



## Journal of Manufacturing Technology Management

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### Article information:

To cite this document:

Chao-Hung Wang, (2019) "How organizational green culture influences green performance and competitive advantage: The mediating role of green innovation", Journal of Manufacturing Technology Management, <https://doi.org/10.1108/JMTM-09-2018-0314>

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# How organizational green culture influences green performance and competitive advantage

Green performance and competitive advantage

## The mediating role of green innovation

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Received 18 September 2018  
Revised 18 September 2018  
12 November 2018  
Accepted 8 January 2019

### Abstract

**Purpose** – Growing public concern about the natural environment is rapidly transforming the competitive landscape and forcing firms to adopt green innovation strategies. Many manufacturing firms have recognized the concept of green innovation, though there has been relatively little research on considerations of its driver and effect. The purpose of this paper is to empirically develop and test a theoretical model that analyzes how organizational green culture (OGC) influences green performance and competitive advantage. Specifically, this model explains how green innovation mediates these relationships.

**Design/methodology/approach** – The paper collected data from 327 manufacturing firms of different industry sectors in Taiwan. Structural equation modeling with AMOS 11 software was applied to analyze the data. Data on specific environmental innovation issues at the firm level are not usually available from published sources, so this paper uses a questionnaire. The questionnaire is developed based on the literature.

**Findings** – The findings of this paper suggest that OGC significantly predicted green performance and competitive advantage, respectively. Moreover, the results show that both green innovation completely mediates between OGC and green performance, and that it has a partially mediating effect on the relationship between organization green culture and competitive advantage under environmental pressure.

**Research limitations/implications** – This study has some limitations that point to the future lines of research. Perhaps, the biggest limitation of the study is that the data are from a single country, which may hamper generalization. This study is also limited in that it is based on cross-sectional data. A final limitation is the origin of organizational culture vs employee attitude culture.

**Originality/value** – This study contributes to the existing literature on organizational culture and innovation by considering green environmental concerns, which have not been empirically explored. This study also offers a unique theoretical argument describing the relationships by considering the mediating effect of green innovation strategy.

**Keywords** Competitive advantage, Green innovation, Organizational green culture, Green performance

**Paper type** Research paper

### Introduction

Environmental issues are increasingly becoming important to manufacturing industries as decision makers face mounting public sensitivity, stricter environmental regulations and growing shareholder pressure to preserve the natural environment (Leonidou *et al.*, 2013; Yu *et al.*, 2017). From the supply side, global warming, carbon restrictions, soil erosion and shortages of electricity are now critical issues for manufacturing industries (Delmas and Toffel, 2008). From the demand side, customers are increasingly shifting their preferences to more environmentally friendly products and services (Kotler, 2011), which are less harmful or even beneficial to the natural environment (Hoffmann, 2007; Zhu *et al.*, 2008). Governmental monitoring and control of ecological impacts of production activity are being implemented to minimize environmental damage. Environmental concerns have thus impacted manufacturing firms' innovation.

Green innovation has responded to this awareness by focusing on greener strategies that allow manufacturing firms to achieve corporate objectives for protecting the natural environment (Robinson and Stubberud, 2013). However, according to Andersen (2008,



p. 3), green innovation research is still in an early phase that lacks substantial achievement. The current literature has few empirical researchers working with innovation and environmental issues. Research on green innovation and performance has also yielded mixed results. On one hand, encouraging manufacturing firms to use green innovation strategies, though they may not increase profits, can lead to the implementation of such strategies (Rao and Holt, 2005). However, other studies have found that such integration could result in poor performance due to increased development time and development costs (Das *et al.*, 2006; Ragatz *et al.*, 2002). These mixed results have increased interest among researchers in better understanding the relationships between the firms' green innovation and green performance (Martins and Terblanche, 2003; McLean, 2005). Accordingly, this paper explores these contradictions to determine if green innovation actually provides green performance for organizations.

One of the variables with a substantial influence on green innovation is organizational green culture (OGC). As Hart (1995) shows, organizational resource have a pivotal role in developing successful environmental strategies, and one of the resources that may support competitive advantage and green performance is OGC (Banerjee, 2002). Culture here refers to a shared system of beliefs, values, ideas and attitudes that shape organizational behavior. Organizational culture can be developed by a managerial team in order to disseminate a set of values to guide corporate goals (Gao, 2017). Accordingly, we consider OGC whose values the firm has internalized throughout the organization and which are typically codified in a mission statement for all employees and managers (Stone *et al.*, 2004). OGC may thus lead employees to accept green innovation as a fundamental value of the organization and to feel more involved in environmental issues.

Given OGC's prominence in recent years, the lack of attention in the literature to the effectiveness of OGC strategies may be surprising (Baker and Sinkula, 2005; De Ruyter *et al.*, 2009; Grinstein and Nisan, 2009). The relationship of OGC and corporate performance is of increased concern for organizations worldwide (De Marchi, 2012), leaving us little information with which to contribute the literature gap. Research in the area would benefit for insights attain from empirical analysis. This study contributes to our knowledge by analyzing how manufacturing firms translate their critical resources (i.e. OGC) into green performance and competitive advantage, and determines how green innovation mediates these relationships.

## Literature and hypotheses

### *OGC and green performance*

Green performance provides key information about environmental impacts, regulatory compliance and organizational systems (Chinander, 2001; Ilinitch *et al.*, 1998; Veleva and Ellenbecker, 2000), which represent the effectiveness and efficiency of firm's environmental action (Neely *et al.*, 1995). Green performance refers to the measurement of the interaction between a business and the environment (Olsthoorn *et al.*, 2001). Previous research has shown that OGC can change existing ways of thinking in organizations and that organization members are important agents of change in this process (Rao and Holt, 2005). Fergusson and Langford (2006) posited that firms are more likely to adopt a green culture strategy if their managers place a high value and show concern for environmental protection (Klassen and Vachon, 2003; Yung *et al.*, 2011). Formal OGC based on eco-environmental values can facilitate and integrate operations relating to different environmental friendly products in a firm (Banerjee *et al.*, 2003). OGC can thus be an important asset that helps firms translate their environmentally proactive strategies into green performance (Schlegelmilch *et al.*, 1996).

When manufacturing firms face environmental pressure, the managerial challenge lies in balancing two opposing objectives: choosing the optimal level of green performance even

though it may reduce profits and obtaining the lowest possible level of green performance in order to maximize profits (Russo and Fouts, 1997). When organizations without green culture may have to have limited resources to invest in their green strategy, upper management may assign those resources to more fundamental organizational priorities, rather than environmental regulations. However, those resources are necessary to support environmental action. This leads a manufacturing firm to favor the second objective. Conversely, when firms with OGC face pressure from environmental protection to develop and report green performance, OGC can be a key driver of green performance. The first objective for the optimal level of green performance could be the best alternative. Hence, it is hypothesized that:

*H1a.* OGC has a positive impact on green performance.

#### *OGC and competitive advantage*

Competitive advantage refers to a superior position in the marketplace that enables a firm to outperform its rivals (Porter, 1985). To achieve competitive advantage, the firm must create positive value which equals or exceeds that of competitors. The theoretical perspective of the natural resource-based view (NRBV) of the firm, first proposed by Hart (1995), is used as the basis for understanding the impact of OGC on the attainment of a firm's competitive advantage. These resources should be valuable, rare, of limited mobility and inimitable. According to Ma (2000, p. 53), competitive advantage is a differential between firms along a comparable dimension that allows one firm to compete better than its rivals. Firms must be able to respond to changing environmental issues by developing new resources (Menguc and Ozanne, 2005). Thus, OGC can be a source of competitive advantage because an OGC should have characteristics that differ from cultures of its competitors and, as an invisible asset, should be difficult for competitors to imitate.

