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Essential micro-foundations for contemporary business operations: Top management tangible competencies, relationship-based business networks and environmental sustainability

Summary

Although various studies have emphasized linkages between firm competencies, networks and sustainability at organizational level, the links between top management tangible competencies (e.g., contemporary relevant quantitative-focused education such as big data analytics and data-driven applications linked with the internet of things, relevant experience and analytical business applications), relationship-based business networks (RBNs) and environmental sustainability have not been well established at micro-level, and there is a literature gap in terms of investigating these relationships. This study examines these links based on the unique data collected from 175 top management representatives (chief executive officers and managing directors) working in food import and export firms headquartered in the UK and New Zealand. Our results from structural equation modelling indicate that top management tangible competencies (TMTCs) are the key determinants for building RBNs, mediating the correlation between TMTCs and environmental sustainability. Directly, the competencies also play a vital role towards environmental practices. The interaction effects further depict that relationship-oriented firms perform better compared to those which focus less on such networks. Consequently, our findings provide a deeper understanding of the micro-foundations of environmental sustainability based on TMTCs rooted in the resource-based view and RBNs entrenched in the social network theory. We discuss the theoretical and practical implications of our findings, and we provide suggestions for future research.

Keywords: micro-foundations; top management tangible competencies; business networks; sustainability, environmental management

Introduction

Environmental sustainability is an issue that garners significant scholarly attention and a vast academic literature has investigated the drivers of sustainability at the organizational level (e.g., Epstein and Roy, 2001; Giunipero et al., 2012; Lozano, 2015), including notable studies published in this journal (Ferlie et al., 2010; González- Benito and González- Benito, 2005; Rueda- Manzanares et al., 2008). However, the literature on environmental sustainability has paid considerably less attention to the drivers of sustainability at the micro-level. An understanding of micro-foundations is critical due to the growing evidence that cognitive beliefs towards environmental sustainability (Frandsen and Johansen, 2011; Fassin et al., 2015; Kim et al., 2014) and the psychological foundations for corporate social responsibility (CSR, sometimes used as an alternative term for social or environmental sustainability) (Doh and Quigley, 2014; Morgeson et al., 2013; Hillenbrand et al., 2013; Kim et al., 2014) are driving environmental practices. Also, the wider business scholarship increasingly points to the need for a better understanding of the micro-foundations of crucial issues in strategic management such as strategic implementation, firm-level heterogeneity, the contribution of human resources to value co-creation as well as routines and capabilities (Felin et al., 2012; Foss, 2011; Foss and Lindenberg, 2013; Schoenherr et al., 2015), but the scholarship on environmental sustainability has largely neglected to address these micro-foundations. Building on this emerging literature, our study specifically investigates the micro-foundations of sustainability by examining the interactions between top management tangible competencies (TMTCs), relationship-based business networks (RBNs) and environmental sustainability.

Essential micro-foundations such as TMTCs rooted in the resource-based view (RBV) of the firm provide the foundations for organizational practices (Abell et al., 2008; Coff and Kryscynski, 2011; Foss, 2011; Nyberg et al., 2014). However, while scholarship on the

micro-foundations of the RBV has dynamically developed in the strategy and HRM literatures (Nyberg et al., 2014; Orlitzky et al., 2011), the RBV literature has continued to focus on the influence of organizational-level resources and capabilities on sustainable/responsible practices (Hart, 1995; Aragon-Correa and Sharma, 2003; Bowen, 2007). The scholarship on CSR and environmental sustainability has provided growing evidence that the individual characteristics of senior managers are demonstrably crucial in guiding environmental practices and organizations are highly heterogeneous in terms of such micro-foundations (Waldman et al., 2006; Godos-Díez et al., 2011; Chin et al., 2013; Renwick et al., 2013; Robertson and Barling, 2013; Stea et al., 2016); Gond et al., 2017), but this scholarship has failed to investigate the role of TMTCs. Our study focuses specifically on the role of modern analytical skills in environmental sustainability. A better understanding of such skills is important because there is growing demand for skilled professionals who have tangible competencies to handle contemporary business operations linked with advanced technology and big data (e.g., big data analytics and the internet of things). It is predicted that, by 2018, the US alone may require over 150,000 skilled people with deep analytical skills (e.g., advanced statistical analysis and machine learning). Similar demand has been noticed in Europe. It is believed that such data-and-IT savvy management can significantly contribute to the effectiveness of business operations that reduce negative environmental impacts. Firms that ignore such skills may deprive themselves of financial and non-financial benefits (e.g., environmental efficiencies). However, there is a lack of empirical research on environmental impacts of such skills (Brown et al., 2011; Barton and Court, 2012a; Akhtar et al., 2015).

While TMTCs can explain the impact of internal drivers of environmental sustainability within the boundaries of organizations, the sustainability literature also points to the critical influence of external drivers in the form of business networks (Collins et al., 2007; Miemczyk et al., 2012; Roome, 2001; Schoenherr et al., 2015; Stea et al., 2016). The general

business literature suggests that social networks play an important role in different organizational processes, including innovation and organizational change (e.g., Powell et al., 1996; Swan and Scarbrough, 2005; Wincent et al., 2013; Aalbers et al., 2014), and scholars have noted the enabling role of networks for the transfer of valuable knowledge across firms (e.g., Hansen, 1999; Tortoriello and Krackhardt, 2010; Tortoriello et al., 2012; Schoenherr et al., 2015). Scholarship on environmental sustainability demonstrates that business networks are essential for developing environmental outcomes for collaborative organizations (Simpson and Power, 2005; Benn et al., 2006) and studies have specifically employed social network theory to explain how the degree of density in the network, trust and satisfaction in the network or the level of centrality of the organization in the network affect environmental practices at the organizational level (e.g., Chen, 2009; Brass et al., 1998; Vurro et al., 2009; Fisher, 2003), but studies have not investigated the role of top management tangible skills and competencies in the formation of trusted and satisfied contemporary business networks. Existing studies in supply chain management that link modern analytical skills with networks mainly examine the links with traditional performance outcomes such as cost, profit and return on investment and do not focus on the relationships with environmental sustainability (Yu and Nagurney, 2013; Schoenherr et al., 2015; Akhtar et al., 2015).

Thereby, given that previous research neglected the role of TMTCs and their links with RBNs and environmental sustainability, the first contribution of this study is to develop a conceptual framework by integrating the micro-foundation view of competencies grounded in the RBV, the relationship-based business network theory and environmental sustainability. Given the focus of previous environmental sustainability research on the organizational level of analysis, the second contribution of this study is to employ the RBV and social network theory at the micro-level in order to explain the drivers of environmental sustainability. The final contribution is linked with the complexity of the framework (i.e. multiple dimensions

and higher-order constructs) and following a comprehensive statistical process, including addressing endogeneity biases that have not properly been addressed by many non-experimental studies (Antonakis et al., 2010; Abdallah et al., 2015; Qin, 2015).

