The Relationship between Innovation Culture and Innovation Outcomes: Exploring the Effects of Sustainability Orientation and Firm Size

Zhongqi Jin[1]

PhD, Senior Lecturer in Marketing
Middlesex University Business School
The Burroughs
London NW4 4BT
UK
Tel: 44 (0)20 8411 5571
E-mail: z.jin@mdx.ac.uk

Jyoti Navare

PhD, Associate Professor
Department of Economics
Middlesex University Business School
The Burroughs
London NW4 4BT
UK
Tel: 44 (0)20 8411 6568
E-mail: j.navare@mdx.ac.uk

Richard Lynch

Professor in Strategic Management
Open University
Walton Hall, Kents Hill,
Milton Keynes MK7 6AA
UK
Tel: +44 (0) 20 7638 4727
Email: Richard.Lynch@open.ac.uk

This is the accepted version of the following article: Jin, Z., Navare, J., Lynch, R. (2018) The Relationship between Innovation Culture and Innovation Outcomes: Exploring the Effects of Sustainability Orientation and Firm Size, [Published online on 19th November, 2018], which has been published in final form at [**https://doi.org/10.1111/radm.12351** (doi: 10.1111/radm.12351)].

[1] Corresponding author

Acknowledgment
The authors would like to thank the participants at the 2014 PDMA Research Forum for their valuable feedback. Furthermore, we would like to thank Dr. Kremena Slovova, Prof. Richard Croucher, Prof. Anne-Wil Harzing, and Prof. Arno Haslberger from Middlesex University for their generous comments on an earlier version of the paper. The authors would also like to thank the editor and two anonymous reviewers of *R&D Management* for their insightful and helpful comments.

Author Biographies

Zhongqi Jin is a Senior Lecturer at Middlesex University Business School, London, UK. He holds a PhD from School of management, University of Bath. He teaches marketing and innovation. His research interests are in the fields of innovation management, product development, and consumer behaviour. He has published in *R&D Management, Journal of Business Research, International Journal of Innovation Management, Creativity and Innovation Management, International Business Review, Journal of Strategic Marketing, Asia Specific Journal of Logistic and Marketing, Asia Pacific Business Review,* among others.

Jyoti Navare is a Doctor of Philosophy in Risk Management (Southampton University), MBA, a Fellow of the Chartered Insurance Institute, Associate of the Institute of Chartered Secretaries and Administrators and Fellow of the Higher Education Academy. She is associated professor at the Middlesex University Business School. She has professional experience as an International Risk Manager and Underwriter based in London and Sweden working closely with Financial Services organisations and governments internationally. She has held visiting professorships in Germany, Poland and Iceland. Her key research activities are in the areas of Risk Management, Innovation, International Marketing and Business Sustainability, Financial Institutions and Regulations, Consumer Behaviour and Professional Education.

Richard Lynch is a Professor in Strategic Management at the Open University, England. He originally studied at UMIST, Leeds University and the London Business School. He worked for over 20 years in business with well-known companies such as J Walter Thompson, General Foods (now part of Mendelez) and Dalgety Spillers (now part owned by Nestle) in positions on marketing and strategic management. He has been involved in higher education for over 30 years and written five books on international marketing and strategy, in addition to eight editions of the textbook *Strategic Management* published by Pearson Education . His current research interests focus on global strategy, particularly with regard to developing countries and sustainability. He has published in the *Journal of Business Research, Asia Pacific Business Review, International Business Review, Management Research Review, Thunderbird International Business Review, Management Decision, Journal of Innovation and Knowledge*, among others.

The Relationship between Innovation Culture and Innovation Outcomes: Exploring the Effects of Sustainability Orientation and Firm Size

Abstract

Being sustainability oriented has become a key strategy for many firms. Equally, innovation culture and innovation outcomes have long been recognized as important contributors to the growth of firms. However, the literature on sustainability and innovation provides limited understanding of the important relationship between sustainability orientation, innovation culture and innovation outcomes. Given that large firms and small firms differ in building and employing their strategic assets, firm size matters in understanding the relationship. Through the lens of resource-based view, we develop a theoretical model embedding the four components and test it using data from a global survey: the 2012 Comparative Performance Assessment Study. Our research contributes to sustainability literature and innovation theory by providing an integrated framework to explicate the mechanism through which the innovation culture of the firm impacts on innovative performance through the sustainability orientation of the firm. The findings advance our understanding of the extent to which sustainable orientation can explain the relationship between innovation culture and innovation outcomes. Our evidence shows that the innovation culture of a firm facilitates the sustainability orientation of the firm and that the converse also applies. The research also contributes to our knowledge of the differences between large and small firms in leveraging their strategic assets in terms of innovation culture and sustainability orientation to facilitate superior innovation outcomes. Although firm size moderates the relationship between innovation culture and innovation outcomes, the research shows that this no longer holds when sustainability orientation is included in the relationship. A strong sustainability orientation can be a competitive advantage for firms in the delivery of superior innovation outcomes.

Key Words: Innovation culture, new product development, sustainability, innovation performance.

1. Introduction

Being sustainability oriented has become a key strategic objective for many firms (Behnam *et al.,* 2018; Behnam and Cagliano, 2017; Johnson, 2015). A 2017 report from the annual global survey by MIT Sloan Management Review in partnership with The Boston Consulting Group found that 60% of firms have a sustainability strategy and 90% of companies consider a sustainability strategy important to remain competitive (Kiron *et al.,* 2017). However, how to build a business case for the sustainability oriented firm still remains an important issue (Claudy *et al.*, 2016). Kiron *et al.,* (2017) reported that only 25% of the firms surveyed had developed a positive business case for sustainability, large firms scoring better than small. The challenge for firms in the era of sustainable development is to balance the increase in operating costs from the adoption of sustainable practices against the benefits of new sustainable products and services that contribute to environmental and social responsibility issues deriving from sustainability-oriented innovation (Adams *et al*., 2016). Hence, scholars stress the importance of understanding the innovative performance of firms engaged in sustainability (Büschgens *et al.*, 2013; Fliaster and Kolloch, 2017).

To understand firm innovative performance we cannot ignore firm culture, especially the culture to innovate. As Teece (1996: 206) puts it "The right culture is not just an important asset to assist in technological development; it may be a requirement". Recent studies have stressed the importance of the role of organizational culture, especially innovation culture (IC), and sustainability orientation (SO) in contributing to the innovative performance of firms (Linnenluecke and Griffiths, 2010; Shevchenko *et al.*, 2016). For example, Adams *et al*., (2016: 189-190) suggest "a fundamental shift in mind-set and purpose from 'doing less harm' to creating shared value and delivering wider benefits for society: 'doing good by doing new things'… Innovation and sustainability are deliberately orchestrated within the firm, implying a growing SOI [Sustainability Oriented Innovation] culture in which sustainability is no longer regarded as an add-on, but rather is/becomes embedded as a cultural and strategic norm." It is, therefore, essential to rethink the mechanism through which the IC impacts on the SO and the innovative

performance of a firm. Within this, firm size has long been recognized as a moderating factor by researchers from both the fields of innovation management (Damanpour, 2010) and environmental management (Darnall *et al.*, 2010; Cordeiro and Tewari, 2015; Reyes-Rodríguez *et al.*, 2016). Extant literature has demonstrated that firm size is related to each of these three factors, but little is known regarding the impact of firm size on these relationships (Damanpour, 2010; Reyes-Rodríguez *et al.*, 2016). Specifically, there are no studies on the relationship between the IC of the firm and its SO in terms of the innovation outcomes (IO) of the firm. Given the pressures to become more sustainable, this gap matters for firms because changes in the IC of the firm may make a significant contribution towards SO (Seebode *et al.,* 2012). Current sustainability and innovation literature provides only a very limited understanding of the relationships between SO, IC and IO. This research employs a resource-based view (RBV) theoretical perspective to examine the relationship between the IC and the IO of a firm within the context of the moderating effect of firm size and the potential mediating effect of SO.

The contribution of this study is three-fold. First, from a RBV perspective, this paper provides an integrated framework to explicate the mechanism through which the IC of the firm impacts on innovative performance through the SO of the firm. This study complements the paper by Behnam and Cagliano (2017) which examines the link between sustainability, innovation and performance from an operations management perspective, thus responding to the calls by Hansen *et al.,* (2009) and by Schaltegger and Wagner (2011) for a better embedded framework that combines both sustainability and innovation theory. Second, this paper advances our understanding with regard to the extent to which sustainable orientation can explain the relationship between IC and IO. This directly addresses the issue of building a business case for sustainability oriented firms (Hockerts, 2015) and the growing literature regarding SO as a strategic asset (Behnam and Cagliano, 2018; Adams *et al.*, 2016). Third, the paper contributes to our knowledge of the differences between large and small firms in leveraging their strategic assets in terms of IC and SO to facilitate superior IO. Although there is growing evidence in both the innovation literature (Damanpour, 2010) and the sustainability management literature (Reyes-Rodríguez *et al.*, 2016) that firm

size is an important moderator, there has been no attempt to the present to integrate these three elements together and examine their impact on the innovative outcomes of the firm (Bos-Brouwers, 2010).