OGC can stimulate competitive advantage among the members of an organization since it can lead them to accept environmental issues as a basic value of the organization (Bansal, 2003). In other words, a strong OGC helps employees to understand the firm's environmental strategy. Thus, employees can know whether the OGC is a part of the firm's core values. Through activities and policies, the firm can generate environmental preservation values, by which competitive advantage will subsequently be attained (Qi *et al.*, 2012). Such an OGC strategy may help differentiate the firm's competitive advantage from significantly eco-friendly values in consumers' minds (Aragón-Correa and Sharma, 2003). Moreover, increasing the green orientation of an organization's culture can help the firm establish a more distinctive picture in the eyes of public (Leonidou *et al.*, 2015). Consequently, if competitive advantage is dependent on appropriate employee behavior and business value, then a supportive OGC can be beneficial for a firm. Hence, it is hypothesized that:

*H1b.* OGC has a positive impact on competitive advantage.

#### *OGC and green innovation*

There is ambiguity about the terminology for green innovation. In the literature, researchers interchangeably use the terms eco-innovation (Belin *et al.*, 2011; Hojnik and Ruzzier, 2016), green innovation (Chen, 2008; Roper and Tapinos, 2016) and environmental innovation (Brunnermeier and Cohen, 2003; De Marchi, 2012). Furthermore, there are numerous definitions for the notion of green innovation. One of the first, Fussler and James (1996) define green innovation as "new products and processes which provide customer and business value but significantly decrease environmental impacts." In a similar manner, Eco-innovation Observatory (2012, p. 8) defines green innovation as the "introduction of any new or significantly improved product, process, organizational change or marketing

solution that reduces the use of natural resources and decreases the release of harmful substances across the whole life-cycle." The Europe INNOVA panel concludes that "eco-innovation means the creation of novel and competitively priced goods, processes, systems, services, and brings quality of life to all people with a life-cycle-wide minimal use of natural resources per unit output, and a minimal release of toxic substances" (cited from Reid and Miedzinski, 2008, p. 7). Accordingly, we define green innovation as products, processes and managerial innovations that lead to a noticeable reduction in environmental burdens (de Medeiros *et al.*, 2018; Hojnik and Ruzzier, 2016).

O'Regan and Ghobadian (2005) proposed that innovation is driven by a company's culture, leadership and strategic planning. They also found that a high level of innovation in firms resulted from a better-defined culture than with firms having less innovation. As such, well-defined environmental culture and policies can facilitate green innovation within an organization (Porter and Van der Linde, 1995a). OGC can promote innovation of environmental technology (Greeno and Robinson, 1992).

Green innovation strategy is derived from an OGC, which consists of the firm's behavior and norms for environmental support. OGC affects managers' attitudes toward green innovation (Özsomer *et al.*, 1997). Managers in organizations whose culture is aligned to environmental preservation are more likely to implement environmental protection policies, enhancing organizational green innovation. Thus, firms differentiate their green innovation ability from their competitors by aligning their organizational culture to support standards of environmental quality. Hence, it is hypothesized that:

*H2.* OGC has a positive impact on green innovation.

#### *Mediating role of green innovation*

Previous studies provide extensive, although not general, evidence for how OGC enhances green performance (Eiadat *et al.*, 2008; Horbach, 2008; Karna *et al.*, 2016). Firms can view environmental investments as either an unfortunate cost of doing business or as a source of competitive advantage, and these divergent perspectives emerge in the relationship between OGC and competitive advantage and green performance. For instance, Zhu *et al.* (2007) suggest that OGC improves performance and competitive advantage. However, Triebswetter and Hitchens (2005) find no evidence of a significant impact of environmental support on competitive advantage. Therefore, a possible explanation for the inconclusive results is that the competitive advantage and green performance may come from the mediating role of green innovation in the relationship between OGC and competitive advantage and green performance, respectively.

#### *Green innovation mediates the relationship between OGC and green performance*

Firms supporting green innovation can obtain green performance that helps to improve their corporate image and even to create new markets (Michaelis *et al.*, 2018). Firms with well-designed OGC can actively enhance their green innovation, which can not only minimize production waste and environmental pollution, but also strengthen the overall corporate green image and reputation. This can increase the firm's green performance due to the popularity of environmentalism with consumers and strict regulations for environmental protection (Berry and Rondinelli, 1998; Chen *et al.*, 2006).

OGC dedication to a shared vision is the key to generating the internal environmental pressure needed for change and innovation (Miles *et al.*, 2000). From a resource-based viewpoint, shared vision is a rare (firm-specific) resource, and few companies have been able to establish or maintain a widely shared sense of mission. Firms are more likely to adopt an eco-innovation strategy if their managers share a high value and care for the environment and its protection. Thus, OGC can trigger green innovation and increase a firm's green

performance (Weller, 2006). Clearly, OGC affects a firm's green performance, but only indirectly, by stimulating firms to adopt a green innovation strategy. Thus, OGC has a unique and direct effect on green innovation only; and the latter, in turn, mediates the effects of the OGC on firm's green performance. Hence, it is hypothesized that:

*H3a.* Green innovation mediates the relation between OGC and green performance.

*Green innovation mediates the relationship between OGC and competitive advantage*

Not only does OGC make clear that a firm has a source of competitive advantage such as green innovation that attracts customers with green values, but OGC also enhances organizational value (Higgins and McAllaster, 2002; Jamrog *et al.*, 2006; Lau and Ngo, 2004). In other words, OGC seeks to enhance the firm's competitive advantage, and the realization of superior green innovation is seen by a firm's managers as a distinct advantage that supports managerial active actions to minimize environment pollution and waste (Banerjee, 2001; Bonifant *et al.*, 1995).

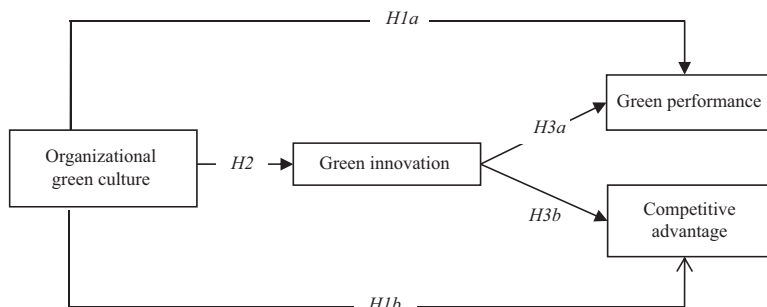
Studies show that adopting a green innovation strategy increases a firm's competitive advantage (Guoyou *et al.*, 2013; Kushwaha and Sharma, 2016). It is considered that green innovation requires employees to develop environmental protection knowledge and share it within the organization. In this sense, green innovation involves the transformation of existing knowledge. As Leonard-Barton (1995) shows, innovation occurs when employees share their insights on production processes, and it results in improving the firm's competitive advantage. We posit that for OGC to be considered a competitive resource, it should not only have a commitment to environmental issues, but the staff should be trained for green innovation. Thus, competitive advantage is a result of OGC, which drives green innovation and is shared throughout the firm. Hence, it is hypothesized that:

*H3b.* Green innovation mediates the relation between OGC and competitive advantage.