Theoretical Development and Hypotheses

Top management tangible competencies and environmental sustainability

Scholars have long suggested that organizational resources and management competencies can play a considerable role in improving environmental performance of firms, and this scholarship has linked these resources and competencies to the RBV (Hart, 1995; Aragon-Correa and Sharma, 2003; Bowen, 2007). The RBV addresses the heterogeneity of firms with regards to their strategic and resource endowments (e.g., Wernerfelt, 1984; Barney, 1991; Kraaijenbrink et al., 2010), and hence allows us conceptually to scrutinize how the development of different types of resources and competencies may contribute towards environmental sustainability. The wider business scholarship has in recent years moved towards investigating the micro-foundations of the RBV (Abell et al., 2008; Coff and Kryscynski, 2011; Foss, 2011; Nyberg et al., 2014), and hence the RBV provides us an important lens through which we can investigate how the micro-foundations such as TMTCs are linked to environmental sustainability that consists of multiple indicators such as waste reduction, reusable packaging, material efficiency, energy consumption and protecting natural environment (Rao et al., 2006; Hart, 1995).

The scholarship linking environmental practices and competencies to the RBV has so far largely failed to investigate the micro-foundations of environmental sustainability. Accepting the underlying general premise that firm-specific resources and competencies can lead to a competitive advantage, this scholarship has long explored how specialized resources (e.g. green innovations or an organization's sustainability reputation) and competencies can

improve organizational environmental practices (Litz, 1996; Russo and Fouts, 1997; Husted and Allen, 2007; cf. Mellahi et al., 2016), while paying less attention to how resources and competencies of leaders can improve environmental sustainability. Most pertinent to our investigation, this scholarship has largely failed to link the micro-foundations of the RBV with environmental sustainability (Frynas and Yamahaki, in press), even though such a micro-level RBV approach has already started to dynamically develop within the strategy and HRM literatures (Nyberg et al., 2014).

The CSR and environmental sustainability literature demonstrates that individual CEOs and other top management teams are crucial in guiding environmental strategies of firms (Waldman et al., 2006; Godos-Díez et al., 2011; Chin et al., 2013; Robertson and Barling, 2013). As Waldman and Balven (2014: 224) recently noted, responsible leadership is "not about whether organizations act responsibly, but about how individuals act and make decisions". This scholarship suggests that sustainable and environmental practices are actively shaped and diffused across the firms' networks by CEOs and other top management team members, notwithstanding whether such leadership is driven by instrumental/economic motives (McWilliams and Siegel, 2011; Siegel, 2009; Canales, 2013) or by stakeholder pressures (Maak and Pless, 2006; Doh and Quigley, 2014). These studies have investigated how the sustainable practices of firms are shaped inter alia by the leaders' workplace pro-environmental behaviours and leadership styles (Robertson & Barling, 2013), the leaders' perceptions of the role of ethics and social responsibility (Godos-Díez et al., 2011), the leaders' political ideology (Chin et al., 2013), the CEO intellectual stimulation (Waldman et al., 2006) or the leaders' personal trust and commitment (Doh and Quigley, 2014). At the same time, this emerging literature has paid no attention to the leaders' personal tangible competencies (e.g., analytical applications, education and experience in quantifying performance dimensions) that are essential micro-foundations for contemporary business

operations inundated with data and analytics (Bennis and O'Toole, 2005; Kor and Mahoney, 2005; Chen et al., 2012; Waller and Fawcett, 2013; Akhtar et al., 2015)

The wider business scholarship on the micro-foundations of the RBV has recently departed from its previous focus on creating resources and competences at the organizational level towards a focus on the role of individuals in creating and utilizing such resources and competencies (Abell et al., 2008; Felin and Hesterly, 2007; Coff and Kryscynski, 2011; Barton and Court, 2012a). This recent RBV scholarship suggests that relevant in-depth knowledge and tangible competencies are not possessed by firms as such, but rather by the individuals within the firms. As Felin and Hesterly (2007: 1430) noted, "valuable capabilities rely on individuals with idiosyncratic goals, desires, and preferences who can choose whether to join, stay, or exert effort [original emphasis]". In turn, the tangible micro-foundation competencies of CEOs and other top management team members, as well as their ability to shape the processes behind the creation and utilization of competencies, shape organizational environmental practices based on analytics (Garbuio et al., 2011; Kor and Mesko, 2013; Sheremata et al., 2010), and we posit that they may also shape environmental sustainability. As Garbuio et al. (2011: 1459) emphasized: "managing the resource structuring process lays largely within the control of the top management team". Extending this line of thinking to environmental sustainability, we hypothesize thus (interrelationships are shown in Figure 1):

H1: Top management tangible competencies (TMTCs) are positively related to environmental sustainability.

[Insert Figure 1 here]

Top management tangible competencies and relationship-based business networks

Top management teams' competencies (educational, experiential and analytical) play a key role in achieving desirable results, including developing relationship-based business networks

linked with trust and information sharing among business partners (Eisenhardt, 1989; Tsai and Ghoshal, 1998; Barton and Court, 2012a; Patnayakuni et al., 2006). For instance, top management education related competencies such as quantitative skills in processing vital information can lead to the development of intra-firm trust and relationship-oriented networks (Zaheer et al., 1998), leading to the sustainable competitive advantage for firms (Barney, 1991; Barney and Hansen, 1994).

By utilizing their education-based competencies as a key resource, top management teams develop relationship based networks enhancing firms' reputation and the creation of new business opportunities (Lado et al., 1992). It has been noted that individuals can strengthen their business networks by strengthening unique relationships with customers and suppliers (Von Hippel, 1998). The top management teams educational competencies can also facilitate the development of social ties and business network relationships (Burt, 1992). Top management education-based competencies are the key knowledge assets that firms can use to develop relationship-based business networks with other organizations in order to develop a sustainability-based competitive advantage (Winter, 1987; Uzzi, 1996). For example, Hambrick et al. (1996) in their study on 32 US airlines found support that diversity in terms of functional background, education and tenure of top management team contributed positively to the substantial actions and responses they took for their respective firms. Thus, it suggests that top management teams' education competencies are essential for their actions they take for the firms. Extending these arguments over to the relationship-based business networks would suggest that those top management teams with problem solving and quantitative-based skills cab be in a far better position to form intra-firm relationship-based networks. Wiersema and Bantel (1992), for instance, found that those firms that have top management teams with higher education levels and extensive problem solving and quantitative training were in a better position to bring a strategic change. Other studies have

also found similar associations, for example, a positive relationship between top management teams' education levels and firms' innovation (Bantel and Jackson, 1989; Kyrgidou and Spyropoulou, 2013).