2. Literature Review and Theoretical Framework

Through the theoretical lens of the RBV, this paper draws on two main streams of literature: sustainability management, and innovation management. How to combine sustainability and innovation is a challenging managerial task facing many firms (Hoffman and Georg, 2013; Schiederig *et al.*, 2012). Success has the potential to deliver both added value and competitive advantage to firms (Hart and Milstein, 2003). Research that combines both sustainability management and innovation management has therefore been growing steadily in the last decade (Xavier *et al.*, 2017). Such research is often referred to as 'sustainability-led innovation' (Hansen *et al.*, 2009) or "innovating for sustainability" (Adams *et al.*, 2016).

Although a substantial body of knowledge exists in this area, researchers point to at least three limitations in this literature. First, the link between sustainability and innovation is not conclusive. Some papers have shown that sustainability strongly facilitates innovation (Nidumolu *et al.*, 2009; Kiron *et al.*, 2013) while other researchers have been more cautious about such a conclusion (Charter and Clark, 2007; Schaltegger *et al.*, 2012). Further understanding is vital because firms need to decide whether to favor sustainability in initiating/developing new product development programs (Behnam and Cagliano, 2018; Palma and Visser, 2012).

Second, there is a significant gap in sustainability research with regard to smaller and medium sized enterprises (SMEs) (Lefebvre *et al., 2003;* Frey *et al.*, 2013; Hörisch *et al.*, 2015). This may be because of the limited availability of new technology and practical experience in sustainability-related issues amongst SMEs (Dearing, 2010). Whatever the reason, the different resources available to large and small firms will impact on their ability to deliver more sustainable outcomes (Darnall *et al.*, 2010; Shevchenko *et al.*, 2016).

Third, although innovation is "a powerful explanatory factor" behind both competitive advantage and higher profitability in firms, unpacking the elements that contribute to the topic has proved more problematic. "We know much less about how and why innovation occurs than what it leads to." (Fagerberg, 2006: 20). Kyrgidou and Spyropoulou (2013) made a similar observation. Scholars have, therefore, called for a more detailed framework on sustainability and innovation theory and practice (Hansen *et al.*, 2009; Schaltegger and Wagner, 2011 Schiederig *et al.*, 2012). From RBV theory, IC and SO can be regarded as strategic assets of the firm (Barney, 1986; Ketata *et al.*, 2015). The key question is how to employ these assets for better firm performance. Large firms differ from small firms in leveraging their strategic assets (Gallo and Christensen, 2011). Hence it is important to take into account the role of firm size when considering the effect of IC and SO on IO.

In this research we propose an integrated framework which explores the relationship between IC, IO and SO in relation to firm size. Our conceptual framework is shown in Figure 1. We discuss our model in more detail in the sections that follow.

----------Insert Figure 1 about here----------

2.1 The relationship between the innovation culture and the innovation outcomes of the firm

Innovation culture is an important facet of organizational culture (Brettel and Cleven, 2011). Studies on organizational culture have been numerous (Schein, 2004; Alvesson, 2002). It has been defined as a reflection of a set of values, beliefs, assumptions and symbols that inform the way a firm conducts its business (Pettigrew, 1979; Schein, 2004) or the collective programming of the mind in a firm (Hofstede, 1998). To facilitate innovation, Büschgens *et al*., (2013) argue that organizations need a culture based on strong shared values and beliefs that recognize the efforts of innovators and tolerate failure. Such culture characteristics have employed such terms as: innovation geared or oriented organizational culture (Wynen *et al.,* 2014), innovation-supportive culture (Chandler *et al.*, 2000), innovative culture (Skerlavaj *et al.,* 2010), and innovation culture (Brettel and Cleven, 2011). These terms are largely interchangeable. For the purpose of this paper and to avoid confusion, we use the term innovation culture (IC).

IC has been defined in various ways. These include risk taking behavior and shared beliefs in new product success (de Brentani *et al.*, 2010); a climate of openness to innovation (Capon *et al.,* 1992); a mind-set of change and adaptability (Andriopoulos, 2001); future market orientation (Atuahene-Gima, 1995). Taking these consideration, we define IC as set of shared beliefs and risk taking behavior which cherishes a climate of openness to innovation, a mind-set towards change and future market orientation and a willingness to take risks and learn continuously.

Denham and Kaberon (2012) show that a culture for innovation promotes the creation and implementation of new ideas and, arguably therefore, its outcomes. Hult *et al.,* (2004) demonstrated that innovativeness positively affects performance. Hence, the innovative culture of the firm is a significant contributor to the innovative performance of the firm (Brettel and Cleven, 2011; Büschgens *et al*., 2013). The underpinning reason for this relationship is that the organization culture of the firm is a potential source of competitive advantage (Barney, 1986; Dubey *et al*, 2017; Ketata *et al.*, 2015). Thus the IC of the firm has the potential to deliver superior performance (Bretel and Cleven, 2011; Teece, 1996). Such studies show that IC and IO are linked and that a stronger IC is likely to produce stronger positive IO. Thus, we argue that:

H1: Innovation culture is positively associated with innovation outcomes.

2.2 The relationship between innovation culture and sustainability orientation

Over the last thirty years, sustainability has become a key business objective for many firms. Consistent with Brundtland's (1987) early exploration of the concept of sustainability and the environment, we define the sustainability orientation (SO) of the firm as 'The extent to which firms are actively integrating sustainability principles into their business purpose' (Claudy *et al*., 2016). These include strategies associated with the environment and the product innovation directed towards achieving this aim. Hansen *et al.,* (2009: 685) argued that "sustainability puts a normative demand on innovation to become more environmentally and socially benign and, at the same time, it provides a new source of innovation and competitive advantage." Thus SO may involve a value judgement by the company as well

as external pressure from legislation, opinion formers and pressure groups (Behnam and Cagliano, 2017; Cordeiro and Tewari, 2015).

The impact of IC on SO is much less researched (Gallego-Alvarez *et al.*, 2011). We argue that the IC of the firm will have a positive impact on the SO of the firm for three reasons. First, a firm with a strong IC is, by definition, constantly looking for new opportunities. Kleysen and Street (2001: 285) define the opportunity exploration with the metaphor of "travelling extensively through innovation opportunities in order to learn or discover more about them". Being sustainability orientated may be one of the outcomes of such endeavours. Second, a meta-analytic literature review by Adams *et al.* (2016) concluded that sustainability-led innovation and traditional innovations have much in common. "Any already developed innovation capability can be an important antecedent of SOI [Sustainable Oriented Innovation] capability" (Adams *et al.*, 2016: 189). Third, a firm with a strong IC tends to invest more in innovation activities and to be more capable of implementing innovative ideas (Hansen *et al.,* 2009; Ketata *et al.*, 2015; Kyrgidou and Spyropoulou, 2013). Therefore, such firms are likely to be better equipped to be sustainability oriented given the environmental uncertainty that they face. Thus we propose that:

H2: Innovation culture is positively associated with sustainability orientation.

2.3 The sustainability orientation of the firm in relation to innovation outcomes

In recent years, the combination of outside pressures and the choice by companies themselves has generated new industries that previously hardly existed. Hockerts (2007) identified six market opportunities from being sustainability oriented: the reduction of costs through increase of efficiency, the reduction of risks, planned reliability, the assurance of legitimacy, the attraction of new customer segments and the development of new products and business segments. SO, therefore, has resulted in the production of major new products and services and, in this sense, delivered a new wave of innovative outcomes (Du *et al.*, 2016). A number of other papers have also supported the view that the SO of the firm leads to positive IO (see, for example, Bos-Brouwers, 2010; Dearing 2010; Schrettle *et al.,* 2013). We therefore assume:

H3. Sustainability orientation is positively associated with innovation outcomes.