Figure 1 shows a causal model to explain the relationship between these variables, and the model is tested in the context of manufacturing settings.

**Methodology**

Data on specific environmental innovation issues at the firm level are not usually available from published sources, so we use a questionnaire. The questionnaire is developed based on the literature in proceeding sections. Measures are reported in the Appendix. Initially 1,000 questionnaires were mailed to manufacturing firms. In total, 608 of the original 1,000 did not respond. A total of 392 questionnaires were received, representing a response rate of 39.2 percent. Since 65 recipients of the original 392 were not considered because they were incomplete. The final sample consisted of 327 usable questionnaires. The survey will be mailed, together with a letter explaining the general purpose of the study.



**Figure 1.**  
Proposed model

*Data collection*

The sample is composed of Taiwanese manufacturing firms since Taiwan manufacturers have recently been accused of environmentally irresponsible acts, such as discharging toxic and hazardous waste, raising public concern of the Taiwanese industry (Grano, 2015; Ho and Hong, 2012). Facing an increased concern over environmental damage, Taiwanese manufacturing firms are more irresponsible with environmental protection (Shih, 2012). The important role of Taiwanese manufacturing industries in the environmental issue demonstrates that this sample is suitable for the topic of this study.

The sample includes a wide range of industries, similar to other studies on this topic (e.g. Fraj *et al.*, 2011; Leonidou *et al.*, 2013; Menguc and Ozanne, 2005). These sectors vary in terms of the amount of pollution produced, degree of public environmental concern, intensity of environmental regulations and environmental liability risks. To maximize variability and generalization, we sought manufacturing firms in geographic locations, and with different levels of environmental performance. The unit of analysis for this study was the company, since aspects relating to OGC and green innovation, affect the entire organization's green performance and competitive advantage, respectively. To enhance generalizability, we focused on the six two-digit Standard Industry Classification (SIC) industry grouping. Table I shows the industry sector distribution of the sample.

*Measurement of constructs*

There is a general lack of methodologically sound studies on the issue of green innovation and green performance (Horbach, 2008). We conducted an extensive literature review to identify valid measures for related constructs, as described below, and a five-point Likert scale (1 = strongly disagree; 5 = strongly agree) was used for all constructs.

*Dependent variables*

To classify green performance, this study uses ISO 14031, which is a sub-category of ISO 14001 for evaluating environmental performance. This standard proposes guidelines for the development of monitoring and measurement tools to evaluate the efficiency of environmental systems (Bennett and James, 1998; Scott Marshall and Brown, 2003). The initial measures of green performance were items from the scales of Konar and Cohen (2001), Yu *et al.* (2017) and Scott Marshall and Brown (2003). Consistent with Yu *et al.* (2017), items that related to green performance were connected with the issues related to encouraging companies to achieve important environmentally related certifications (e.g. ISO 14031). Respondents were asked about the importance of measuring green performance using an instrument developed based on the ISO 14031 standard, including nine items.

Strategically important natural resource-based sources of competitive advantage that represent "what the firm has" were considered as core resources and strategy-based sources

**Table I.**  
Industry sector  
distribution  
of the sample

| SIC code – Industry sector: number (%)               | No. of employees: (%) | Company age: years (%) |
|--|-----------------------|------------------------|
| 26 – Paper and Allied Products: 43 (13%)             | < 100: 39 (12%)       | < 10 years: 39 (12%)   |
| 28 – Chemicals and Allied Products: 95 (29%)         | 101–500: 111 (34%)    | 11–20 years: 56 (17%)  |
| 33 – Primary Metal Industries: 26 (8%)               | 501–1,000: 75 (23%)   | 21–30 years: 88 (27%)  |
| 35 – Machinery and Computer Equipment: 101 (31%)     | 1,001–3,000: 59 (18%) | 31–40 years: 72 (22%)  |
| 37 – Transportation Equipment: 52 (16%)              | 3,000–5,000: 23 (7%)  | 41–50 years: 43 (13%)  |
| 39 – Miscellaneous Manufacturing Industries: 10 (3%) | > 5,000: 20 (6%)      | > 50 years: 29 (9%)    |

of competitive advantage that present “what the firm does” were considered as core strategies. To capture the impact of improvements in the firm’s competitive advantage through the differentiation of core resources and core strategies, this study uses the four-item market differentiation and innovation differentiation advantage scales from Chandler and Hanks (1994) and Zhou *et al.* (2009) to fit the green industry content.

*Independent variables*

Environmental patents or environmental investments have been extensively employed as proxies for green innovation (Jaffe and Palmer, 1997), yet they could lead to under- or over-estimate innovation. Following Horbach (2008), this study instead uses self-reported data on the effect of the green innovation. Measures relating to green innovation consisted of nine items taken from the scale of Chen *et al.* (2006), Chen (2008) and Roper and Tapinos (2016). As described above, three dimensions combine to form green innovation: green product innovation, green process innovation and green managerial innovation. OGC measurement was by the scale of Banerjee (2002) and Fraj *et al.* (2011). This scale involves six items that express the extent the company adopts environmental values and formalizes them through internal policies, and mission statements, together with communication programs for employees.

**Results**

*Measure validation*

We used confirmatory factor analysis to assess the validity and reliability of our measures in the conceptual model. Each construct’s reliability was assessed by composite Cronbach’s (CR)  $\alpha$  coefficient. The CR values of all constructs ranged between 0.809 and 0.897, and being greater than 0.7, indicated a reliable measurement of the theoretical construct as an element of the structural model (Bagozzi and Yi, 1988). The average variance extracted (AVE) for the measures ranged from 0.511 to 0.635, meeting standards in the literature for accepted value 0.5 (Nunnally and Bernstein, 1994). Discriminant validity (i.e. the degree to which measures of constructs are distinct) was assessed by estimating a two-factor first-order model for each possible pair of scales. Following Fornell and Larker (1981), we compared the square root of AVE exceeding the correlation for all pairs of constructs as a criterion for discriminant validity. Table II shows the descriptive statistics and correlation matrix of all research variables.

The targeting respondents including owner, R&D manager and purchasing manager were identified as key informants because of their experience and knowledge in the implementation of environmental innovation strategy and environmental performance. Moreover, half of the key informants (50 percent) had been working with the company more than ten years, indicating that they had experience with management of the company’s culture. Table III shows the distribution of respondents. Respondents were specifically asked to identify the most challenging innovation and environmental pressure. Nonresponse bias (i.e. limited follow-ups, comparison of early and late response, etc.)

| Constructs                    | Mean | SD   | CR    | AVE   | 1           | 2           | 3           | 4           |
|-------------------------------|------|------|-------|-------|-------------|-------------|-------------|-------------|
| 1. Organization green culture | 4.67 | 0.68 | 0.809 | 0.569 | <i>0.75</i> |             |             |             |
| 2. Green innovation           | 3.17 | 0.72 | 0.872 | 0.511 | 0.46**      | <i>0.71</i> |             |             |
| 3. Green performance          | 3.82 | 0.63 | 0.838 | 0.635 | 0.55**      | 0.62**      | <i>0.79</i> |             |
| 4. Competitive advantage      | 3.55 | 0.64 | 0.897 | 0.521 | 0.49**      | 0.51**      | 0.58**      | <i>0.72</i> |

**Notes:**  $n = 327$ . Square root of the AVE is shown on diagonal (italics). Correlations are below the diagonal. \*\* $p < 0.01$

**Table II.**  
Descriptive statistics  
and correlation matrix



was addressed in two independent tests for nonresponse bias. Early and late respondents were compared (Armstrong and Overton, 1977) for number of employee and age of company. *T*-tests showed no significant difference, indicating that nonresponse bias was not a significant problem in this study.