Recent research also notes that managerial cognitive capabilities lead to the development of dynamic capabilities, and the heterogeneity of cognitive managerial capabilities affect organizational performance (Helfat and Peteraf, 2015). Gavetti (2012) also suggested that leaders with superior associative mental skills have greater success in identifying strategic opportunities. The top management teams on the basis of their higher level of educational-based competencies could be in a far better position to not only for valuable relationship-based networks but could also identify potential networks that generate relational assets in the form of sustainable practices (Helfat and Peteraf, 2015). Those top management teams with better educational competencies are expected to perform the activities in a reliable manner when called in for a particular analytical task (Helfat and Winter, 2011).

Relationship-based business networks developed on the basis of individuals' characteristics can be enduring, and it has been noted that such valuable resources flow from network ties (Yli-Renko et al., 2001; Grossman et al., 2012; Inkpen and Tsang, 2005). For instance, top management experience based competencies can also be useful for the development of relationship-based networks. Scholars have noted that top management teams' experience-based competencies influence their orientation and the strategic choices linked with relationship-based networks (Hambrick and Mason, 1984; Anderson, 2008).

Additionally, top management teams' analytical-oriented competencies can play an important role for the development of relationship-based business networks. For example, McAfee and Brynjolfsson (2012:64) noted that, "the more companies characterized themselves as data-driven, the better they performed on objective measures of financial and operational results … companies in the top third of their industry in the use of data-driven

decision making were on average, 5% more productive and 6% more profitable than their competitors". It is also noted that top performing companies are using five times more analytical-based competencies than low performing companies, indicating a potential link of the use of analytical competencies on performance (LaValle et al., 2013). Research notes that top management teams' analytical competencies directly shape absorptive capacity of managers to build better complex business networks (Kor and Mesko, 2013; Helfat and Peteraf, 2015). As Barton and Court (2012b) noted, "advanced analytics is likely to become a decisive competitive asset in many industries and a core element in companies' efforts to improve performance". This suggests that top management teams with a higher level of analytical competencies can be in a better position to develop relationship-based business networks compared to those with limited analytical competencies. Given the discussed linkages between tangible characteristics of education, experience and analytical competencies, and relationship-based business networks, we hypothesize:

H2: Top management tangible competencies (TMTCs) are positively related to

relationship-based business networks.

Relationship-based business networks and environmental sustainability

Relationship-based business networks (RBNs) are typically explained with the help of network theories, and networks have emerged due to the increased complexity of contemporary business operations massively connected through information and data flows among network ties (Schoenherr et al., 2015; Yu and Nagurney, 2013). Such networks are also connected based on trust, satisfaction, and joint decision making that contribute to environmental practices (Li, et al., 2010; Patnayakuni, et al., 2006). Scholars have noted that these networks play a key role in mediating access to valuable resources, thus enabling innovation and an organizational change (e.g., Coleman, 1988; Powell et al., 1996; Swan and

Scarbrough, 2005) that help to create knowledge linked with environmental sustainablility (Schoenherr et al., 2015). This relates closely with a new way of constructing environmental initiatives, for instance, green and ethical purchasing, reduction of waste, and other environmental initiatives. Thus, RBNs could be particularly important for providing valuable know-how that works together in order to develop and strengthen environmental outcomes.

Despite the importance of social networks, much remains to be learned about the specific ways in which these networks influence sustainability indicators. In particular, the link between the relationship based business networks, how these relationship based networks share best practices and build mutual trust, and the impact this has on environmental sustainability is currently in its infancy. Thus integration of insights from the social network theory into the study of environmental sustainability offers a remarkable potential (Galaskiewicz, 2011; Schoenherr et al., 2015). Due to its vital role, scholars have pointed out the enabling role of social networks for the transfer of valuable environmental knowledge across firms that prepare them to co-action against unsustainable practices (e.g., Hansen, 1999; Tortoriello and Krackhardt, 2010; Tortoriello et al., 2012).

Trust and the length of a relationship have also been indicated as playing an important role for the flow of resources across network partners. For instance, the density and strength of the social ties have been suggested to be important components for the development of innovation linked with sustainble outcomes (Borgatti and Cross, 2003; Hansen, 1999; Powell et al., 1996). Since RBNs exhibit higher levels of trust and satisfaction, such networks build superior information and data sharing platforms contributing to joint decision making for better environmental outcomes (Batt, 2003; Patnayakuni et al., 2006; Li et al., 2010). Firms also gain key market shares by using trusted and satisfied business networks, which allow them to react to market changes effectively and efficiently. Such connected business partners work together to collect, analyze, and integrate data to support their joint decision making

(Batt, 2003; Li et al., 2010). This enables them to detect their operational deficiencies and improve logistics affecting environmental components such as waste reduction, material efficiency and overall environmental performance (Rao et al., 2006; Patnayakuni et al., 2006; Li et al., 2010).

Given the business network sharing logic, incremental changes in such businesses (e.g., commitment, trust, joint decision making and satisfaction) would be likely to leave positive impacts on environmental sustainability. Moreover, greater levels of satisfaction and trust in business networks have been shown to be linked with more positive perceptions of environmental concerns (Batt, 2003; Li et al., 2010; Rao et al., 2006).

Schoenherr and Speier-Pero (2015) also noted various benefits of relationship-based business networks, including increased visibility, reduced network complexity, cost reductions, better demand planning, and other operational developments contributing to environmental sustainability (Rao and Holt, 2005). These scholars also believed that such networks help firms to identify risks and potential customers linked with environmental policies. The existence of enduring relationships and mutual trust in business networks are arguably the key assets that help in responding to changing environmental regulations and relevant supplier practices affecting the whole business network sustainability (Simpson and Power, 2005).

Relationship-based network partners share insights and analytics that assist them to adapt innovative approaches to deal with complex business networks linked with modern data-and-information driven operations. Their intensively connected approach based on trust and joint decision making can facilitate them to deal with such contemporary operations effectively, which in turn helps to gain environmental advantages over competitors (Tan et al., 2015; Grossman et al., 2012). We thus hypothesize the links between RBNs and environmental sustainability:

H3: Relationship-based business networks (RBNs) are positively related to environmental sustainability.