2.4 *The mediating effect of sustainability orientation*

In recent times there has been a strong drive towards sustainable-oriented innovation products and services (Ketata *et al.*, 2015; Fliaster and Kolloch, 2017; Schiederig *et al*., 2012) with such descriptors as 'green' or 'environmentally friendly'. There are three reasons for such change: the impact of new sustainable technologies (Dubey *et al.*, 2017); government policies and legislation leading to new environmental process standards (ISO 9000 and ISO 14000); changes in social attitudes within society (Brundtland, 1987). The outcome of such pressures has been for some firms to adopt and/or develop innovations that are oriented towards delivering increased sustainability (Nidumolu *et al.*, 2009). However, such changes at the level of the firm do not just happen: they require the organisational culture of the firm to become more responsive to sustainability issues and pressures (Fliaster and Kolloch, 2017) and, in some firms, to take the initiative with a significant change in organisational culture with regard to becoming more 'sustainability oriented' (Denham and Kaberon, 2012). Such organizational culture change initiatives may require firms to become more innovative (Ketata *et al.,* 2015; Kyrgidou and Spyropoulou, 2013). The combination of sustainability and innovation is a challenging managerial task facing such firms (Hoffman and Georg, 2013). Our first two hypotheses argued that IC is directly related to IO and SO. However, there is evidence that firms that lack an innovation capability are unlikely to become truly sustainable (Büschgens *et al.*, 2013; Shevchenko *et al.*, 2016). Recent research shows that increased SO provides a further way of increasing the innovation capability of a firm and therefore its IO (e.g. Behnam and Calgliano, 2017, 2018). This supports the existence of the indirect effect of IC on IO via SO. Thus SO mediates the relationship between the IC and IO. However, because some firms are not fully committed to sustainability (Smith *et al.*, 2010) and not focused primarily on innovation and its related capabilities (Reyes-Rodríguez *et al.,* 2016), it follows that SO will not necessarily account completely for the relationship between IC and IO. We therefore argue that:

H4: Sustainability orientation partially mediates the relationship between innovation culture and innovation outcomes.

2.5 *The moderating effect of firm size*

Firm size is an important factor in the literature on innovation theory (Damanpour, 2010; Camison-Zornoza *et al.*, 2004) and sustainability (Zhai *et al.*, 2018; Lefebvre *et al., 2003;* Gallo and Christensen, 2011). In essence, there are two opposing theoretical views. Some scholars argue that larger organizations can be more innovative due to their stronger resources and capabilities in research and development, marketing and finance (Ettlie and Rubenstein, 1987; Dixon-Fowler *et al.*, 2013). They are more able to tolerate the possible failure of new products and the costs associated with innovation and change. They are, therefore, able to take higher risks and be more innovative (Price *et al.*, 2013). Conversely, other scholars argue that that smaller organizations are more innovative due to their flexible and less formal organizational structure and their ability to make quick decisions in response to environmental change (Chen and Hambrick, 1995; Darnall *et al.*, 2010; Guo *et al.*, 2017). Some researchers have argued that this relationship may be present but is rather weak (Camison-Zornoza, *et al.*, 2004; Ettlie and Rubenstein, 1987). Other researchers have recognized the indirect, moderating role of firm size on innovation activities (Andries and Faems, 2013; Zona *et al.,* 2013). Hence, we argue on balance that firm size moderates the relationship between IC and IO. However, given the conflicting empirical evidence in this area, our research seeks to provide a new perspective on this important issue.

With regard to the size and direction of the influence of firm size on IC and IO, large firms both in terms of their culture and organizational structure are typically more diverse than smaller firms. This may, therefore, make them less effective in yielding IO (Andries and Faems, 2013). Moreover, given the limited resources and the pressure to survive, smaller firms may be more effective in yielding IO under a similar IC (Guo *et al.*, 2017; Zona *et al.*, 2013). We therefore argue that:

H1a: Larger firms have a weaker relationship between innovation culture and innovation outcomes than smaller firms.

Although IC is positively related to SO, there is some evidence that firm size influences this relationship (Darnell *et al.,* 2010; Hörisch *et al.,* 2015). Chen and Hambrick (1995) concluded that small firms tend to show a greater propensity for action, and execute their responses faster, in spite of being slower and less visible in announcing such responses. Gallo and Cristensen (2011) showed that, when attempting increased sustainability, larger firms tend to resort to an increase in formality and complexity with a more bureaucratic code of conduct. They were therefore less effective than their smaller counterparts. According to Delmas and Toffel (2008: 1027), "differences in the influence of corporate departments lead their facilities to prioritize different external pressures and thus adopt different management practices," hence making large firms less effective in response to the external pressures for sustainability than small firms. We, therefore, argue that:

H2a: Larger firms have a weaker relationship between innovation culture and sustainability orientation than smaller firms.

The research into the impact of firm size on SO is relatively new. The consensus seems to be that firm size matters for firms engaging in sustainability activities. Gallo and Christensen (2011) found that there is a positive relationship between firm size and the firm's support for sustainability and sustainability reporting. Hoffmann *et al.,* (2012) stress the importance and the difficulty for smaller enterprises to convert green practices into competitive advantage.

The extent to which firms engage in sustainability initiatives is influenced by the available resources of the firm, including finance and human resources, through the implementation of new manufacturing technologies, and from the development of green products and the employment of green supply chain management (Darnall *et al.*, 2010; Dubey *et al*., 2017). Larger firms have the economies of scope to spread the risk of failure and absorb the costs of being sustainability oriented. They also have the resources to establish and maintain scientific facilities, to hire professional and skilled workers in diverse disciplines and to raise capital and market sustainability oriented innovations (Chandy and Tellis, 2000; Price *et al.*, 2013). The pressures become even more acute when firms need to engage in more than one sustainability initiative at any one time. Large firms are more likely to possess the critical resources to

pursue the invention of new products and related sustainable activities (Gerstenfeld and Roberts, 2000; Hörisch *et al*., 2015). They can engage in higher numbers of sustainability initiatives and have the resources to sustain such activity over longer periods (Gallo and Christensen, 2011). We, therefore, argue that:

H3a. Larger firms have a stronger relationship between sustainability orientation and innovation outcomes than smaller firms.

Research methodology

3.1 data collection

The empirical analysis in this paper is based on data from the CPAS survey, which was conducted in 2012. The CPAS survey was conducted online. The survey questionnaire was pilot-tested three times before formal data collection began. An e-mail invitation was sent to firms which were either PDMA members (3391) or on the PDMA contact list (21,588). In total 1,167 firms attempted the survey. The completed survey was checked and reviewed by four researchers, yielding a valid response of 452 firms. These firms were based in 24 countries and distributed across all sectors of economic activity, including business to business, business to consumer, low tech to high tech, and manufacturing to services. Markham and Lee (2013) provides a detailed sample description and Lee and Markham (2014) describes the survey design and methodological considerations. Because this is the fourth such survey, the reliability of the main constructs has been well tested and reported. The salient point for the purpose of this paper is that the dataset contains a wide range of information on new product development activities carried out by firms. In summary, this includes information regarding IC, SO, IO, firm size, innovation strategy, global reach, nature of technology, and the tangibility of products.

Measurement of key scales

Innovation culture (IC)*:* in line with prior research (e.g. Wynen *et al., 2014),* the construct was measured by eight items on a five point scale as follows. Respondents were asked to think about the culture within their business unit, what percent of time does their organization reflect following

values 1) Open to the constructive conflict that occurs within the innovation process; 2) Failure is understood to be a natural part of the innovation process; 3) Both innovation and risk-taking are valued for career development; 4) Recruitment parameters include the consideration of innovation potential; 5) Managers establish objectives in the areas of innovation including training, measures and results; 6) These established objectives are used in the performance review process; 7) Management effectively communicates its innovation values internally; 8) Management effectively communicates its innovation values externally. The five points range from: never, about 25% of time, about 50% of time, about 75% of time, and virtually always.

Sustainability orientation (SO) was measured by 10 items on a five point scale as follows: Respondents are asked about the importance to their company of the following:

1) Environmental sustainability; 2) social sustainability; 3) sustainability criteria for new product development; 4) measuring new product progress on sustainability; 5) future importance of sustainability-type criteria.

They were then asked to evaluate the degree to which their companies carry out the following activities: 6) developing sustainability policies; 7) managing their product's carbon foot print; 8) using the Triple Bottom Line for product planning; 9) including sustainability in their product development budget; 10) selecting suppliers and partners based on sustainability criteria. They were given five measurement choices: not at all important, slightly important, somewhat important, moderately important, and extremely important. These items are in line with existing research (Waddock, 2008).

Innovation outcomes were measured by two indexes: internal NPD success (INNOUT1) and external NPD success (INNOUT2) (Griffin and Page, 1996). INNOUT1 was measured by two items using a seven point Likert scale. Respondents were asked the extent to which they agree with two following statements:

a) Does their new product program meet the performance objectives set out for it?

b) Overall, was their new product program a success?

INNOUT2 was measured by a four point rating scale: respondents were asked to rate their business unit's overall new product success as compared with their primary competitors over the past 5 years in terms of 1) the most successful in the industry; 2) in the top third of the industry; 3) in the middle third of the industry; and 4) in the bottom third of the industry.