Following Podsakoff and Organ (1986), we used Harman's one-factor test to assess whether common method bias was a potential threat. Since the first factor accounted for 35.5 percent of the variance, and there was no general factor in the un-rotated factor structure that accounted for the majority of variance. Thus, common method bias is not an issue of concern.

#### *Test of hypotheses*

To test mediation we followed the standards steps, set forth by Baron and Kenny (1986), that must be met before a variable may be considered a mediating variable. Table IV provides the estimates obtained from the structural equation model. Model 1 shows that OGC significantly predicted green performance ( $\beta = 0.806, p < 0.001$ ) and competitive advantage ( $\beta = 0.747, p < 0.001$ ), respectively, supporting *H1a* and *H1b*. Model 2 shows the positive impact of OGC on green innovation ( $\beta = 0.751, p < 0.001$ ), verifying *H2*. This finding is congruent with the previous studies (e.g. Naranjo-Valencia *et al.*, 2011; Wirttenberg, 2014). Model 3 shows that the mediating roles of green innovation related to respective green performance ( $\beta = 0.601, p < 0.001$ ) and competitive advantage ( $\beta = 0.711, p < 0.001$ ) are significant. This suggests that OGC influences green innovation, and green innovation in turn influences green performance and competitive advantage.

The final step is to show whether or not the strength of the relation between OGC and green performance and competitive advantage is significantly reduced when green innovation is added to Model 1. When Model 4 includes the mediator of green innovation, the influence of OGC on green performance is not statistically significant ( $\beta = 0.352, p > 0.1$ ), supporting *H3a*. This indicates that effect of OGC is completely mediated by green innovation. Without considering green innovation, the direct effect of OGC on green performance is supported by *H1a*. However, while green innovation was incorporated into Model 1, it is surprising that the effect of OGC on green performance does not seem to have a significant effect. Once the relation between OGC and competitive advantage is accounted for, there is a weaker relation between OGC and competitive advantage ( $\beta = 0.541, p < 0.001$ ), which is smaller than that of Model 1 ( $\beta = 0.747, p < 0.001$ ). The result provides evidence for the partial mediating role of green innovation in the OGC–competitive advantage link supporting *H3b*.

### **Discussion and managerial implications**

Our findings have a number of significant managerial implications. There is a clear positive influence of OGC on green performance. An OGC supporting environmentally friendly values directs managers to become conscious of resources used, waste produced and energy consumed, thereby improving the firm's green performance. While recognizing that existing

**Table III.**  
Distribution of  
respondents

| Title: (%)                   | Tenure in industry: years (%) |
|------------------------------|-------------------------------|
| CEO (owner): 29 (9%)         | < 5 years: 46 (14%)           |
| General manager: 39 (12%)    | 5–10 years: 36 (11%)          |
| Purchasing manager: 88 (27%) | 11–20 years: 82 (25%)         |
| R&D manager: 92 (28%)        | 21–30 years: 108 (33%)        |
| Marketing manager: 43 (13%)  | 31–40 years: 44 (13%)         |
| Others: 36 (11%)             | > 40 years: 11 (4%)           |

| Testing steps in mediation model | Model 1 coefficients | Model 2 coefficients | Model 3 coefficient | Model 4 coefficient |
|----------------------------------|----------------------|----------------------|---------------------|---------------------|
| <i>Testing Step 1</i>            |                      |                      |                     |                     |
| Predictor: OGC                   |                      |                      |                     |                     |
| Outcomes: GP ( <i>H1a</i> )      | 0.806 (4.89)***      |                      |                     |                     |
| CA ( <i>H1b</i> )                | 0.747 (4.84)***      |                      |                     |                     |
| <i>Testing Step 2</i>            |                      |                      |                     |                     |
| Predictor: OGC                   |                      |                      |                     |                     |
| Outcome: GI ( <i>H2</i> )        |                      | 0.751 (4.86)***      |                     |                     |
| <i>Testing Step 3</i>            |                      |                      |                     |                     |
| Mediator: GI                     |                      |                      |                     |                     |
| Outcomes: GP                     |                      |                      | 0.601 (5.25)***     |                     |
| CA                               |                      |                      | 0.711 (5.66)***     |                     |
| <i>Testing Step 4</i>            |                      |                      |                     |                     |
| Predictor: OGC                   |                      |                      |                     |                     |
| Mediator: GI                     |                      |                      |                     | 0.677 (4.81)***     |
| Outcomes: GP ( <i>H3a</i> )      |                      |                      |                     | 0.352 (1.05)        |
| CA ( <i>H3b</i> )                |                      |                      |                     | 0.541 (8.74)***     |
| <i>Overall fit</i>               |                      |                      |                     |                     |
| $\chi^2$                         | 320.07               | 186.01               | 402.62              | 700.83              |
| df                               | 144                  | 82                   | 195                 | 332                 |
| RMSEA                            | 0.061                | 0.062                | 0.057               | 0.042               |
| GFI                              | 0.92                 | 0.95                 | 0.90                | 0.93                |
| NFI                              | 0.91                 | 0.93                 | 0.91                | 0.92                |
| IFI                              | 0.95                 | 0.96                 | 0.95                | 0.93                |

**Notes:** OGC, organization green culture; GI, green innovation; GP, green performance; CA, competitive advantage. Numbers in parentheses show *t*-values. \*\*\* $p < 0.001$

**Table IV.**  
Testing mediator  
effects using  
structural  
equation model

green environmental regulations and rapidly changing technological environments may be a serious challenge, our results encourage managers to adopt OGC characteristics. For a firm to make green culture a priority, it should hire managers who support environmental issues that represent shared values of a green culture the firm wants to espouse. Under current strict environmental regulations and environmental attitudes, managers should practice eco-friendly conduct to create new market opportunities for their firms and thus improve the firm's green performance.

This finding shows that OGC can increase competitive advantage. From a practical standpoint, managers must develop a culture supporting environmental values because OGC can differentiate the firm from its competitors. Managers can cultivate the shared value of eco-friendly production processes to reduce negative environmental impacts (e.g. Jaffe *et al.*, 2002) through organizational culture in order to sustain competitive advantage. Though existing environmental protection pressure may not be easily manipulated, we suggest that these managers be fully aware of their organization's environmental strategy when environmental problems arise in order to make appropriate decisions. Their decisions related to competitive advantage clearly depend on their organization's intention to engage in green culture activities.

