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DRIVERS OF ENVIRONMENTAL SUSTAINABILITY IN WINE FIRMS: THE ROLE AND EFFECT OF WOMEN IN LEADERSHIP

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The Role and Effect of Women in Leadership

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Abstract

Employing resource-based perspectives of the firm as a theoretical foundation, this article empirically examines the relationship between women in two different types of leadership roles and environmentally sustainable firms. I study an unbalanced panel data set of 2,006 wine firms in Australia for the period 2007–2014. The results suggests that when accounting for their individual, independent effects, women in *technical* leadership roles are positively associated with environmental sustainability, while women in *professional* leadership roles are not. However, the potential complementarities of women in both roles are explored, their interactive, co-joint (complementary) effect explains significantly more variance in the environmental sustainability variable than their individual effects. The results are discussed along with limitations and directions for future research.

Keywords

Australia, complementary, environmental sustainability, gender diversity, sustainability, wine, women

Do women leaders influence firm outcomes in the area of environmental sustainability? The literature suggests that they could, although such a postulate is unclear. For example, studying Fortune 1000 firms, Post, Rahman, and Rubow (2011) find that boards that have women directors are positively associated with environmental strengths. In their study of Fortune 500 companies, Glass, Cook, and Ingersoll (2015) find marginal support for a relationship between women on boards and environmental sustainability. However, in his study of Australia's largest firms, Galbreath (2011) finds no relationship between women on boards and environmental performance. In a study of S&P 500 firms, neither do Walls, Berrone, and Phan (2012). Other studies investigating women on boards are hard to decipher, because measurements are an overall composite corporate social responsibility (CSR) score, which masks the effect on the environmental sustainability component (e.g., Harjoto, Laksmana, & Lee, 2015; Byron & Post, 2016; Webb, 2004), or else they do not measure an environmental dimension at all (e.g., Bear, Rahman, & Post, 2010).

In short, while there is increasing interest in understanding if women leaders are associated with environmental sustainability, the data are limited. First, majority of studies only consider women in board of director positions (for an exception, see Glass et al., 2015). Second, the results are mixed or inconclusive. Studying mainly women directors, for example, does not account for the human capital of women in other leadership roles in the firm, nor how women in different leadership roles might interact—or complement each other—to improve firm outcomes. As environmental sustainability becomes a key strategic imperative (Lubin & Esty, 2011), and as gender diversity in the workplace is considered both an economic and ethical imperative (Adams, 2016; Curtis, Schmid, & Struber, 2012; Krishnan &Park, 2005; McCabe, Ingram, & Dato-on, 2006), further research is needed to understand the nature of the relationship between women in leadership roles and environmental sustainability.

To address research gaps, this paper makes three contributions. First, relying on resource-based perspectives of the firm as a theoretical framework, I make an argument that the human capital of women in both professional and technical leadership roles are expected to advantage firms, particularly in the area of environmental sustainability. Professional leadership roles have influence over areas such as strategy, values and culture, stakeholder management, marketing communications, sales and channel management, and product pricing. Technical leadership roles have influence over areas such as product development, operations management, and research and development. By moving the research beyond the study of women on boards of directors, I test the possibility if women leaders in professional and technical roles are positively associated with environmental sustainability.

Second, the human capital resources of women in professional and technical roles might not be independent or standalone. In other words, they might be complementary. Complementary perspectives within the resource-based literature suggest that when combined with a complementary resource, two or more resources can offer greater value than they would otherwise individually (Dierickx and Cool 1989; Foss 1998; Teece 1986). Little research has tested if women in different leadership roles could act as complementarities such that they build on their otherwise independent effects, and this is something I test to advance the literature.

Third, a good deal of attention has focused on gender quotas as a means to increase the number of women on boards of directors (e.g., Adams, 2016; Gregorič, Oxelheim, Randøy, & Thomsen, 2015). Yet, the evidence is mixed with respect to whether or not having more women on boards actually leads to better firm outcomes, such as financial performance (Galbreath, 2016), and whether or not mandated quotas are appropriate (Adams, 2016). This article takes a different approach in that the emphasis moves beyond boards of directors (which has been studied extensively) to other leadership roles, while recognizing that environmental sustainability

is becoming an increasingly important indicator of firm success. The results therefore have practical implications, in that firms seeking to improve the representation of women in various leadership roles have some evidence to guide their effort, while gaining insight into whether or not women in different leadership roles have a positive influence on environmental sustainability.

Background

The Advantages of Women: A Resource-Based Perspective

The issue of gender diversity in business organizations has become prominent in both academia and the popular press, and has been described as an economic imperative that is important to strategic success and economic competitiveness on one hand (Curtis et al., 2012; Krishnan & Park 2005), and an ethical imperative that signals an awareness of and commitment to social responsiveness on the other hand (McCabe et al., 2006). Of theories used in the extant literature to examine the value that women can offer to organizations, the resource-based view of the firm (RBV) has gained some acceptance.

To understand how firms acquire and sustain competitive advantages (e.g., an advantage in environmental sustainability), the RBV focuses on organizational factors. While not altogether excluding industry structure, the RBV principally theorizes that internal, idiosyncratic resources explain differences in the competitive advantages of firms competing within the same industry (Barney, 1991). Firms are viewed in terms of their unique bundles of tangible (e.g., financial, physical) and intangible (e.g., human capital, IP) resources as being the source of their competitive advantages, rather than the product market combinations chosen for their deployment (Barney, 1991). This implies that the locus of attention of the firm shifts from building market power (e.g., via manipulation of industry structure) to leveraging those resources

that could be used efficiently and effectively in competing in their given industry, regardless of how attractive or favorable the industry is.