For this research, we incorporated four control variables: tangibility of products, nature of technology, innovation strategy and global reach. We chose these four variables for the following reasons:

First, the tangibility of products has long been associated with new product development. Although there are commonalities between the development of new physical goods (generally tangible) and new services (generally intangible), scholars have increasingly stressed the differences in developing these two areas (Papastathopoulou and Hultink, 2012). Second, there is extensive research literature on the differences in innovation between a high tech industry and a low tech industry (Lynn *et al.*, 1999). It is, therefore, necessary to take the nature of technology into consideration. Thirdly, given that the dependent variables are innovation outcomes, some innovative activities may have also played a role. We use innovation strategy here as a proxy for such considerations (Terzioski, 2010), measuring whether the firm values to be the first to the market, as fast followers as indicated by Miles *et al*., (1978). Finally, given that we consider both IC and SO, it is important to take into account the degree of globalization of the firm: we use the term global reach to measure this construct (Macagno, 2013).

3.2 Common Method Bias

Common method bias can be a major problem for survey related studies and may yield misleading results if it not controlled properly (Podsakoff *et al.*, 2012). We performed two statistical tests to assess the potential threat of common method bias. First, we applied Harman's one factor test (Podsakoff *et al.,* 2003). When entering all of the construct measures jointly into the exploratory factor analysis, no single general factor or components accounted for the majority of the variance. Using confirmatory factor analysis, the one factor model reported a worse and unacceptable fit (CFI=0.61, TLI=0.57, RMSEA=0.17, χ^2/df=2634.33/189=13.93, p value=0.000). For comparison,

the four factor measurement model reported an acceptable fit (CFI=.979, TLI=.970, RMSEA=.045, χ^2/df=288.445/152=1.898, p=0.000). The difference in the Chi-square values between these two models is statistically different ($\Delta\chi^2$=2345.85, df=37, p=0.000). These results support the absence of common method bias.

Second, we applied Lindell and Brandt's (2000) post hoc marker variable technique, where the smallest or second smallest correlation coefficient serves as a proxy for common method variance. We partialled out the second smallest observed correlation (R=-0.004; Table 2) from the initial correlation matrix using Lindell and Whitney's (2001) approach. No changes of significance were found beyond those previously already significant correlations after this correction. This indicated that there was no threat from common method bias in the results as suggested by Malhotra *et al.* (2006). Hence both test results suggest the absence of common bias variance.

3. Results

As the measurement items of the main constructs are well established, we used Confirmative Factor Analysis (CFA) to check the convergent validity and discriminant validity of constructs using the Lavaan Package in R language. The validity test results for multi-item constructs are shown in Table 1. As Table 1 shows, the CFA results suggested an acceptable fit. This is demonstrated by the goodness-of-fit index: χ^2=288.445, df=152, normed Chi-square χ^2/df=1.898<3, comparative fit index (CFI)=.979>0.95, Tucker Lewis index or non-normed fit index (TLI/NNFI)=.970>0.95, root mean square error of approximation (RMSEA)=.045<0.05 (Hair *et al.*, 2009). Convergent validity was checked through a t-test for each item: all were high and significant. The same test checked the standard errors of the estimated coefficients: all were very low. We also examined the average variance extracted (AVE) for each construct. All the AVE values were above 0.5. The convergent validity, therefore, held (Hair *et al*., 2009). Discriminant validity was also examined by checking the confidence interval around the correlation estimate for each pair of constructs examined. It never exceeded 1.0, while the squared correlation coefficients for each pair of constructs never exceeded

their AVEs (Anderson and Gerbing, 1988; Fornell and Larcker, 1981). The construct reliability was satisfactory because all constructs exhibited Cronbach's alphas greater than or equal to 0.70 (Nunnally, 1978). In addition, composite reliability was also satisfactory because all the coefficients were greater than 0.60 (Hair *et al.*, 2009).

The descriptive statistics and inter-correlations among the variables are shown in Table 2. Multi-collinearity was checked during the multiple regression analysis via calculating the Variance Inflation Factors (VIF). All the values are smaller than 2 indicating that there was no threat from multi-collinearity. When the missing data is less that 5 percent of the overall sample, the missing value of the variable is treated using the mean or median of the variable.

The Hypotheses were tested using multivariate regression analysis following suggestions by Preacher *et al.,* (2007) and Zhao *et al.,* (2010) instead of the three step procedure by Baron and Kenny (1986). The mediation and moderation effects were calculated via the PROCESS macro procedure in SPSS developed by Hayes, 'Model 4' for mediation and 'Model 1' for moderation respectively as detailed in Hayes (2013). We used bootstrapping calculations and mean centering when interaction items were entered. The bootstrap sample size is 10,000 as recommended by Zhao *et al.,* (2010) and Hayes (2013). We also adopted the composite indicator approach specified by the OECD (2008) guidance on obtaining value of constructs, i.e. multiple item variables were calculated using the composite index with equal weight for each factor item.

Table 3 and Table 4 present the results of the regression analysis for moderation and mediation respectively. The hypothesis test results are summarized in Table 5.

=====Insert Tables here==========

From Model 1 in Table 3 it can be seen that IC is positively related to IO (R^2=0.23 and .22, $p<0.01$ for innout1 and innout2 respectively). We further probed the moderating impact of the firm size using the Johnson-Neyman technique (Pollack *et al.*, 2012; Hayes, 2013), which provides the 'regions of significance' for the conditional effect of firm size, that is, the values within the range of firm size in

which the association between IC and IO is statistically different from zero. We calculated the conditional effect of IC on IO together with the upper and lower limits of a 95 percent confidence interval of the conditional effect. The region of significance is determined when the confidence interval lies either wholly above zero or below zero. The Johnson-Neyman significance regions for InnOut1 are either up to the 98 percentile of the firm size or above the 99 percentile of firm size, indicating about 99 percent of firm size values lies in the region of significance. For InnOut2, the region of significance accounts for 98 percent of firm values. The findings support both H1 and H1a.

It is clear that from Table 3, Model 2 indicates that IC is related positively to SO (R^2 =.26, $p<0.01$). H2 is, therefore, supported. Model 2 in Table 3 shows that the interaction between firm size and IC is not significant. It follows that H2a is not supported.

Model 3 in Table 3 tests the moderation of firm size on the relationship between SO and IO. The data shows that SO is related positively to IO after controlling for other variables (R^2=0.19 and .21, $p<0.01$ for innout1 and innout2 respectively). It follows that H3 is supported, whereas H3a is not supported.

The H4 hypothesis is about the mediation effect of SO on the relationship between IC and IO. This was tested via a combination of Model 4, and Model 5 in Table 4. Model 4 indicates that IC is statistically significantly in relation to SO. Considering IC and SO simultaneously as predictors of IO, Model 5 indicates that both variables demonstrate a statistically significant relationship except SO for innovation outcome 2. Table 4 also provides the direct effects of IC on IO and the indirect effects of IC via sustainability on IO. As can be seen from Table 4, the direct effect of IC on Innovation outcome 1 is 0.64 ($p<0.01$). The indirect effect of IC via SO on innovation outcome 1 is 0.09 ($p>0.05$), calculated as the product of 0.50 (Model 4, unstandardized coefficient of IC on SO) and 0.18 (Model 5, unstandardized coefficient of SO on innovation outcome 1). Similarly, the indirect effect of IC on innovation outcome 2 is 0.04 ($P<0.05$), the direct effect of which is 0.11 ($p<0.01$). The total effect in Table 4 is the sum of direct effect and indirect effect. Given that "the total effect is larger than the indirect effect and of the same sign", we have calculated the ratio of indirect effect versus total effect (Hayes, 2013, p.193). The

ratio of the indirect effect over total effect of for innovation outcome 2 is 0.04/0.18-0.28 with a 95 percent bias corrected bootstrapping interval [0.04, 0.9]. The ratio of innovation outcome 1 is 0.15 [.01, .34] much smaller than 0.28. These findings support that the mediation effect identified in H4 for innovation outcome 2 but not for innovation outcome 1.

4. Discussion and conclusions

From a RBV perspective, this research examined the relationship between IC and IO of a firm in relation to the moderating effect of firm size and the potential mediating effect of SO. We considered IC and SO as intangible strategic assets and integrated them into a model that also included firm size and the IO of a firm. We validated the model by testing a number of hypotheses across a sample of 400 firms in 24 countries in both the developed and developing parts of the world. Not all hypotheses were supported. The results are summarized in Table 5.