If the influence of OGC on green innovation does indeed represent a causal connection between these two, then our findings have important managerial implications. The findings of this study show how OGC offers an opportunity for managers to improve green innovation in manufacturing firms. Specifically, managers must support and shape green culture to mobilize and direct employee energy to achieve green innovation. This involves

sharing green culture value within an organization. For example, managers must cultivate environmentally friendly values for disseminating knowledge among organizational members by recognizing the importance of green culture to increase green innovation. Managers may consider developing a supportive green culture in a work environment that is environmentally oriented. Such organizational cultures facilitate the innovation of the manufacturing firm's green strategy by employees' supportive behavior. Employees in organizations that have OGC are more likely to participate in environmental protection, enhancing organizational green innovation ability (Khazanchi *et al.*, 2007).

Our finding of the fully mediating effect of green innovation strategy is important since the mediation has largely been overlooked in previous research. This is a significant finding because it points to strategy implications. Traditionally, innovation focuses on superior competence and market pioneering, such as technological or service innovation, to boost innovation advantage. Our results suggest that managers could influence innovation by promoting the values of reducing environmental harm used to create strong green innovation. Of course, such effect would require managers to lead in the green direction. In order to successfully innovate and adapt environmental progress, managers have to meet certain requirements in terms of their shared values. This green innovation could be incorporated into OGC that managers are often required to implement.

Our study also shows that green innovation strategy partially mediated the OGC–competitive advantage relationship. This suggests that OGC might directly affect competitive advantage or indirectly affect competitive advantage through green innovation. The direct effect of OGC on competitive advantage is supported by *H1b*. We re-examine the source of competitive advantage with particular attention to environmental resources. Since OGC can support competitive advantage, green innovation is not redundant. Indeed, green innovation should be emphasized in the OGC because an OGC proactive to green innovation often leads to competitive advantage. Hence, managers should work toward an internal organizational climate that supports green innovation. To achieve competitive advantage, manager must create positive OGC that can differentiate the firm from competitors. When incorporated into an OGC, green innovation enables managers to create new opportunities for the firm's competitive advantage. The concept indicates that competitive advantage can be obtained by offering a superior green value culture that not only supports OGC but also uses green innovation to create further new market opportunities for the firm. As such, OGC allows a firm to efficiently manage natural resources by being embedding in green innovation, which in turns lead to sustained competitive advantage (Gupta and Kumar, 2013; Wagner, 2006).

### **Theoretical contribution**

The role of organizational culture in affecting competitive advantage and performance is well discussed in the organizational literature (Deshpandé and Farley, 2004; Farley *et al.*, 2008). What is less understood is how OGC affect green performance and competitive advantage by the mediating role of green innovation. The key findings of this study signify our contribution to the theory of management. Although the determinants concerns have received major attention in green innovation research, most literature on green innovation does not focus specifically on organizational culture issues. On one hand, previous green innovation research has highlighted the role of market-pull and technology-push factors as determinants of green innovation (Cleff and Rennings, 1999; Jaffe *et al.*, 2002; Porter and Van der Linde, 1995b). On the other hand, the research concerning the outcomes of implementing OGC strategies has remained scarce for a long time. There are few studies on the alignment between OGC and green innovation apart from Yang *et al.* (2017). This study contributes to the existing literature on organizational culture and innovation by considering green environmental concerns, which have not been empirically explored,

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though some literature supports the importance of green issues. (e.g. Moreton *et al.*, 2005; Sugita and Takahashi, 2015).

From a theoretical perspective, the findings of this study show that executives in a firm with a misalignment between OGC and green performance should do. This study offers a unique theoretical argument describing the relationship by considering the mediating effect of green innovation strategy. OGC requires a balance between lowering the cost of production to meet environmental regulations and increasing investment for environmentally friendly technologies (Klassen and Whybark, 1999). OGC firms should prepare internally for green innovation to a firm's green performance to succeed (Bernauer *et al.*, 2007). This implies that green innovation differs from other innovation since green performance goals differ from other motivations, and green innovation strategy is more important than other organizational strategies. Our results indicate that unless green innovation is based on OGC, the final effect of any organizational culture on a firm's green performance will be questionable.

This study sheds light on the relationship between OGC and selected aspects of performance, and interest triggered by green innovation. The resource-based viewpoint (RBV) suggests that a firm's valuable, rare and difficult to imitate resources can yield competitive advantage (Barney, 1991). Most studies argue that organizational culture is grounded in RBV logic (e.g. Kleinschmidt *et al.*, 2007), but our findings suggest that organizational culture should be focused on environmental considerations. This finding extends the previous research of Russo and Fouts (1997). This contribution is supported by the NRBV since the NRBV suggests that firms must be able to respond to changing environmental pressures by developing new resources.

### Limitation and future research

This study has some limitations that point to the future lines of research. Perhaps, the biggest limitation of the study is that the data are from a single country, which may hamper generalization. Although Taiwanese manufacturing settings display an attractive context, in addition, as a developed country, Taiwan has been enforced strict environmental regulations. In light of this limitation, future work should test this study's hypotheses in other economic and culture settings, including newly industrialized countries such as Brazil, South Korea or Singapore, with concerns for the natural environment.

This study is also limited in that it is based on cross-sectional data. To identify the long-term effects of implementation of green innovation strategy and OGC on green performance and competitive advantage, there should be long-term research. Future research should utilize longitudinal studies that can capture the dynamic consequences of green innovation, allowing researchers to explore causal relationships between OGC, green innovation and the firm's green performance over time.

A final limitation is the origin of organizational culture vs employee attitude culture. In other words, the question whether the unit of analysis is the group rather than the individual. Our questionnaire was collected from individuals. But individual employee behavior may deviate from the general organizational culture, potentially limiting interpretation of this study since OGC was defined at the organization level. However, the managerial literature shows that the organizational culture is an aggregation of individual employee behaviors, so we believe that the individuals' behaviors can be a proxy for organizational culture. Previous studies have consistently showed that employee behavior is the ideal approach for organizational culture (Hu *et al.*, 2012; Wilson and Howarth, 2002).

### References

- Andersen, M.M. (2008), "Eco-innovation – towards a taxonomy and a theory", paper presented at the 25th Celebration DRUID Conference, Copenhagen Business School, Copenhagen, June 17-20.
- Aragón-Correa, J.A. and Sharma, S. (2003), "A contingent resource-based view of proactive corporate environmental strategy", *Academy of Management Review*, Vol. 28 No. 1, pp. 71-88.