Additionally, given the arguments discussed to build hypotheses 1-3, we propose a sub-hypothesis linked with these arguments. RBNs are linked with TMTCs mentioned earlier (e.g., Kor and Mesko, 2013; Helfat and Peteraf, 2015), which are also the key determinants for environmental practices (e.g., Garbuio et al., 2011; Kor and Mesko, 2013; Sheremata et al., 2010). In addition, while there is a relationship between TMTCs and environmental sustainability (e.g., Coleman, 1988; Powell et al., 1996; Swan and Scarbrough, 2005), networks may also mediate the relationship between TMTCs and environmental sustainability. The value of capabilities may depend on the context where they are used, while networks may particularly help to enhance capabilities through achieving synergies between organizations and between individuals. Notably scholarship on technology clusters and innovation networks suggests that such networks are increasingly an important precondition for achieving environmental sustainability (Casper, 2007; Sol et al., 2013).

The mediating role of network components (e.g., trust) studied at the macro level has shown important links between environmental knowledge that could strengthen network competencies. This also provides learning opportunities for weakly connected network operators. Consequently, involved managers could sharpen their competencies that can also contribute to their environmental practices (Levin and Cross, 2004). Such networks share high-performance work systems that can influence network ties, mental capabilities, organizational citizenship behaviour and human resource practices. This leads them to achieve better environmental sustainability through administrative efficiency and flexibility results in due to the coordination and macro-level exploitation of relevant knowledge resources, ultimately supporting the internal social structure linked with managers' competencies and their environmental practices (Evans and Davis, 2005).

Social network capital as a mediator also shows strong links between open innovation and firm environmental performance. Research also believed that such innovation strengthens network capabilities and influence sustainable practices among network partners (Rass et al., 2013; Godos-Díez et al., 2011; Helfat and Peteraf, 2015). Although such studies dealing with certain social network components as a mediator at the macro-level provide some guidelines, the mediating links between TMTCs and the indicators of environmental sustainability has not been established empirically. We thus propose an additional hypothesis based on the above arguments:

H4: RBNs mediate the relationship between TMTCs and environmental sustainability.

Method

Sample and procedure

The sample for this study consists of 175 chief executive officers (CEOs) and managing directors working in selected global import and export firms (dairy, meat, vegetables and fruits) headquartered in the UK and New Zealand. The sample characteristics are given in Table 1.

[Insert Table 1 here]

The KOMPASS database was used to reach a total of 850 CEOs and managing directors. After excluding incomplete responses, a total of 175 (20% response rate) usable responses were utilized to conduct structural equation modelling with parcelling (DeShon, 1998; Kline, 2011). When such top-management research participants (i.e., CEOs and managing directors) are involved, obtaining high response rates is very challenging (Cycyota and Harrison, 2006). Also, studies show that an average response rate from developed countries such as the UK, the United States and New Zealand is generally not high (Mehta et al., 2003; Mellahi and Harris, 2016). For example, Draulans et al. (2003) obtained 6–11% response rates from the

UK and other European countries. Similarly, by using a mail survey method, Spriggs et al. (2000) received a response rate of 16% from selective UK beef producers. We therefore made extra efforts to improve our response rate, which included sending multiple reminders to complete our survey, making possible in-person visits for deliveries and collections where geographical distance allowed, inclusion of short and concise statements in the questionnaire, providing enough time to fill in the questionnaire, avoiding busy periods of the year (e.g., Christmas and other major events) and offering a summary of our findings. In short, our purposive sampling method helped use to choose those samples who fulfil the study objectives and to get a suitable sample size to apply appropriate statistical procedures.

The reason behind selecting the particular roles and responsibilities of CEOs and managing directors is their significant connections with contemporary data-and-analytical driven requirements for modern business operations. Advances in information technology provide opportunities to get new insights from big data (i.e., structured and unstructured data) and make evidence-based decisions. When top-management such as CEOs and managing directors are equipped with such skills, they avail data hidden-opportunities that may not be explored without having tangible quantitative skills linked with their job description. Also, data-and-analytical driven senior management may create an evidence-based and data-driven culture helping to achieve sustainability. Additionally, research on these roles and their effects on environmental sustainability is emerging and studies have called for more research in this domain (Yu and Nagurney, 2013; Schoenherr et al., 2015; Akhtar et al., 2015). Thus, the choice of particular roles and responsibilities of CEOs and managing directors (details provided in Appendix) makes an endeavour to bridge the research gap as well as contribute to explore the links between the roles and responsibility and their effects on environmental sustainability that needs data-and-analytical driven requirements from top management.

Food import and export firms provided a very interesting and somewhat under-researched context for our investigation (Yu and Nagurney, 2013; Schoenherr et al., 2015; Akhtar et al., 2015). The above selected food import and export firms (dairy, meat vegetables and fruits) headquartered in the UK and New Zealand are globally connected (the USA, Europe, Australia, New Zealand, China, Malaysia, Thailand, Saudi Arabia, UAE, India, Pakistan, Bangladesh and Sri Lanka) and they generate both local and global impacts. Locally, the content explores the selected under-researched domains in New Zealand and the UK. Globally, New Zealand dairy accounts approximately 35% to the global trade and exports 95% of the entire dairy produce (Schewe, 2011). New Zealand also supplies more than 40% of total global lamb exports (Ledgard et al., 2011). Thus, our research content helps to enlighten global-local research impacts.

Measures, reliability and validity

All measurement items utilized in this study were measured on a 5-point Likert scale (strongly disagree = 1; strongly agree = 5). The construct details – including the relevant studies, brief item description and codes – are presented in the Appendix. Although the items were taken from past studies, all constructs used in this study were also refined by using exploratory factor analysis (EFA). EFA with varimax rotations, eigenvalues ≥ 1 and scree plots assisted us to develop the constructs.

Top management tangible competencies (TMTC, independent variable):

TMTC were measured using three different constructs: 1) education-based competencies, 2) experience-based competencies, and 3) analytical-based competencies. Education-based and experience-based items were taken from past studies (Bennis and O'Toole, 2005; Kor and Mahoney, 2005). The studies by Chen et al. (2012) and Waller and Fawcett (2013) assisted

us in building the construct for assessing analytical-based competencies. A total of 17 items were used in the survey to measure the tangible competencies (see Appendix, Table 5). The reliability and validity results of all underlying constructs are given in Table 2, including items internal consistency (α), loadings (λ), average variance extracted and construct reliability.

[Insert Table 2 here]

The items (see Appendix, Table 5) mainly measured: relevant in-depth knowledge, analytical expertise, quantitative techniques used, quantitative education, understanding data, using analytical insights for better business performance, analytical skills to predict customers' demand and performance improvement, use of analytics for performance measurement and finding new business opportunities, using analytics for quantifying business performance, analytical workforce and analytics being a major business strategy.

Relationship-based business networks (RBNs, mediator)

A total of 8 items measured relationship-based business networks (Patnayakuni et al., 2006; Li et al., 2010). The items measured: trusted information exchange for RBNs, sharing best practices for building better RBNs, basing RBNs on mutual trust, satisfied relationships with business partners, long term relationships with strategic partners and avoiding unwanted demands that can hurt RBNs.