First, our results support the positive relationship between IC and IO. This is consistent with existing literature recognizing IC as a strategic asset facilitating superior IO (Brettel and Cleven, 2011; Kyrgidou and Spyropoulou, 2013). However, our research goes further by revealing the moderating role of firm size. The results suggest that a strong IC leads to more innovative outcomes in smaller firms than larger firms. It refutes the argument made by some researchers that large firms are better placed to yield IO because of the superior resources and capabilities that they possess (Damanpour, 2010; Price *et al.*, 2013).

Specifically with regard to SMEs, our research sheds new light on the inconsistent and inconclusive results of previous research into the relationship between IC and SME performance. For example, O'Regan *et al.,* (2005) found a strong positive relationship whereas Terziovski (2010: 898) did not "find a significant relationship between IC and SME performance". Andreis and Faems (2013) suggested specifically that SMEs can significantly improve their ability to generate turnover by engaging in innovative activities such as patenting in the same way as their larger counterparts. Our findings provide further evidence from a more general perspective that SMEs with a strong IC can outperform large firms.

Furthermore, this observation questions the nature and value of the resource capability of large firms to deliver effective innovation.

Second, our findings show that IC is positively related to SO, that is, the stronger the IC, the more likely the firm is to be sustainability oriented. However, we do not find that firm size plays a role in moderating such a relationship. Firms with a strong IC tend to have a strong SO irrespective whether they are large or small. This result is unexpected in relation to our previous understanding of the role of firm size as we expected stronger relationship between IC and SO for smaller firms (Chen and Hambrick, 1995). For example, Gallo and Christensen (2011) suggested that firm size matters in sustainability-related behaviors. Our findings regarding the role of IC in this regard provide additional insight into the calls from several papers (Hoffmann, *et al.* 2012; Linnenluecke and Griffiths, 2010; Nidumolu *et al*., 2009) for further understanding of the drivers of environmental management and sustainability resources with regard to IC serving an important antecedent for SO regardless of the size of the firm.

Our research supports the positive relationship between SO and IO. This is consistent with recent research (Du et al., 2016; Behnam and Cagliano, 2017). We find firm size, however, does not impact on this relationship. This result is both counter-intuitive and a significant new finding from this study. It refutes the argument made by some researchers that large firms have the resources to engage in higher numbers of sustainability initiatives and have the resources to sustain such activity over longer periods (Darnall *et al*., 2010; Dixon-Fowler *et al*, 2013; Pantouvakis *et al.*, 2017). Research by Shevkenko *et al.,* (2016: 911) concluded that large firms differ from small firms partly as a result of the expectations of external stakeholders: our evidence shows that there is no difference between large and small firms with regard to SO and innovation. Our findings also respond to the argument that SO is different in nature from the profit maximization assumption that underpins much of business strategy: SO is a normative objective of the firm, regardless of the range and size of the firm's assets (Fliaster and Kolloch, 2017; Hansen *et al*., 2009).

Finally, our research supports the mediation effect of SO towards the relationship between IC and IO when the latter is bench-marked externally against competitors of the firm. This indicates that the

impact of IC can be realized partly by adopting a sustainability strategy through a SO. Dangelico and Pujari (2013) examined the mediating effect of green product design and green manufacturing processes in the link between external integrative capabilities and performance outcomes measured by the creation of new opportunities and financial outcomes. They found a mediation effect for the latter but not the former. Our research examines the matter from another perspective: the mechanism of the impact of IC on IO. Our evidence shows that SO facilitates such an impact. In other words, having a sustainability orientated strategy pays dividends for firms.

5. Theoretical Contributions

This study contributes to the literature from three perspectives. First, Hansen *et al*., (2009) and Schaltegger and Wagner (2011) both call for a better embedded framework that combines both sustainability and innovation theory. Using the theoretical lens of the RBV, this paper proposes an integrated framework which explicates the mechanism through which the IC of the firm impacts on innovative performance via the SO of the firm. This research complements the study by Behnam and Cagliano (2017) which examined the link between sustainability, innovation and performance from an operations management perspective.

The conceptual framework we have developed partially unpacks the bi-directional relationship between sustainability and innovation by examining two important aspects of innovation: IC and IO. The evidence provides some additional clarification of the important theoretical issues in the literature as to whether sustainability leads innovation or vice versa (Behnam and Cagliano, 2018; Adams *et al*., 2016; Hansen *et al.,* 2009; Linnenluecke and Griffiths, 2010). Our evidence suggests that the IC of the firm facilitates SO and the SO of the firm, in turn, facilitates IO.

Second, by testing the proposed integrated conceptual framework, this research directly addresses the issue of building a business case for sustainability oriented firms (see, for example, Claudy *et al*, 2016; Hockerts, 2015; Reyes-Rodríguez *et al*., 2016) and the growing literature regarding SO as a strategic asset (Adams *et al.*, 2016). Our paper explores the mediating effect of SO on the relationship between IC and IO. Extant literature suggests that adopting a sustainability oriented strategy may be perceived by some

firms as high risk (Hansen *et al*., 2009; Shevchenko *et al*., 2016). Our evidence suggests that the effect of adopting a sustainability oriented policy is by no means negative for firms. Indeed, SO can be a source of competitive advantage because it intervenes in the relationship between the IC and the IO positively when the IO are bench-marked with the competitors of the firm. Our research therefore, provides novel insights on the role of SO and, in particular, its role in relation to the different types of IO.

Third, the paper advances our understanding regarding the differences between large and small firms in leveraging their strategic assets in terms of IC and SO to facilitate superior IO. Extant literature suggests that firm size is an important moderator in both innovation management field and sustainability management field (e.g. Damanpour, 2010; Reyes-Rodríguez *et al.*, 2016). There has been no study so far to investigate the impact of firm size on the relationship between IC, SO and innovation outcome (Bos-Brouwers, 2010). We find that firm size moderates the relationship between IC and IO, but does not moderate the relationships between SO, IC and IO. Given that "size has been a fundamental variable" in innovation theory (Camison-Zornoza *et al.*, 2004: 350), our findings add notably to the theory in this regard (Zhai *et al.,* 2018).

To conclude, this study contributes to RBV theory by proposing and empirically validating a conceptual framework which explicates the mechanism through which two important intangible strategic resources namely IC and SO impact on the IO of a firm.

6. Managerial Implications

Sustainability and innovation are becoming increasingly important to practitioners. Our findings provide significant guidance in this regard. First, we have demonstrated both IC and SO are positive factors to drive IO. Second, firm size matters in the direct relationship between IC and IO. But it does not matter when SO is included in the equation. Thus the research has demonstrated the contingent nature of firm size. Firm size does not matter for the relationship between SO and IO, if the latter is set against the firm's own objectives. Managers from both small and large firms should be aware of this and use it to

their advantage. Therefore, where small and large firms are equally engaged in the same area of innovation, the small firm is likely to have an advantage with respect to the IO. Managers of large firms, therefore, need to be cognizant of this possibility. In this respect it supports the thinking by Delmas and Toffel (2008) that there is a need for corporate departments of large firm to evaluate their management practices to enable them to improve their effectiveness with regard to both IO and sustainability.

Finally, SO plays an important, but not dominant, role in facilitating the positive relationship between IC and IO. This study provides empirical evidence that firms should not only build a strong IC but will also benefit from developing a strong SO. It should not be viewed as a necessity or a burden to firms but rather as a positive asset, especially in the initiation and development of new products. This will contribute towards greater IO of the firm with such solutions depending on both the size of the firm and the IC of the firm.

7. References

Adams, R., Jeanrenaud., S. Bessant, J. Denyer D., and Overy, P. (2016) Sustainably-oriented innovation: A systematic review. *International Journal of Management Reviews*, 18(2), 180-205.

Alvesson, M. (2002) *Understanding Organizational Culture.* London: Sage.

Andries, P., and Faems, D. (2013) Patenting activities and firm performance: Does firm size matter?. *Journal of Product Innovation Management,* 30(6), 1089-1098.

Andriopoulos, C. (2001). Determinants of organisational creativity: a literature review. *Management Decision.* 39(10), 834-841.

Anderson, J. C., and Gerbing, D.W. (1988) Structural equation modeling in practice: A review and recommended two-step approach. *Psychological Bulletin.* 103(3), 411-23.

Atuahene-Gima, K. (1995). An exploratory analysis of the impact of market orientation on new product performance. *Journal of Product Innovation Management.* 12(4), 275–293.

Barney, J. B. (1986) Organizational Culture: Can it be a source of sustained competitive advantage? *Academy of Management Review*, 11, 656-665

Baron, R. M., and Kenny. D.A. (1986) Moderator-mediator variables distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology,* 51(6), 1173-82.