- Armstrong, J.S. and Overton, T.S. (1977), "Estimating nonresponse bias in mail surveys", *Journal of Marketing Research*, Vol. 14 No. 3, pp. 396-402.
- Bagozzi, R.P. and Yi, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16 No. 1, pp. 74-94.
- Baker, W.E. and Sinkula, J.M. (2005), "Environmental marketing strategy and firm performance: effects on new product performance and market share", *Journal of the Academy of Marketing Science*, Vol. 33 No. 4, pp. 461-475.
- Banerjee, S.B. (2001), "Managerial perceptions of corporate environmentalism: interpretations from industry and strategic implications for organizations", *Journal of Management Studies*, Vol. 38 No. 4, pp. 489-513.
- Banerjee, S.B. (2002), "Corporate environmentalism: the construct and its measurement", *Journal of Business Research*, Vol. 55 No. 3, pp. 177-191.
- Banerjee, S.B., Iyer, E.S. and Kashyap, R.K. (2003), "Corporate environmentalism: antecedents and influence of industry type", *Journal of Marketing*, Vol. 67 No. 2, pp. 106-122.
- Bansal, P. (2003), "From issues to actions: the importance of individual concerns and organizational values in responding to natural environmental issues", *Organization Science*, Vol. 14 No. 5, pp. 510-527.
- Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120.
- Baron, R.M. and Kenny, D.A. (1986), "The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations", *Journal of Personality & Social Psychology*, Vol. 51, pp. 1173-1182.
- Belin, J., Horbach, J. and Oltra, V. (2011), "Determinants and specificities of eco-innovations-an econometric analysis for the French and German industry based on the community innovation survey", French, *Cahier du GREThA* 2011: 17.
- Bennett, M. and James, P. (1998), "Environment under the spotlight: current practice and future trends in environment-related performance measurement for business", Certified Accountants Educational Trust, London.
- Bernauer, T., Engel, S., Kammerer, D. and Sejas Nogareda, J. (2007), "Determinants of green innovation – ten years after Porter's win-win proposition: how to study the effects of environmental regulation", *Politische Vierteljahresschrift*, Vol. 39, pp. 323-341.
- Berry, M.A. and Rondinelli, D.A. (1998), "Proactive corporate environmental management: a new industrial revolution", *Academy of Management Perspectives*, Vol. 12 No. 2, pp. 38-50.
- Bonifant, B.C., Arnold, M.B. and Long, F.J. (1995), "Gaining competitive advantage through environmental investments", *Business Horizons*, Vol. 38 No. 4, pp. 37-47.
- Brunnermeier, S.B. and Cohen, M.A. (2003), "Determinants of environmental innovation in US manufacturing industries", *Journal of Environmental Economics and Management*, Vol. 45 No. 2, pp. 278-293.
- Chandler, G.N. and Hanks, S.H. (1994), "Market attractiveness, resource-based capabilities, venture strategies, and venture performance", *Journal of Business Venturing*, Vol. 9 No. 4, pp. 331-349.
- Chen, Y.S. (2008), "The driver of green innovation and green image–green core competence", *Journal of Business Ethics*, Vol. 81 No. 3, pp. 531-543.
- Chen, Y.S., Lai, S.B. and Wen, C.T. (2006), "The influence of green innovation performance on corporate advantage in Taiwan", *Journal of Business Ethics*, Vol. 67 No. 4, pp. 331-339.
- Chinander, K.R. (2001), "Aligning accountability and awareness for environmental performance in operations", *Production and Operations Management*, Vol. 10 No. 3, pp. 276-291.
- Cleff, T. and Rennings, K. (1999), "Determinants of environmental product and process innovation", *European Environment*, Vol. 9 No. 5, pp. 191-201.
- Das, A., Narasimhan, R. and Talluri, S. (2006), "Supplier integration – finding an optimal configuration", *Journal of Operations Management*, Vol. 24 No. 5, pp. 563-582.

- De Marchi, V. (2012), "Environmental innovation and R&D cooperation: empirical evidence from Spanish manufacturing firms", *Research Policy*, Vol. 41 No. 3, pp. 614-623.
- de Medeiros, J.F., Vidor, G. and Ribeiro, J.L.D. (2018), "Driving factors for the success of the green innovation market: a relationship system proposal", *Journal of Business Ethics*, Vol. 147 No. 2, pp. 327-341.
- De Ruyter, K., De Jong, A. and Wetzels, M. (2009), "Antecedents and consequences of environmental stewardship in boundary-spanning B2B teams", *Journal of the Academy of Marketing Science*, Vol. 37 No. 4, pp. 470-487.
- Delmas, M.A. and Toffel, M.W. (2008), "Organizational responses to environmental demands: opening the black box", *Strategic Management Journal*, Vol. 29 No. 10, pp. 1027-1055.
- Deshpandé, R. and Farley, J.U. (2004), "Organizational culture, market orientation, innovativeness, and firm performance: an international research odyssey", *International Journal of Research in Marketing*, Vol. 21 No. 1, pp. 3-22.
- Eiadat, Y., Kelly, A., Roche, F. and Eyadat, H. (2008), "Green and competitive? An empirical test of the mediating role of environmental innovation strategy", *Journal of World Business*, Vol. 43 No. 2, pp. 131-145.
- Farley, J.U., Hoenig, S. and Ismail, Z. (2008), "Organizational culture, innovativeness, market orientation and firm performance in South Africa: an interdisciplinary perspective", *Journal of African Business*, Vol. 9 No. 1, pp. 59-76.
- Fergusson, H. and Langford, D. (2006), "Strategies for managing environmental issues in construction organizations", *Engineering, Construction and Architectural Management*, Vol. 13 No. 2, pp. 171-185.
- Fornell, C. and Larcker, D. (1981), "Structural equation modeling and regression: guidelines for research practice", *Journal of Marketing Research*, Vol. 18 No. 1, pp. 39-50.
- Fraj, E., Martínez, E. and Matute, J. (2011), "Green marketing strategy and the firm's performance: the moderating role of environmental culture", *Journal of Strategic Marketing*, Vol. 19 No. 4, pp. 339-355.
- Fussler, C. and James, P. (1996), *Driving Eco-innovation: A Breakthrough Discipline for Innovation and Sustainability*, Pitman Publishers, London.
- Gao, Y. (2017), "Business leaders' personal values, organisational culture and market orientation", *Journal of Strategic Marketing*, Vol. 25 No. 1, pp. 49-64.
- Grano, S.A. (2015), *Environmental Governance in Taiwan: A New Generation of Activists and Stakeholders*, Routledge, London.
- Greeno, J. and Robinson, S. (1992), "Rethinking corporate environmental management", *Columbia Journal of World Business*, Vol. 27 Nos 3/4, pp. 222-232.
- Grinstein, A. and Nisan, U. (2009), "Demarketing, minorities, and national attachment", *Journal of Marketing*, Vol. 73 No. 2, pp. 105-122.
- Guoyou, Q., Saixing, Z., Chiming, T., Haitao, Y. and Hailiang, Z. (2013), "Stakeholders' influences on corporate green innovation strategy: a case study of manufacturing firms in China", *Corporate Social Responsibility and Environmental Management*, Vol. 20 No. 1, pp. 1-14.
- Gupta, S. and Kumar, V. (2013), "Sustainability as corporate culture of a brand for superior performance", *Journal of World Business*, Vol. 48 No. 3, pp. 311-320.
- Hart, S.L. (1995), "A natural-resource-based view of the firm", *Academy of Management Review*, Vol. 20 No. 4, pp. 986-1014.
- Higgins, J.M. and McAllaster, C. (2002), "Want innovation? Then use cultural artifacts that support it", *Organizational Dynamics*, Vol. 31 No. 1, pp. 74-84.
- Ho, M.S. and Hong, C.S. (2012), "Challenging new conservative regimes in South Korea and Taiwan", *Asian Survey*, Vol. 52 No. 4, pp. 643-665.
- Hoffmann, E. (2007), "Consumer integration in sustainable product development", *Business Strategy and the Environment*, Vol. 16 No. 5, pp. 322-338.