Environmental sustainability (dependent variable)

Environmental sustainability measured the decrease in total waste to output ratio, following reusable packaging policy, material efficiency, decreased energy consumption, and negative impacts on the natural environment (Rao et al., 2006; Hart, 1995). Discriminant validity of the constructs was measured using two methods. First, the correlation between the constructs

did not exceed the value of 0.85 (Kline, 2011), ranging between 0.36 and 0.49. Second, as listed in Table 3, the square of the correlation (ϕ^2) by each pair of constructs was less than the average variance explained (AVE) (Sekaran, 2000; Chiang et al., 2012).

[Insert Table 3 here]

Chi-square difference tests did not detect any difference between the respondents and non-respondents, early to late respondents did not depict significant differences either. Additionally, the control variables [types of networks (veg. & fruits, meat, dairy), industry (manufacturing/producers/importers/exporters), size of firms (number of employees and turnover), gender, and age were used and showed no significant differences.

We also addressed endogeneity biases that have been ignored by many non-experimental studies (Antonakis et al., 2010; Abdallah et al., 2015; Qin, 2015). Such biases mainly include common-method variance (CMV), measurement error and omitted variables (Hamilton and Nickerson, 2003; Antonakis et al., 2010). To address common-method variance theoretically, extant research was used to develop a systematic questionnaire and measures that were also later refined using EFA. The guidelines (avoiding unfamiliar words, double-barrelled questions and technical words) provided by Tourangeau et al. (2000) were also used. The items were further grouped with different conceptual dimensions. The extensive use of negatively-worded items was avoided, as such items could distrust the respondents' pattern of responding and can create a source of bias (Podsakoff et al., 2003). The respondents were also informed about the anonymity of the survey. We also avoided a single-informant bias and collected data from CEOs and managing directors. Statistically, Harman's one-factor test produced multiple factors explaining greater variance compared to a single factor solution or combinations. The marker variable technique (the variable was the number of languages respondents knew) proposed by Lindell and Whitney (2001) provided very small correlations. The latent factor approach also did not show any issues (Malhotra et al., 2006).

To deal with the measurement error, we used SEM with the maximum likelihood estimate and a multiple indicator approach, which correct for "the biasing effects of random measurement errors" (Frone et al., 1994). Omitted biases exist in various forms (for details see Antonakis et al., 2010; Antonakis et al., 2014), the most important guide in this regard is "theory, theory and more theory" (Antonakis and Dietz, 2011; Antonakis et al., 2014) to develop constructs and multiple constructs can help to address this point. We followed these guidelines and our constructs consisted of multiple items and sub-constructs (e.g., TMTCs consists of three dimensions; RBNs were measured with 7 items; and environmental sustainability was assessed with 5 items). The descriptive statistics and correlation matrix of the underlying constructs are provided in Table 4.

[Insert Table 4 here]

Results

Figure 2 depicts the hypotheses and the relevant standardized results. Hypothesis H_1 proposes that top management tangible competencies (TMTCs) positively affect environmental sustainability (ES). This hypothesis is supported at $p < 0.01$ with $\beta = 0.46$. Hypotheses H_2 (TMTCs positively affect relationship-based business networks, RBNs) and H_3 (RBNs positively affect ES) are also supported with $\beta = 0.38$ ($p < 0.01$) and $\beta = 0.29$ ($p < 0.01$) respectively. Additionally, the fit indices with a non-significant p-value (0.126) and R^2 values ranging from 14% to 40% are given underneath Figure 2, showing stronger support to the final model.

[Insert Figure 2 here]

H_4 [mediating analysis, relationship-based business networks mediate the relationship between top management tangible competencies (TMTCs) and environmental sustainability] was tested by using three approaches, namely a) causal-steps approach (Baron and Kenny,

1986), b) Sobel typed-tests (Sobel, 1982) and c) Bootstrapping (Preacher and Hayes, 2008). The causal-steps approach showed that the independent variable (TMTCs) significantly affects the dependent variable (environmental sustainability, ES) with $\beta = 0.47$ and t-value = 6.98 at $p < 0.001$. The independent variable also significantly affects the mediating variable (relationship-based business networks, RBNs), as $\beta = 0.35$ and t-value = 4.99 at $p < 0.001$. Further, RBNs (mediator) significantly affects ES with $\beta = 0.46$ and t-value = 6.86 at $p < 0.001$. Finally, when the model was controlled for the mediating variable (RBNs), the previous relationship (i.e., between TMTCs and SUS) was reduced ($\beta = 0.34$ and t-value = 5.18 at $p < 0.001$) but still significant. The results thus showed partial mediation rather than full mediation as the previous relationship was still significant. The Sobel test also showed that the indirect effect of the independent variable on the dependent variable via the mediator is significantly different from zero at $p < 0.001$. Additionally, the Aroian and Goodman tests showed the same results. The bootstrapping method with 5000 samples and 95% confidence interval was also utilized (Preacher and Hayes, 2008) with parcelling as a the strategy to conduct the required analyses. First, it was found that TMTCs were positively associated with ES [($\beta = 0.84$, t (172 df) = 6.98, $p < 0.001$)], total effects. It was also found that TMTCs were positively related to RBNs [($\beta = 0.54$, t (172 df) = 4.99, $p < 0.001$)]. Moreover, the mediator (RBNs) was positively associated with ES [($\beta = 0.40$, t (172 df) = 5.04, $p < 0.001$)]. Additionally, the analysis indicated that the direct effect of TMTCs on ES was reduced [($\beta = 0.63$, t (172 df) = 5.18, $p < 0.001$)] when controlled for RBNs, thus, partially mediated with confidence intervals ranged from 0.11 to 0.37.

To further investigate the relationship between the intensity of having stronger micro-foundations such as TMTCs and sustainability, surveyed companies were categorized into high or low intensity of TMTCs. The t-test results in that the grouping is significantly different at $p < 0.00$ with means ($\overline{x}$) 4.01 and 4.33 for low TMTCs and high- TMTCs

respectively. Similarly, the groups for RBNs [$(\overline{x})$ 4.01; $(\overline{x})$ 4.20; p < 0.01] and environmental sustainability [$(\overline{x})$ 4.00; $(\overline{x})$ 4.25; p < 0.05] were different. As shown in Figure 3, our interaction analysis concludes that more environmental sustainability or sustainable practices are achieved when firms' top management is equipped with tangible competencies (e.g., quantitative background and analytical skills) with in-depth relevant knowledge. Firms also adapt better sustainable practices when TMTCs are interacted with RBNs ($\beta = 0.15$, p < 0.05).