Behnam, S., and Cagliano, R. (2018). Are innovation resources and capabilities enough to make businesses sustainable? An empirical study of leading sustainable innovative firms. *International Journal of Technology Management*. (Forthcoming)

Behnam, S., Cagliano, R., & Grijalvo, M. (2018). How should firms reconcile their open innovation capabilities for incorporating external actors in innovations aimed at sustainable development? *Journal of Cleaner Production*, *170*, 950–965.

Behnam, S., and Cagliano, R. (2017). Be sustainable to be innovative: An analysis of their mutual reinforcement. *Sustainability*, 9(1), 1-18.

Bos-Brouwers, H. (2010) Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice. *Business Strategy and the Environment,* 19, 417–435.

Brettel, M., and Cleven, N.J. (2011) Innovation culture, collaboration with external partners and NPD performance, *Creativity and Innovation Management,* 20, 253–272.

Brundtland, G.H., (1987) Report of the world commission on environment and development: Our common future. *World commission on environment and development*, New York, NY: United Nations

Büschgens, T., A. Bausch., and Balkin, D.B. (2013) Organizational culture and innovation: A meta-analytic review. *Journal of Product Innovation Management,* 30 (4), 763–781.

Camison-Zornoza, C., R. Lapiedra-Alcami, M. Segarra-Cipres, and Boronat-Navarro, M. (2004) A meta-analysis of innovation and organizational size. *Organization Studies,* 25, 331-361

Capon, N., Farley, J., Lehman, D., and Hulbert, J.H. (1992) Profiles of product innovators among large U.S. manufacturers. *Management Science,* 38 (2), 157–160.

Chandler, G. N., Keller, C., and Lyon, D.W.(2000) Unravelling the determinants and consequences of an innovation-supportive organizational culture. *Entrepreneurship Theory and Practice.* 25(1), 59-76.

Chandy, R., and Tellis, G.W. (2000) The incumbent's curse? Incumbency, size and radical product innovation. *Journal of Marketing.* 64(3), 1-17.

Charter, M., and Clark, T. (2007) *Key conclusions from sustainable innovation conferences 2003–2006 organised by The Centre for Sustainable Design*. Available at: *cfsd.org.uk/Sustainable%20Innovation/Sustainable_Innovation_report.pdf*

Chen, M., and Hambrick, D (1995) Speed, stealth, and selective attack: How small firms differ from large firms in competitive behavior. *Academy of Management Journal, 38* (2), 453-482.

Claudy, M. C., Peterson, M., and Pagell, M. (2016). The roles of sustainability orientation and market knowledge competence in new product development success. *Journal of Product Innovation Management*, *33*72-85.

Cordeiro, J., and Tewari, M. (2015). Firm characteristics, industry context, and investor reactions to environmental CSR: A stakeholder theory approach. *Journal of Business Ethics*, *130*(4), 833-849.

Damanpour, F. (2010) An integration of research findings of effects of firm size and market competition on product and process innovations. *British Journal of Management,* 21(4), 996-1010.

Dangelico, R.M., and Pujari, D. (2010) Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics,* 95, 471–486.

Darnall, N., I. Henriques, and Sadorsky, P. (2010) Adopting proactive environmental strategy: The influence of stakeholders and firm size. *Journal of Management Studies,* 47(6), 1072–1094.

de Brentani, U., Kleinschmidt, E. J. and Salomo, S. (2010) Success in global new product development: Impact of strategy and the behavioral environment of the firm. *Journal of Product Innovation Management,* 27, 143–160.

Dearing, A. 2010. Sustainable innovation: Drivers and barriers. *World Business Council for Sustainable Development.* [http:www.oecd.org/innovation/inno/2105727.pdf.]

Delmas, M. A., and Toffel, M.W.(2008) Organizational responses to environmental demands: opening the black box. *Strategic Management Journal,* 29(10), 1027-1055.

Denham, J., and Kaberon, R. (2012) Culture is king: How culture contributes to innovation. *Journal of Product Innovation Management,* 29 (3), 358-360.

Dixon-Fowler H.R., Slater D.J., Johnson J.L., Ellstrand A.E., and Romi A.M. (2013) Beyond "Does it pay to be green?" A meta-analysis of moderators of the CEP-CFP relationship. *Journal of Business Ethics,* 112(2), 353–366.

Du, S., Yalcinkaya, G., and Bstieler, L. (2016). Sustainability, social media driven open innovation, and new product development performance. *Journal of Product Innovation Management*, *33*55-71.

Dubey, R., Roubaud, D., Gunasekaran, A., Childe, S. J., Papadopoulos, T., Hazen, B., and Giannakis, M. (2017). Examining the effect of external pressures and organizational culture on shaping performance measurement systems (PMS) for sustainability benchmarking: Some empirical findings. *International Journal of Production Economics*, *193*63-76.

Ettlie, J. E., and Rubenstein, A.H. (1987) Firm size and product innovation. *Journal of Product Innovation Management,* 4(2), 89–108.

Fagerberg, J. (2006). Innovation: A guide to the literature. Chapter 1, 1-29: In Fagerbberg, J., D.C. Mowery, and R.R. Nelson. 2006. *The Oxford Handbook of Innovation*. Oxford University Press, Oxford.

Fliaster, A. and Kolloch, M. (2017), Implementation of green innovations – The impact of stakeholders and their network relations. *R&D Management*, (47), 689–700.

Fornell, C., and Larcker, D.F. (1981) Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research,* 28(1), 39-50.

Frey, M., Iraldo, F., and Testa, F. (2013) The determinants of innovation in green supply chains: evidence from an Italian sectoral study. *R&D Management*, 43, 352–364.

Gallo, P. J., and Christensen, L.J. (2011) Firm size matters: An empirical investigation of organizational size and ownership on sustainability-related behaviors. *Business & Society*, 50 (2), 315-349.

Gallego-Alvarez, I., J. Prado-Lorenzo, and Garcıa-Sanchez, I-M. (2011) Corporate social responsibility and innovation: A resource-based theory. *Management Decision*, 49 (10), 1709-1727.

Gerstenfeld A, and Roberts H. (2000) Size matters: Barriers and prospects for environmental management in small and medium-sized enterprises. In *Small and Medium-Sized Enterprises and the Environment*, Hillary R (ed). Greenleaf Publishing: Sheffield; 106–118.

Griffin, A., and Page, A. (1996) PDMA success measurement project: Recommended measures for product development success and failure. *Journal of Product Innovation Management,* 13(6), 478–96.

Guo, H., Tang, J., Su, Z. and Katz, J. A. (2017), Opportunity recognition and SME performance: the mediating effect of business model innovation*. R&D Management*, (47) 431–442.

Hansen, E. G., F. Grosse-Dunker, and Reichwald,R. (2009) Sustainability innovation cube – A framework to evaluate sustainability-oriented innovations. *International Journal of Innovation Management*. 13(4), 683–713.

Hart, S. L. and Milstein, M. B. (2003) Creating sustainable value. *Academy of Management Executive,* 17, 56–69.

Hair, J. Jr., Black., W., Babin, B., Anderson, R., and Tatham, R. (2009) *Multivariate Data Analysis,* 7th ed., Pearson, Prentice Hall: Englwood Cliffs, NJ.

Hayes, A. F. (2013) *Introduction to mediation, moderation, and conditional process Analysis: A regression-based approach*. New York, NY: The Guilford Press.

Hockerts, K. (2007) *Managerial perceptions of the business case for corporate social responsibility*. CBS Working Paper Series, no. 03-2007. Frederiksberg: Copenhagen Business School.

Hockerts, K. (2015). A cognitive perspective on the business case for corporate sustainability. *Business Strategy & The Environment* 24(2), 102-122.

Hoffman, A. J., and Georg, S. 2013. Introduction to business and the natural environment: Chapter 1, *Business and the Natural Environment*, Hoffman, A. J. and Georg, S. (Eds.), Routledge, London.

Hofmann, K. H., G. Theyel, and Wood,C.H. (2012) Identifying firm capabilities as drivers of environmental management and sustainability practices - Evidence from small and medium-sized manufacturers. *Business Strategy & the Environment,* 21 (8), 530-545.

Hofstede, G. (1998) Identifying organizational subcultures: an empirical approach. *Journal of Management Studies*, 35, 1, 1-12 .

Hörisch, J., Johnson, M. P., and Schaltegger, S. (2015) Implementation of Sustainability Management and Company Size: A Knowledge-Based View. *Business Strategy & The Environment. 24*(8), 765-779.

Hult, G. T., R. F. Hurley, and Knight,G.A. (2004) Innovativeness: Its antecedents and impact on business performance. *Industrial Marketing Management,* 33, 429-438.