- Hojnik, J. and Ruzzier, M. (2016), "What drives eco-innovation? A review of an emerging literature", *Environmental Innovation and Societal Transitions*, Vol. 19, pp. 31-41.
- Horbach, J. (2008), "Determinants of environmental innovation – new evidence from German panel data sources", *Research Policy*, Vol. 37 No. 1, pp. 163-173.
- Hu, Q., Dinev, T., Hart, P. and Cooke, D. (2012), "Managing employee compliance with information security policies: the critical role of top management and organizational culture", *Decision Sciences*, Vol. 43 No. 4, pp. 615-660.
- Ilinitch, A.Y., Soderstrom, N.S. and Thomas, T.E. (1998), "Measuring corporate environmental performance", *Journal of Accounting and Public Policy*, Vol. 17 Nos 4/5, pp. 383-408.
- Jaffe, A.B. and Palmer, K. (1997), "Environmental regulation and innovation: a panel data study", *The Review of Economics and Statistics*, Vol. 79 No. 4, pp. 610-619.
- Jaffe, A.B., Newell, R.G. and Stavins, R.N. (2002), "Environmental policy and technological change", *Environmental and Resource Economics*, Vol. 22 Nos 1/2, pp. 41-70.
- Jamrog, J., Vickers, M. and Bear, D. (2006), "Building and sustaining a culture that supports innovation", *People and Strategy*, Vol. 29 No. 3, pp. 9-19.
- Karna, A., Richter, A. and Riesenkauff, E. (2016), "Revisiting the role of the environment in the capabilities–financial performance relationship: a meta-analysis", *Strategic Management Journal*, Vol. 37 No. 6, pp. 1154-1173.
- Khazanchi, S., Lewis, M.W. and Boyer, K.K. (2007), "Innovation-supportive culture: the impact of organizational values on process innovation", *Journal of Operations Management*, Vol. 25 No. 4, pp. 871-884.
- Klassen, R.D. and Vachon, S. (2003), "Collaboration and evaluation in the supply chain: the impact on plant-level environmental investment", *Production and Operations Management*, Vol. 12 No. 3, pp. 336-352.
- Klassen, R.D. and Whybark, D.C. (1999), "The impact of environmental technologies on manufacturing performance", *Academy of Management Journal*, Vol. 42 No. 6, pp. 599-615.
- Kleinschmidt, E.J., De Brentani, U. and Salomo, S. (2007), "Performance of global new product development programs: a resource-based view", *Journal of Product Innovation Management*, Vol. 24 No. 5, pp. 419-441.
- Konar, S. and Cohen, M.A. (2001), "Does the market value environmental performance?", *The Review of Economics and Statistics*, Vol. 83 No. 2, pp. 281-289.
- Kotler, P. (2011), "Reinventing marketing to manage the environmental imperative", *Journal of Marketing*, Vol. 75 No. 4, pp. 132-135.
- Kushwaha, G.S. and Sharma, N.K. (2016), "Green initiatives: a step towards sustainable development and firm's performance in the automobile industry", *Journal of Cleaner Production*, Vol. 121, pp. 116-129.
- Lau, C.M. and Ngo, H.Y. (2004), "The HR system, organizational culture, and product innovation", *International Business Review*, Vol. 13 No. 6, pp. 685-703.
- Leonard-Barton, D. (1995), "Wellsprings of knowledge: building and sustaining the sources of innovation", Harvard Business School Press, Boston, MA.
- Leonidou, C.N., Katsikeas, C.S. and Morgan, N.A. (2013), "Greening the marketing mix: do firms do it and does it pay off?", *Journal of the Academy of Marketing Science*, Vol. 41 No. 2, pp. 151-170.
- Leonidou, L.C., Fotiadis, T.A., Christodoulides, P., Spyropoulou, S. and Katsikeas, C.S. (2015), "Environmentally friendly export business strategy: its determinants and effects on competitive advantage and performance", *International Business Review*, Vol. 24 No. 5, pp. 798-811.
- McLean, L.D. (2005), "Organizational culture's influence on creativity and innovation: a review of the literature and implications for human resource development", *Advances in Developing Human Resources*, Vol. 7 No. 2, pp. 226-246.
- Ma, H. (2000), "Competitive advantage and firm performance", *Competitiveness Review: An International Business Journal*, Vol. 10 No. 2, pp. 15-32.

- Martins, E. and Terblanche, F. (2003), "Building organisational culture that stimulates creativity and innovation", *European Journal of Innovation Management*, Vol. 6 No. 1, pp. 64-74.
- Menguc, B. and Ozanne, L.K. (2005), "Challenges of the 'green imperative': a natural resource-based approach to the environmental orientation–business performance relationship", *Journal of Business Research*, Vol. 58 No. 4, pp. 430-438.
- Michaelis, T.L., Aladin, R. and Pollack, J.M. (2018), "Innovation culture and the performance of new product launches: a global study", *Journal of Business Venturing Insights*, Vol. 9, pp. 116-127.
- Miles, M.P., Covin, J.G. and Heeley, M.B. (2000), "The relationship between environmental dynamism and small firm structure, strategy, and performance", *Journal of Marketing Theory and Practice*, Vol. 8 No. 2, pp. 63-78.
- Moreton, K., Williamson, D. and Lynch-Wood, G. (2005), "An emergent typology of strategy, innovation and culture as determinants of business performance in small- and medium-sized environmental enterprises", paper presented at the Proceeding of the 11th Annual International Sustainable Development Research Conference, Helsinki, June 6–8.
- Naranjo-Valencia, J.C., Jiménez-Jiménez, D. and Sanz-Valle, R. (2011), "Innovation or imitation? The role of organizational culture", *Management Decision*, Vol. 49 No. 1, pp. 55-72.
- Neely, A., Gregory, M. and Platts, K. (1995), "Performance measurement system design: a literature review and research agenda", *International Journal of Operations and Production Management*, Vol. 15 No. 4, pp. 80-116.
- Nunnally, J.C. and Bernstein, I. (1994), *Psychometric Theory*, McGraw-Hill, New York, NY.
- O'Regan, N. and Ghobadian, A. (2005), "Innovation in SMEs: the impact of strategic orientation and environmental perceptions", *International Journal of Productivity and Performance Management*, Vol. 54 No. 2, pp. 81-97.
- Olsthoorn, X., Tyteca, D., Wehrmeyer, W. and Wagner, M. (2001), "Environmental indicators for business: a review of the literature and standardisation methods", *Journal of Cleaner Production*, Vol. 9 No. 5, pp. 453-463.
- Özsoyner, A., Calantone, R.J. and Di Bonetto, A. (1997), "What makes firms more innovative? A look at organizational and environmental factors", *Journal of Business and Industrial Marketing*, Vol. 12 No. 6, pp. 400-416.
- Podsakoff, P.M. and Organ, D.W. (1986), "Self-reports in organizational research: problems and prospects", *Journal of Management*, Vol. 12 No. 4, pp. 531-544.
- Porter, M.E. (1985), "Technology and competitive advantage", *Journal of Business Strategy*, Vol. 5 No. 3, pp. 60-78.
- Porter, M.E. and Van der Linde, C. (1995a), "Green and competitive: ending the stalemate", *Harvard Business Review*, Vol. 73 No. 5, pp. 120-134.
- Porter, M.E. and Van der Linde, C. (1995b), "Toward a new conception of the environment–competitiveness relationship", *Journal of Economic Perspectives*, Vol. 9 No. 4, pp. 97-118.
- Qi, G., Zeng, S., Li, X. and Tam, C. (2012), "Role of internalization process in defining the relationship between ISO 14001 certification and corporate environmental performance", *Corporate Social Responsibility and Environmental Management*, Vol. 19 No. 3, pp. 129-140.
- Ragatz, G.L., Handfield, R.B. and Petersen, K.J. (2002), "Benefits associated with supplier integration into new product development under conditions of technology uncertainty", *Journal of Business Research*, Vol. 55 No. 5, pp. 389-400.
- Rao, P. and Holt, D. (2005), "Do green supply chains lead to competitiveness and economic performance?", *International Journal of Operations and Production Management*, Vol. 25 No. 9, pp. 898-916.
- Reid, A. and Miedzinski, M. (2008), "Eco-innovation", final report for sectoral innovation watch. Europe Innova. Technopolis group, Brussels, May.