[Insert Figure 3 here]

Discussion and conclusion

The aims of this research were to assess the relationships between top management tangible competencies (TMTCs), relationship-based business networks (RBNs) and environmental sustainability. We found that TMTCs were positively related to RBNs and environmental sustainability. RBNs were also positively correlated to environmental sustainability. Additionally, RBNs plays a partial mediating role between TMTCs and environmental sustainability. These results support our theoretical framework underpinned by our hypothesis development.

Theoretical implications

The findings of this article provide important insights to organizational theory by demonstrating how the interactions between the individual level competencies and skills and the relationship based networks influence environmental sustainability, drawing on the micro-foundations of the RBV and social network theory linked with trust and information sharing. Emerging sustainability studies at the individual level of analysis have focused more around understanding the role of green leadership and employees' pro-environmental behaviour in sustainability (e.g., Kim et al., 2014; Renwick et al., 2013; Robertson and

Barling, 2013), however, little research has been conducted in explicating the important role of micro-foundations and top management competencies in environmental sustainability. Thus we bring micro-foundations to the extant literature on environmental sustainability. In contrast to previous sustainability research that focused on the possession of specialist environmental competencies by companies (e.g. pollution prevention competencies, the ability to create green innovations or an organization's sustainability reputation) (e.g. Hart, 1995; Chen et al. 2006; Lourenço et al., 2014), we particularly emphasise contemporary skills possessed by individuals (e.g., modern data-mining and analytical skills with social networking competencies) that are imperative for modern business operations, as these operations are being inundated with structured and unstructured data. We additionally contribute to the existing literature on environmental sustainability by providing specific and deeper insights on the linkages between the micro foundations such as individuals' skills and competencies and relationship based business networks rooted in the social network theory and how these in turn affect environmental sustainability. Essentially, we establish a link not only between the micro-foundations and environmental sustainability, but also the micro-foundations and relationship based business networks that partially mediate the correlation between TMTCs and environmental sustainability (Coleman, 1988; Powell et al., 1996; Swan and Scarbrough, 2005).

These findings have important implications for the RBV and network theories. Recent scholarship from the RBV lens has begun to explore the micro-foundations of the RBV (Abell et al., 2008; Coff and Kryscynski, 2011; Foss, 2011; cf. Nyberg et al., 2014), investigating market factors within human resource management, most notably, the unit-level human capital resource (cf. Nyberg, et al., 2014) and within strategic management such as the micro-foundations of value appropriation and the micro-foundations of firm-level heterogeneity (Foss, 2011). However, the RBV scholarship has failed to explore the micro-

foundations of nonmarket factors, most notably environmental sustainability (Frynas and Yamahaki, 2016), which our study helps to explore. We suggest that individual skills and competencies play an important role in enhancing environmental sustainability, in contrast to the previously popular view that resources required for environmental sustainability "depend upon large numbers of people or teams engaged in coordinated actions such that few individuals, if any, have sufficient breadth of knowledge to grasp the overall phenomenon" (Hart, 1995: 989). Hence we demonstrate that the micro-foundations of the RBV matter as much for environmental sustainability as they matter for HRM or strategic management. Furthermore, the ideas put forward in this article echo the wider research on dynamic capabilities (e.g., Teece, 2007; 2014) as well, which upholds that an individual's characteristics directly influence sensing and seizing opportunities and firm performance.

These findings also have implications for network theories, as they have emphasized the social and relational factors for economic activities (e.g., Granovetter, 1985; Burt, 1992; Schoenherr et al., 2015), however most of the research focus has been at the organizational level such as organization wide networks and how these influence learning as well as organizational performance thus ignoring the role of individuals' skills and competencies in the formation of relationship based business networks. Therefore, we firmly bring micro-foundations into the network based theories and highlight the important role of individual skills and competencies in the formation of relational assets in the form of relation based business networks that lead to environmental sustainability.

In summary, this study contributes to extant research on environmental sustainability; particularly it identifies the micro-level variables and thus enhances our understanding of how individual skills and competencies may serve as the key foundations for environmental sustainability. It is one of the first attempts to link individuals' skills and competencies to the concept of environmental sustainability and relationship based business networks. Answering

to the research call by Foss and colleagues (e.g., Felin et al., 2015; Foss, 2011; Felin and Foss, 2005) for an integrated view on the interactions between the micro and organizational level analysis, this article has identified possible individual level skills and competencies for environmental sustainability. The interplay of individual skills and competencies and relationship based business network considerations may be leveraged to develop organization-wide environmental practices.

Practical implications

The findings of this study have important implications for managers and policy makers. Organizations are facing growing pressures from various stakeholders to improve their environmental performance. Understandably, green leadership and green management practices have received much attention. But our findings suggest that green leadership and new management practices should be accompanied by nurturing micro-level top management skills and competencies in order to improve organizations' environmental sustainability. Thus, organizations would benefit from investing and hiring managers and employees that have key skills and competencies relevant for improving environmental sustainability, as organizations navigate through the complex demands of various stakeholders.

In their selection of sustainability professionals, companies understandably tend to focus on sustainability-related skills and competencies (e.g. engineering skills or familiarity with ISO14000 and other management systems) and relational skills and competencies (e.g. publicity skills or the ability to negotiate with civil society and policy makers). But our findings suggest that tangible personal skills such as analytical expertise or knowledge of quantitative techniques play an important role in daily business operations and may improve environmental sustainability by quickly unpacking the knowledge and expertise required in managerial decisions on environmental sustainability. In fact, we think that data-savvy and analytical-oriented top management can possibly make better decisions regarding

environmental sustainability because they are better able to sift through a constantly growing wealth of data, especially in large, complex multinational companies with far-flung global operations.

The findings further suggest that quantitative education, data mining, analytical insights are important with regards to scanning external demand and pressure for better environmental sustainability. Thus companies would be better off by investing in analytical skills in order to predict customer demand for green products, quantifying environmental performance and external market potential for new business opportunities and analytical-oriented workforce which can all improve environmental sustainability. The findings further indicate that having these characteristics also help to build trusted information exchange platforms, share best practices for building better RBNs, create mutual trust and foster relationships with business partners. Consequently, through such characteristics and network relationship firms together achieve better environmental sustainability. The intensity of TMTCs and RBNs both together may provide better environmental sustainability. It is thus worthwhile to take this on board that relationship oriented-firms may equip their top management with better tangible skills and relevant knowledge so they might apply analytics to achieve better sustainable practices.