Johnson, M. P. (2015). Sustainability Management and Small and Medium-Sized Enterprises: Managers' Awareness and Implementation of Innovative Tools. *Corporate Social Responsibility & Environmental Management*, *22*(5), 271-285

Ketata, I., Sofka, W., and Grimpe, C. (2015) The role of internal capabilities and firms' environment for sustainable innovation: evidence for Germany. *R&D Management*, 45, 60–75.

Kiron, D., Kruschwitz, N., Reeves, M., and Goh., E. (2013) The benefits of sustainability-driven innovation. *MIT Sloan Management Review,* **54**, 2, 69-73.

Kiron, D., Unruh, G., Kruschwitz, N., Reeves, M., Rubel, H., and zum Felde A.M. (2017) Corporate sustainability at a crossroads: Progress toward our common future in uncertain Times. *MIT Sloan Management Review*, 58(4), 1A-27.

Kleysen, R.F., and Street C.T. (2001) Towards a multi-dimensional measure of individual innovative work behavior. *Journal of Intellectual Capital,* 2(3), 284-296.

Kyrgidou, L. P., and Spyropoulou, S. (2013) Drivers and performance outcomes of innovativeness: An empirical study. *British Journal of Management,* 24 (3), 281-298.

Lee, H., and Markham,S. K. (2014). The 2012 Product Development and Management Association's comparative performance assessment study: Methods, data and results. 2014 Annual PDMA Research Forum. October 2014, Denver, USA.

Lefebvre, E., L.A. Lefebvre, and Talbot . S. (2003). Determinants and impacts of environmental performance in SMEs. *R&D Management,* 33, 263–83.

Lindell, M. K., and Brandt C.J. (2000). Climate quality and climate consensus as mediators of the relationship between organizational antecedents and outcomes. *Journal of Applied Psychology,* 85, 331–348.

Lindell, M. K., and Whitney, D.J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology,* 86, 114–121.

Lynn, G. S., S.P. Schnaars, and Skov, R.B. (1999) Survey of new product forecasting practices in industrial high technology and low technology businesses. *Industrial Marketing Management,* 28(6), 565-571.

Linnenluecke, M. K., and Griffiths, A. (2010). Corporate sustainability and organizational culture. *Journal of World Business*, *45*(4), 357-366.

Macagno, T. (2013) A model for managing corporate sustainability. *Business & Society Review, 118* (2), 223-252.

Malhotra, N. K., S.S. Kim, and A. Patil, A. (2006) Common method variance in IS research: A comparison of alternate approaches and a reanalysis of past research. *Management Science*, 52, 1865-1883.

Markham, S. K., and Lee. H. (2013) PDMA's 2012 Comparative performance assessment study. *Journal of Product Innovation Management,* 30(3), 408–429.

Miles, R., Snow, C., Meyer, A., and Coleman H.J. (1978) Organizational strategy, structure, and process. *Academy of Management Review,* 3(3), 546–62.

Nidumolu, R., C.K Prahalad, and Rangaswami M.R. (2009) Why sustainability is now the key driver of innovation. *Harvard Business Review,* 87(9), 56–64.

Nunnally, J. C. (1978). *Psychometric Theory*. 2ed. .McGraw-Hill Book Company: New York.

OECD. (2008) *Handbook on Constructing Composite Indicators*: *Methodology and User Guide.* OECD Publication: Paris.

O'Regan N., A. Ghobadian, and Gallear, G. (2005) In search of the drivers of high growth in manufacturing SMEs. *Technovation,* 26(1), 30-41.

Palma, N. C., and Visser, M. (2012). Sustainability creates business and brand value, *Journal of Brand Strategy,* 1(3), 217-222.

Papastathopoulou, P., and Hultink, E.J. (2012) New service development: An analysis of 27 years of research. *Journal of Product Innovation Management,* 29 (5), 705-714.

Pantouvakis, A., Vlachos, I., and Zervopoulos, P. D. (2017). Market orientation for sustainable performance and the inverted-U moderation of firm size: Evidence from the Greek shipping industry. *Journal of Cleaner Production*, 16(5),705-720.

Pettigrew, A. (1979) Studying organizational culture. *Administrative Science Quarterly,* 24, 570-581.

Podsakoff, P. M., S. B. MacKenzie, J-Y. Lee, and Podsakoff, N.P. (2003) Common method biases in behavioural research: a critical review of the literature and recommended remedies. *Journal of Applied Psychology,* 88, 879–903.

Podsakoff, P. M., S. B. MacKenzie, and Podsakoff, N.P. (2012) Sources of method bias in social science research and recommendations on how to control it. *Annual Review of Psychology,* 63, 539–569.

Pollack, J. M., E.M. Vanepps, and Hayes, A.F. (2012) The moderating role of social ties on entrepreneurs' depressed affect and withdrawal intentions in response to economic stress. *Journal of Organizational Behavior, 33*(6), 789-810.

Preacher, K. J., D.D. Rucker, and Hayes, A.F (2007) Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*, 185-227.

Price, D., Stocia, M., and Boncell, R(2013) The relationship between innovation, knowledge, and performance in family and non-family firms: An analysis of SMEs. *Journal of Innovation and Entrepreneurship,* 2(14), 1-20.

Reyes-Rodríguez, J. F., Ulhøi, J. P., and Madsen, H. (2016). Corporate environmental sustainability in Danish SMEs: A longitudinal study of motivators, initiatives, and strategic effects. *Corporate Social Responsibility & Environmental Management*, *23*(4), 193-212.

Schaltegger, S. and Wagner, M., (2011) Sustainable entrepreneurship and sustainability innovation: categories and interactions, *Business Strategy and the Environment*, 20(4), 222–237

Schaltegger, S., Lüdeke-Freund, F., and Hansen, E. (2012) Business cases for sustainability: The role of business model innovation for corporate sustainability. *International Journal of Innovation and Sustainable Development,* 6(2), 95-119.

Schrettle, S., Hinz, A., Scherrer-Rathje, M., and Friedli, T. (2014) Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. *International Journal of Production Economics,* 147, 73-84.

Schiederig, T., Tietze, F., and Herstatt, C. (2012) Green innovation in technology and innovation management – an exploratory literature review. *R&D Management*, 42,180–192

Seebode, D., S. Jeanrenaud, and Bessant. J. (2012) Managing innovation for sustainability. *R&D Management,* 42 (3), 195-206.

Schein, E. (2004) *Organizational Culture and Leadership*. 3rd Edition, Jossey-Bass: San Francisco, CA.

Shevchenko, A., Lévesque, M., and Pagell, M. (2016) Why firms delay reaching true sustainability. *Journal of Management Studies*, *53*(5), 911-935.

Schrettle, S., Hinz, A., Scherrer-Rathje, M., and Friedli, T. (2014) Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. *International Journal of Production Economics,* 147, 73-84.

Skerlavaj, M., Song, J., and Lee, Y. (2010) Organizational learning culture, innovative culture and innovations in South Korean firms. *Expert Systems with Applications* .37(9), 6390-6403.

Smith, A., Voss, J.-P. and Grin, J. (2010) Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges, *Research Policy,* 39, 435–448

Teece, D. J. (1996). Firm organization, industrial structure, and technological innovation. *Journal of Economic Behavior & Organization*, 31(2), 193-224.

Terzioski, M. (2010). Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: A resource-based view. *Strategic Management Journal,* 31(8), 892–902.

Waddock, S. (2008). Leading corporate citizens: Vision, values, and value added (3rd ed.). New York: McGraw-Hill/Irwin

Wynen, J., Verhoest, K., Ongaro, E., and van Thiel, S. (2014). Innovation-oriented culture in the public sector: Do managerial autonomy and result control lead to innovation? *Public Management Review,* 16(1), 45-66.

Xavier, A., Naveiro, R. M., Aoussat, A. and Reyes, T. (2017) Systematic literature review of eco-innovation models: Opportunities and recommendations for future research, *Journal of Cleaner Production,* 149, 1278-1302

Zhai, Y.-M.; Sun, W.-Q.; Tsai, S.-B.; Wang, Z.; Zhao, Y.; Chen, Q. (2018) An empirical study on entrepreneurial orientation, absorptive capacity, and SMEs' Innovation Performance: A sustainable perspective. *Sustainability, 10*, 314-327.

Zhao, X., J. Lynch, G. and Chen, Q. (2010) Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research,* 37 (2), 197–206.

Zona, F., A. Zattoni, and Minichilli, A.(2013) The contingency model of boards of directors and firm innovation; The moderating role of firm size. *British Journal of Management,* 24(3), 299-315.

