, knowledge regarding the role of TMT internal composition has been not only inconsistent and unreliable but also insufficient and inconclusive.

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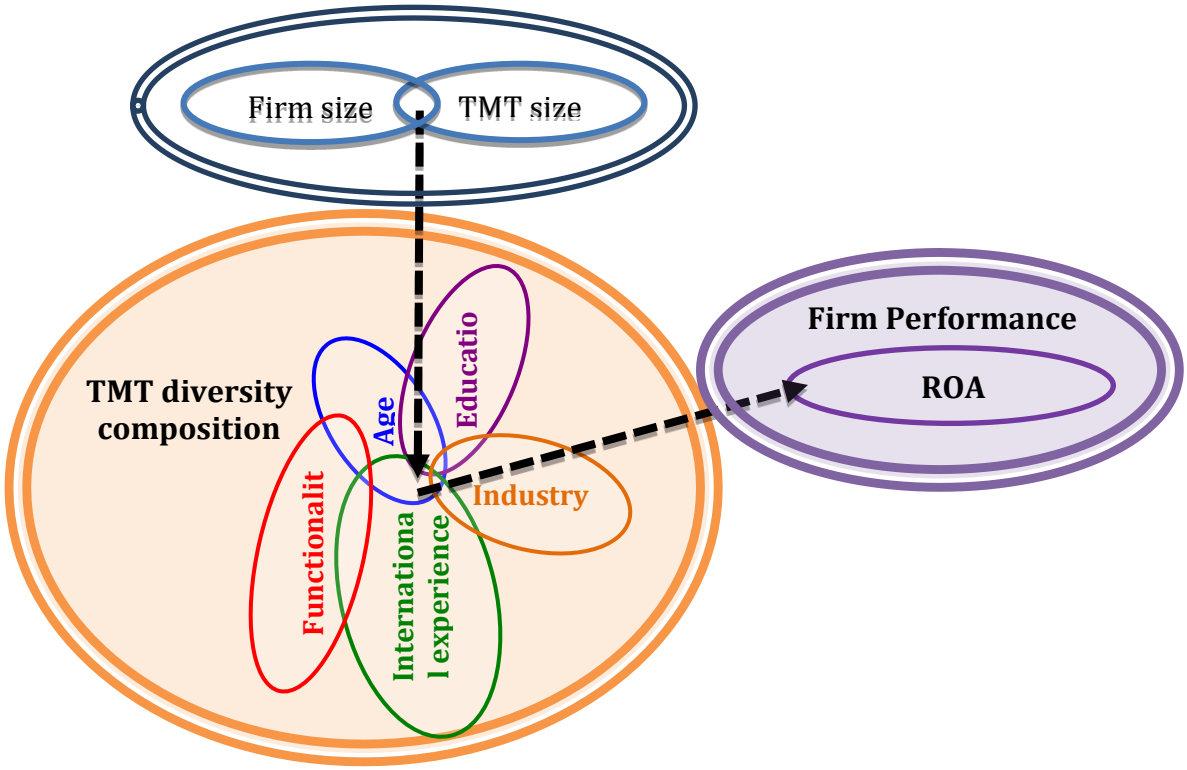
Figure 1.
Research model: Upper Echelons and the Complexity Theory



Source: Based on Wu et al., 2014, p. 1650

Table 1. Means, Standard Deviations and Correlations

Variable	Mean	Standard deviation	1	2	3	4	5	6	7	8
1. edubackdiv	0.38	0.24	1.00							
2. edulevdiv	0.47	0.16	0.26***	1.00						
3. funcdiv	0.40	0.32	0.0024	0.0042	1.00					
4. industdiv	0.39	0.28	0.14*	0.23**	-0.30**	1.00				
5. agediv	0.43	2.059	0.05	0.13**	0.12**	-0.021	1.00			
6. intexpdiv	0.27	0.23	0.15**	0.001	0.14*	0.014	0.0021	1.00		

7. TMT size	5.76	2.44	0.12**	0.29***	0.16**	0.19**	0.18**	0.13*	1.00	
8. Firm size	173	0.547	0.0069	0.04	0.10*	0.03	0.001	0.11*	0.17*	0.02
9. ROA	0.066	0.17	0.43***	-0.06	-0.13*	0.14**	0.014	0.11*	0.013	1

Note 1: * p<0.5; ** p<0.01; ***p<0.001

Note 2: Education background diversity (edubackdiv); Education level diversity (edulevdiv); Functional diversity (funcdiv); Industry diversity (industdiv); Age diversity (agediv); International Experience diversity (intdivexp)

Table 2. Intermediate solutions for high firm performance and TMT typologies

Intermediate solutions for high firm performance				
	Models	Raw Coverage	Unique Coverage	Consistency
Configuration 1	~agediv*~edubackdiv*~funcdiv*~industdiv*~intexpdiv	0.69	0.015	0.87
Configuration 2	agediv*edubackdiv*funcdiv*industdiv*intexpdiv*TMTsize	0.67	0.15	0.93
Configuration 3	edubackdiv*industdiv*~intexpdiv	0.85	0.02	0.94
Configuration 4	~agediv*~edulevdiv*funcdiv*~intexpdiv	0.55	0.01	0.91
Configuration 5	~agediv*~funcdiv*~intexpdiv	0.43	0.03	0.97
Configuration 6	*agediv*funcdiv*industdiv*intexpdiv	0.83	0.10	0.95
Overall solution coverage: 0.5782				
Overall solution consistency: 0.9275				

Intermediate solutions for high firm performance. TMT typologies				
		heterogeneous TMT	**homogeneous TMT**	**Mixed TMT**
Configuration 1	Demographic		~ agediv ~ educbackdiv	
	Managerial		~ funcdiv ~ industdiv ~ intexpdiv	
Configuration 2	Demographic	agediv educbackdiv		
	Managerial	funcdiv industdiv intexpdiv		
Configuration 3	Demographic			educbackdiv
	Managerial			industdiv ~ intexpdiv
Configuration 4	Demographic			~ agediv ~ edulevdiv
	Managerial			~ intexpdiv funcdiv
Configuration 5	Demographic		~ agediv	
	Managerial		~ funcdiv ~ intexpdiv	

Configuration 6	Demographic	agediv		
	Managerial	funcdiv industdiv intexpdiv		

Note 1: The tilde ~indicates negation of membership
Note 2: Education background diversity (edubackdiv); Education level diversity (edulevdiv); Functional diversity (funcdiv); Industry diversity (industdiv); Age diversity (agediv); International Experience diversity (intdivexp)