Finally, policy makers should pay greater attention to the importance of the above-mentioned skills. On the one hand, policy makers need to employ more government officials with quantitative education or analytical skills in order to better evaluate corporate environmental performance or the success of existing government regulations. On the other hand, they could encourage the development of such skills through educational policies (e.g. by investing in the relevant educational institutions or rewarding universities that make quantitative skills obligatory in environmental management courses) and they could encourage the development of relevant RBNs (e.g. by removing any legal barriers to collaboration between corporations or by developing public programmes for the exchange of

sustainability best practices in SME clusters). In fact, we think that the lack of the required quantitative or analytical skills in government may be an important reason why environmental regulation sometimes fails to be successfully implemented and why regulation fails to improve corporate environmental performance, especially in developing/emerging economies whose governments often lack the relevant skilled professionals.

Limitations and future research

We acknowledge the limitations of our research, but we also recognize several valuable opportunities for further research on this topic, since scholarship examining the specific role of micro-foundations and network based business relationships in environmental sustainability is still in its infancy. Firstly, while we underpinned the theoretical grounds based on arguments raised by previous research and addressed endogeneity issues, no causal claims can be made as this is a non-experimental study. Future research might conduct in-depth longitudinal case studies to further unpack the interactions between individual competencies, networks and environmental sustainability. Secondly, our study is based on one specific industry and future research would benefit from follow-up studies in other industries, given that the underlying constructs can behave differently in different industries. Finally, the role of TMTCs and RBNs may vary inter alia between different contexts due to the differences in home country and host country institutional environments, or they may vary between different points in time as contemporary business requirements and analytical techniques change due to technology and new business requirements and their connections with environmental sustainability. Therefore we suggest that future research would benefit by testing our model in different institutional contexts and at different time periods. Studies may also combine different measures, including top management competencies, specific leadership style, top management pro-social behaviour, employees' attitudes, norms and

belief systems as well as HRM practices and examine their impact on environmental sustainability.

In this paper, we focus only on environmental sustainability. We believe, however, that integrating social and financial measures of sustainability can provide important insights. Therefore, future studies can examine two-fold linkages regarding sustainability dimensions. First, sustainability may be tested as a multi-dimensional construct if they do not show competing and contrasting effects, which will require a comprehensive scale development approach. Second, once the scales are developed, research can focus on the links between the dimensions that might reveal inter alia interesting results for those firms that believe that environmental sustainability is often achieved at the cost of financial loss.

Future research should also focus on pure technical skills of top management, how these skills can help them to make automated business decisions, to optimize business performance and to quantify micro-level environmental performance measures. As modern business operations are intensively inundated with data and analytics and technology (e.g., big data analytics and internet of things), this trend has thrown many challenges for managers and executives to continuously up-date their skills to remain part of the game. Researching the links between specific modern skills at micro-level and their impact on environmental performance outcomes at organizational level may provide valuable insights.

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Table 1. Sample characteristics

	Category	No	%
Job titles	Directors	106	61
	CEOs	69	39
Agri-food networks	Veg. & fruits	98	56
	Meat	52	30
	Dairy	25	14
Employees	<20	41	23
	20-100	81	46
	101-200	53	30
Turnover($m)	<15	28	16
	15-60	147	84
Total		175	100

Table 2. Reliability and validity of constructs, evaluation of measurement models

Constructs	Items	α	λ	AVE	C.R
Top management tangible competencies (TMTC): Education-based competencies Experience-based competencies Analytical-based competencies	TMTC_Ed TMTC_Ex TMTC_An	0.74	0.79 0.72 0.62	0.51	0.76
Relationship-based business networks (RBNs):	RBN1 RBN2 RBN3 RBN4 RBN5 RBN6 RBN7	0.91	0.70 0.73 0.78 0.80 0.92 0.73 0.73	0.60	0.91
Environmental sustainability (ES)	ES1 ES2 ES3 ES4 ES5	0.89	0.74 0.83 0.86 0.77 0.80	0.61	0.92

α = items reliability; λ = loadings; AVA =average variance explained; C.R =construct reliability

Table 3. Second method for discriminant validity

Constructs	Statistics			Condition met
	ϕ	ϕ^2	AVE	$\phi^2 < AVE$
TMTC & RBNs	0.36	0.13[a]	0.56[b]	Yes
TMTC & ES	0.47	0.22	0.56	Yes
RBNs & ES	0.46	0.21	0.61	Yes

ϕ=correlation between factors, [a]ϕ^2, 0.36*0.36 = 0.13; [b]AVE, (0.51+0.60)/2 = 0.56 (AVE for TMTC & RBNs)

Table 4. Descriptive statistics and correlation matrix of underlying constructs

| Constructs	$\overline{x}$	σ	TMTCs	RBNs	ES
Top management tangible competencies (TMTCs)			1		
Relationship-based business networks (RBNs)	4.17	0.27	0.36	1	
Environmental sustainability (ES)	4.10	0.41	0.47	0.46	1
	4.09	0.48			

$\overline{x}$ (mean); σ (standard deviation); n=175; all correlations are significant at p < 0.01

Appendix
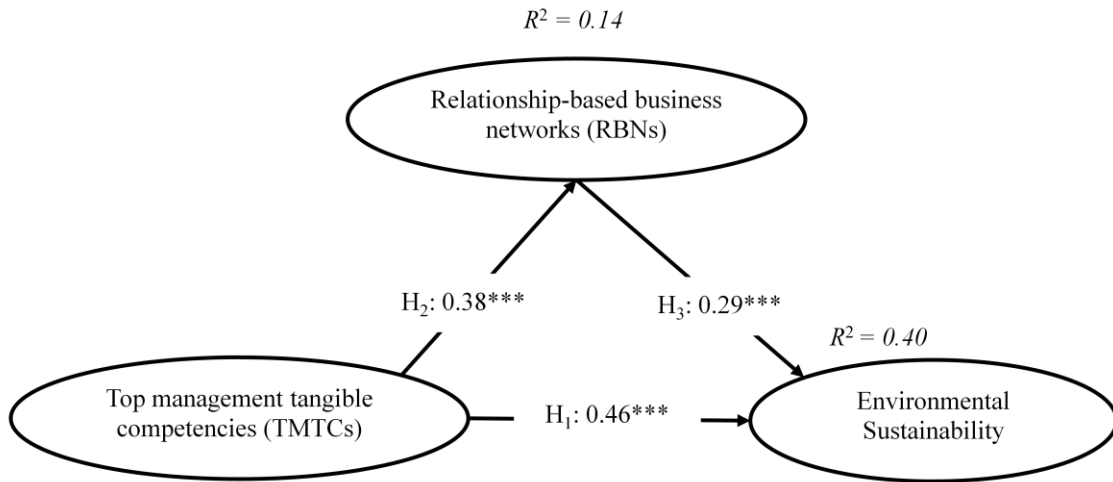
Table 5. Constructs, brief item description and codes