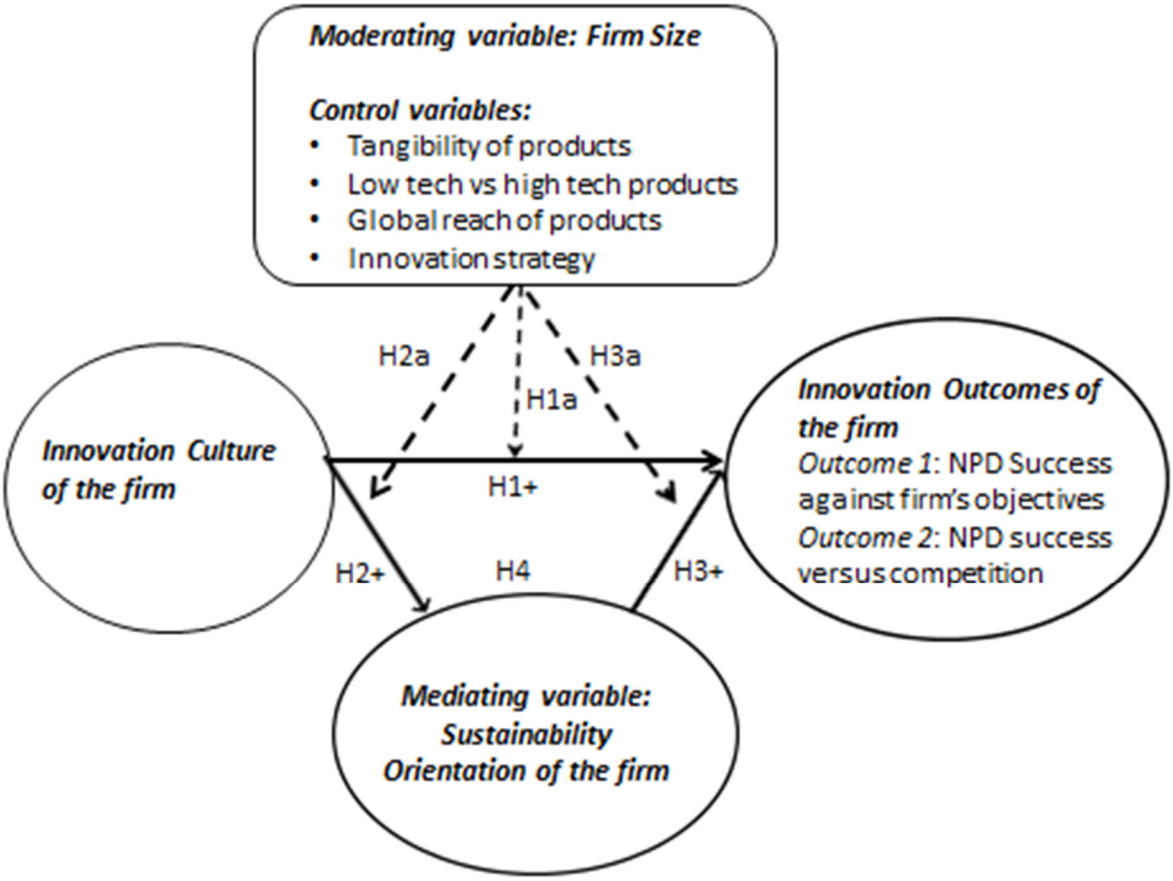

Figure 1. Conceptual Framework

Table 1. Details of Measures and Results of Validity Tests

Item Description	Factor Loadings	Construct Reliability	AVE
Sustainability Orientation (SO)		.95	.64
1) Environmental sustainability	0.751		
2) social sustainability, sustainability criteria.	0.775		
3) sustainability criteria for new produc development,	0.82		
4) measuring new product progress oı sustainability	0.853		
5) future importance of sustainability-type criteria	0.861		
6) developing sustainability policies	0.734		
7) managing their product's carbon foot print	0.784		
8) using the Triple Bottom Line for product planning,	0.772		
9) including sustainability in their product developmen budget,	0.877		
10) selecting suppliers and partners based on	0.756		
Innovation Culture (IC)		.87	.53
1) Both innovation and risk-taking are valued fo career development	0.605		
2) Recruitment parameters include consideration fo innovation potential	0.636		
3) Managers establish objectives in the areas o innovation including training, measures and results	0.812		
4) These established objectives are used in th performance review process	0.777		
5) Effectively communicates its innovation value internally	0.814		
6)Effectively communicates its innovation value externally	0.702		
Innovation outcome 1		.89	.81
a) Does their new product program meet th performance objectives set out for it?	.923		
b) Overall, was their new product program a success?	.874		
Intangibility of Products		.82	.60
1) the ability to conduct a physical count of what they offer	0.766		
2) ability to store what they offer, and	0.880		
3) ability to display what they offer.	0.666		

χ^2=288.445, df=152, χ^2/df=1.898, CFI=.979, TLI=.970, RMSEA=.045

Table 2. Descriptive Statistics and Correlations

	Variable	M	SD	1	2	3	4	5	6	7	8
1	Innovation culture	3.03	.90								
2	Sustainability orientation	2.87	1.07	.471**							
3	InnOut1[a]	5.75	2.02	.383**	.287**						
4	InnOut2[b]	2.66	.80	.294**	.271**	.466**					
5	Firm Size	0.00	1	-.035	.021	.046	-.031				
6	Product Tangibility	3.65	1.21	.214**	.198**	.203**	.173**	-.058			
7	Global Reach	3.33	2.20	.059	.274**	.175**	.175**	-.004	.324**		
8	High-tech	2.77	1.16	-.141**	-.144**	.062	-.206**	-.006	-.025	-.026	
9	Innovation strategy	2.88	.95	.353	.247**	-.220**	.389**	.002	.233**	.165**	-.221**

a. InnOut1 means innovation outcome 1, indicating new product programme bench-marked against firm own objectives. b. InnOut2 means innovation outcome 2, indicating new product programme success bench marked against competitors. **p<.01 *p<.05 (two tailed test)

Table 3. Test of Moderating Effect by Firm Size (N=452)

	Model 1		Model 2	Model 3	
	InnOut1	InnOut2	SO	Innout1	Innout2
Intercept	4.63**	1.97**	2.51**	4.38**	1.90**
Innovation culture (IC)	.60**	.14***	.51**		
Sustainability orientation (SO)				.34**	.11**
Product tangibility	.19*	.03	.05	.21**	.04
Firm Size	-.03	-.06	.05	.06	-.04
Global Reach	-.03	.04*	.06**	-.05	.02
High Tech	-.24**	-.09**	.03	-.24**	-.08*
Innovation Strategy	.41**	.24**	.05	.51**	.26**
IC*Firm Size	-.41**	-.12*	.03		
SO*Firm Size				-.31	-.06
R^2	.23	.22	.26	.19	.21
F-value	19.40**	17.36**	22.19**	15.16**	16.85**
DF(7,444)					
ΔR^2	.01	0.01	<0.01	<0.01	<0.01
F-change	7.58**	3.91*	.12	2.52	1.14
DF(1,444)					

**p<.01 *p<.05 (Two tailed)

Table 4. Regression Results for Mediation: IC->SO->IO

	Model 4	Model 5	
	SO	Innout1	Innout2
Intercept	.97**	2.62**	1.46**
IC	.50**	.54**	.11*
SO		.18*	.08*
Product tangibility	.09*	.17*	.02
Firm Size	.04	.09	-.03
Global Reach	-.06**	-.03	.03
High Tech	-.06	-.23**	-.08*
Innovation Strategy	.05	.38**	.23**
Direct Effect		.54**	.11**
Indirect effect		.09	.04*
Total effect		.63**	.15**
Ratio of Indirect to total effect		.15	.28
R^2	.26	.22	.26
F-value	25.92**	21.05**	25.92**
DF(6,445)			

IO	Boot Indirect effect	Boot SE	Bias corrected 95% Confidence Interval
InnOut1	.09	.04	[.01, .19]
InnOut2	.04	.01	[.01, .08]

**p<.01 *p<.05 N=452, All p-values two tailed.

Table 5. Summary of Test Results

	Model used for hypothesis test	The hypothesis is supported or not
H1: Innovation culture is positively associated with innovation outcomes. H1a: Larger firms have a weaker relationship between innovation culture and innovation outcomes than smaller firms.	Model 1	Yes.
H2: Innovation culture is positively associated with sustainability orientation. H2a: larger firms have a weaker relationship between innovation culture and sustainability orientation than smaller firms.	Model 3	Yes for the positive relationship, no for the moderation effect
H3: Sustainability orientation is positively associated with innovation outcomes. H3a: Larger firms have a stronger relationship between sustainability orientation and innovation outcomes than smaller firms.	Model 2	Yes for the positive relationship. No for the moderation effect
H4: Sustainability orientation mediates the relationship between innovation culture and innovation outcomes.	Model 4&5	Yes, partial mediation found for Innovation Outcome 2 but not for innovation outcome 1.