- Robinson, S. and Stubberud, H.A. (2013), "Green innovation in Germany: a comparison by business size", *Journal of International Business Research*, Vol. 12 No. 1, pp. 47-56.
- Roper, S. and Tapinos, E. (2016), "Taking risks in the face of uncertainty: an exploratory analysis of green innovation", *Technological Forecasting and Social Change*, Vol. 112, pp. 357-363.
- Russo, M.V. and Fouts, P.A. (1997), "A resource-based perspective on corporate environmental performance and profitability", *Academy of Management Journal*, Vol. 40 No. 3, pp. 534-559.
- Schlegelmilch, B.B., Bohlen, G.M. and Diamantopoulos, A. (1996), "The link between green purchasing decisions and measures of environmental consciousness", *European Journal of Marketing*, Vol. 30 No. 5, pp. 35-55.
- Scott Marshall, R. and Brown, D. (2003), "Corporate environmental reporting: what's in a metric?", *Business Strategy and the Environment*, Vol. 12 No. 2, pp. 87-106.
- Shih, F.L. (2012), "Generating power in Taiwan: nuclear, political and religious power", *Culture and Religion*, Vol. 13 No. 3, pp. 295-313.
- Stone, G., Joseph, M. and Blodgett, J. (2004), "Toward the creation of an eco-oriented corporate culture: a proposed model of internal and external antecedents leading to industrial firm eco-orientation", *Journal of Business and Industrial Marketing*, Vol. 19 No. 1, pp. 68-84.
- Sugita, M. and Takahashi, T. (2015), "Influence of corporate culture on environmental management performance: an empirical study of Japanese firms", *Corporate Social Responsibility and Environmental Management*, Vol. 22 No. 3, pp. 182-192.
- Triebswetter, U. and Hitchens, D. (2005), "The impact of environmental regulation on competitiveness in the German manufacturing industry – a comparison with other countries of the European Union", *Journal of Cleaner Production*, Vol. 13 No. 7, pp. 733-745.
- Veleva, V. and Ellenbecker, M. (2000), "A proposal for measuring business sustainability: addressing shortcomings in existing frameworks", *Greener Management International*, Vol. 31, pp. 101-119.
- Wagner, S.M. (2006), "A firm's responses to deficient suppliers and competitive advantage", *Journal of Business Research*, Vol. 59 No. 6, pp. 686-695.
- Weller, R.P. (2006), *Discovering Nature: Globalization and Environmental Culture in China and Taiwan*, Cambridge University Press, Cambridge.
- Wilson, M.A. and Howarth, R.B. (2002), "Discourse-based valuation of ecosystem services: establishing fair outcomes through group deliberation", *Ecological Economics*, Vol. 41 No. 3, pp. 431-443.
- Wirtenberg, J. (2014), "Building a culture for sustainability: people, planet, and profits in a new green economy", ABC-CLIO, Santa Barbara, CA.
- Yang, Z., Sun, J., Zhang, Y. and Wang, Y. (2017), "Green, green, it's green: a triad model of technology, culture, and innovation for corporate sustainability", *Sustainability*, Vol. 9 No. 8, pp. 1-23.
- Yu, W., Ramanathan, R. and Nath, P. (2017), "Environmental pressures and performance: an analysis of the roles of environmental innovation strategy and marketing capability", *Technological Forecasting and Social Change*, Vol. 117, pp. 160-169.
- Yung, W.K., Chan, H., So, J.H., Wong, D.W., Choi, A.C. and Yue, T. (2011), "A life-cycle assessment for eco-redesign of a consumer electronic product", *Journal of Engineering Design*, Vol. 22 No. 2, pp. 69-85.
- Zhou, K.Z., Brown, J.R. and Dev, C.S. (2009), "Market orientation, competitive advantage, and performance: a demand-based perspective", *Journal of Business Research*, Vol. 62 No. 11, pp. 1063-1070.
- Zhu, Q., Sarkis, J. and Lai, K.H. (2007), "Green supply chain management: pressures, practices and performance within the Chinese automobile industry", *Journal of Cleaner Production*, Vol. 15 No. 11, pp. 1041-1052.
- Zhu, Q., Sarkis, J. and Lai, K.H. (2008), "Green supply chain management implications for 'closing the loop'", *Transportation Research Part E: Logistics and Transportation Review*, Vol. 44 No. 1, pp. 1-18.

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## Appendix

### Measurement Scales

#### *Green performance (Yu et al., 2017)*

- (1) Our firm conforms with requirements of inputs of energy.
- (2) Our firm conforms with requirements of community relations.
- (3) Our firm conforms with requirements of outputs of air emissions
- (4) Our firm conforms with requirements of indicators on the local, regional or national condition of the environment.
- (5) Our firm conforms with requirements of outputs of waste-water.
- (6) Our firm conforms with expectations of implementation of environmental policies and programs.
- (7) Our firm has achieved important environment related certifications (e.g. ISO 14031).
- (8) Our firm has regularly achieved targets for energy conservation, recycling or waste reductions.
- (9) On average, overall environmental performance of our company has improved over the past five years.

#### *Competitive advantage (Chandler and Hanks, 1994; Zhou et al., 2009)*

##### Innovation differentiation:

- (1) We are constantly investing to generate new capabilities that give us an advantage over our competitors.
- (2) Our firm offers that there was a new way of serving customers.

##### Market differentiation:

- (1) It is difficult for our competitors to imitate us.
- (2) Nobody can copy our corporate routines, processes and culture.

#### *Green innovation (Chen, 2008; Chen et al., 2006; Roper and Tapinos, 2016)*

##### Green production innovation:

- (1) Our firm uses less or non-polluting/toxic materials.
- (2) Our firm improves environmentally friendly packaging for existing and new products.
- (3) Our firm recovers of firm's end-of-life products and recycling.
- (4) Our firm uses eco-labeling.

##### Green process innovation:

- (1) Our firm uses low energy consumption such as water, electricity, gas and petrol during production/use/disposal.
- (2) Our firm uses recycled, reused, or remanufactured materials.
- (3) Our firm uses cleaner technology to make savings and prevent pollution (such as energy, water, and waste).

##### Green managerial innovation:

- (1) Our firm redefines operation and production processes to ensure internal efficiency that can help to implement.
- (2) Our firm re-designs product or service to meet new environmental criteria or directions.

#### *Organizational green culture (Banerjee, 2002; Fraj et al., 2011)*

- (1) Our firm makes a concerted effort to make every employee understand the importance of environmental preservation.

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- (2) Our firm has a clear policy statement urging environmental awareness in every area.
- (3) Environmental preservation is a high priority activity in our firm.
- (4) Preserving the environment is a central corporate value in our firm.
- (5) Our firm links environmental objectives with our other corporate goals.
- (6) Our firm develops products and processes that minimize environment impact.

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