Constructs	Brief items description	Codes
Top management tangible competencies (TMTC): (Bennis and O'Toole, 2005; Kor and Mahoney, 2005; Chen et al., 2012; Waller and Fawcett, 2013) Education-based competencies Experience-based competencies	• I have in-depth business knowledge that helps to understand our business operations	TMTC_Ed1
	• I use network analytics to understand our business network operations	TMTC _Ed2
	• I know key quantitative techniques for improving business operations (e.g. optimization techniques)	TMTC _Ed3
	• I have sufficient quantitative educational background to produce insights from big data	TMTC _Ed4
	• I have experience to understand complex import and export business operations	TMTC _Ex1
	• My experience in data mining helps our company to improve our business operations	TMTC _Ex2
	• My experience in quantitative analytics is the key determinant for our performance improvement	TMTC _Ex3
	• My experience in analytics helps our company to improve our key business operations	TMTC _Ex4
Analytical-based competencies	• Our analytical dashboard helps to create business opportunities	TMTC _An1
	• We frequently use analytical skills to predict customers' demand (e.g., buying patterns)	TMTC _An2
	• Our analytical skills are the key assets for our performance improvement	TMTC _An3
	• Our dashboard indicate the key analytical insights	TMTC _An4
	• We use analytics to create more external business opportunities (e.g., developing/opening a new branch)	TMTC _An5
	• Our analytics help us to quantify our performance	TMTC _An6
	• We pay special attention for analytical skills when we hire our employees	TMTC _An7
	• Our analytics strongly support our business strategy	TMTC _An8
	• Analytics help us to make automated decision making	TMTC _An9

Relationship-based business networks (RBNs) (Patnayakuni et al., 2006; Li et al., 2010)	• We have created trusted information exchange systems for our RBNs	RBN1
	• We share our best practices for building better RBNs	RBN2
	• Our RBNs are based on mutual trust	RBN3
	• Overall, we have satisfactory relationships with business partners	RBN4
	• We have long term relationships with our strategic partners	RBN5
	• Both sides in the relationship do not make any demands that can hurt the relationship	RBN6
	• Our relationship network mechanisms are based on participatory decision-making	RBN7
Sustainability (SUS): (Rao et al., 2006; Hart, 1995) Environmental sustainability	• Our total waste to output ration is reducing	ES1
	• We strongly follow reusable packaging policy	ES2
	• Our material efficiency is increasing	ES3
	• Our energy consumption is decreasing	ES4
	• Our negative impacts on natural environment are reducing	ES5
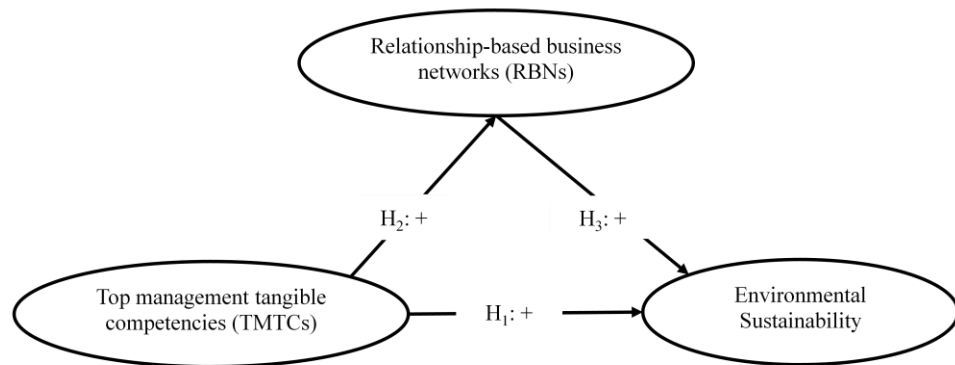
H_4: Relationship-based business networks also mediate the relationship between TMTCs and sustainability

Figure 1. Interrelationships between underlying constructs: essential micro-foundations

$R^2 = 0.14$

Relationship-based business networks (RBNs)

$H_2: 0.38***$ $H_3: 0.29***$

$R^2 = 0.40$

Top management tangible competencies (TMTCs)

$H_1: 0.46***$

Environmental Sustainability

H_4: Relationship-based business networks also mediates the relationship between TMTC and sustainability

*** statistically significant at $p < 0.01$

$n = 175; p = 0.126; \chi^2/df = 1.181; CFI = 0.990; TLI = 0.987; IFI = 0.990; RMSEA = 0.032$

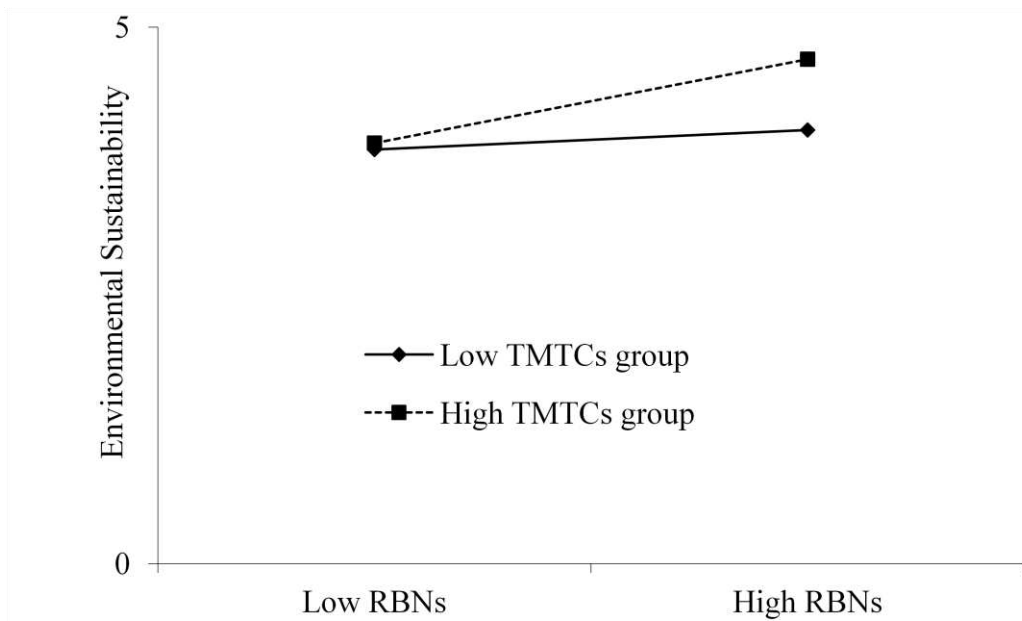*Figure 2. Structural results for hypothesis testing, R^2 values and fit indices*

Figure 3. Interaction effects of essential micro-foundations

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