The RBV necessarily posits that firms gain advantages over rivals on the basis of their unique and valuable resources (Barney, 1991; Peteraf & Barney, 2003). Although many different types of resources have been posited to impact on competitive advantage (Galbreath, 2005), human capital resources are thought to be particularly important (Ployhart, Nyberg, Reilly, & Maltarich, 2014). Human capital resources are not only important at individual levels (e.g., the human capital of Steve Jobs), but also through complementary interaction (e.g., the complementary effect of Steve Jobs and Steve Wozniak in the early days of Apple). That is, the advantage of the human capital of any one individual may rest in a complementary, where two or more [human capital] resources can offer greater value than they would otherwise individually (Dierickx and Cool 1989; Foss 1998; Teece 1986). However, some scholars suggest that many firms have not capitalized effectively on their human capital resources (Katzenbach, Beckett, Dichter, Feigen, Gagnon, Hope, & Ling, 1995). Examples of underutilized human capital resources include women and groups such as those of diverse racial or ethnic backgrounds, who might bring valuable resources to firms. In the case of women, many reasons explain why their human capital is expected to be unique and valuable, and a source of competitive advantage.

First, women are known to be more orientated to supporting and maintaining relationships than men (Rosener, 1995), which could give firms an advantage in managing the many stakeholders who risk their financial and other (e.g., time, skills, social capital) investments in the firm. Second, evidence suggests that women are particularly strong in areas such as new idea generation and innovation (Miller & Triana, 2009; Rosener, 1995), which are thought to be critical to competitive advantage. Third, women appear to be very good at seeing big picture issues, which aids them in developing high quality strategies (Kalleberg & Leicht,

1991). Fourth, women may bring unique connections to external sources of dependency, such as key stakeholder groups (e.g., consumers) (Daily, Certo, & Dalton, 1999). Finally, women appear to tolerate unethical practices less than men (Wong & Wan, 2011). Less tolerance for unethical practices could, in part, explain why women appear to be more sensitive to issues having moral and/or ethical considerations (Carroll, 1991). For example, women demonstrate a higher concern for the natural environment than men, while engaging more frequently than men in behaviour intended to benefit the environment (Davidson & Freudenburg, 1996; Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). Given these various traits and capabilities, as women take up leadership positions in firms, the human capital resources they provide are expected to improve organizational learning, productivity, quality, morale, ethical and moral standards, and performance, among others (Rosener, 1995). Such improvements could lead to competitive advantages (Barney, 1991), such as an advantage in environmental sustainability.

Theory and Hypotheses

Requirements for Environmental Sustainability: A Resource-Based Perspective

Environmental sustainability is increasingly important to firms (Bansal and Roth, 2000; de Villers, Naiker, & van Staden, 2011; Eccles, Ioannou, & Serafeim, 2014; Post, Rahman, & Rubow, 2011). Environmental sustainability is important because economic opportunities, legislative initiatives, and stakeholder pressures are influencing business decisions with respect to sustaining the natural environment (Ambec & Lanoie, 2008; Bansal & Roth, 2000; Bendell & Kearins, 2005; Delmas, Lim, & Nairn-Birch, 2015; Delmas & Montes-Sancho, 2010; Delmas & Toffel, 2005; Kassinis & Vafeas, 2006; Porter & van der Linde, 1995; Sharma & Henriques, 2005). However, firms that pursue environmental sustainability face a number of challenges. For example, environmental strategies can require expensive investments in new technology and technical systems and processes, as well as in new forms of cross-functional employee

coordination (Bansal, 2005; Berrone & Gomez-Mejia, 2009). Shrivastava and Hart (1995) argue that environmental sustainability requires far-reaching changes in business processes and organizational strategies. This is supported by Berrone and Gomez-Mejia (2009) and Siebenhüner and Arnold (2007), who suggest that demonstrating environmental sustainability may require the reinvention of products or the complete re-engineering of existing corporate processes. There is also an argument that pursuing environmental sustainability may entail ethical challenges, in that firms may face situations in which flouting the law or regulatory requirements could be more economically beneficial, whereas meeting these requirements would come at an economic cost (Kassinis & Vafeas, 2002). Firms also need to navigate complex stakeholder needs and requirements, as pressure for environmental sustainability increases from this cohort (Delmas & Toffel, 2005; Kassinis & Vafeas, 2006; Sharma & Henriques, 2005).

Accordingly, I argue that to create an advantage in environmental sustainability, a firm needs to demonstrate: 1) innovation capacity; 2) stakeholder engagement and management abilities; and 3) ethical values. Innovation is important because increased environmental sustainability is unlikely to be achieved by applying ready-made concepts or by attempting to implement conventional strategies in new contexts (Nidumolu, Prahalad, & Rangaswami, 2009). For example, while replacing office lights with energy-saving (and emission-reducing) Light Emitting Diode (LED) or Compact Fluorescent Light (CFL) bulbs may be relatively straightforward and simple, creating new environmentally sound features in products (or producing completely new products that target environmentally sensitive consumers) or eliminating pollutants in complex manufacturing processes requires more thoroughgoing innovation (Nidumolu et al., 2009; Porter & van der Linde, 1995). Investment in their innovation capacity is thus important for firms seeking to adhere to environmentally sustainable principles, (Hull & Rothenberg, 2008; McWilliams & Siegel, 2000).

Similarly, a firm that wishes to be perceived as environmentally friendly and sustainable is likely to require new marketing strategies and new marketing messages that enhance and reinforce the firm's position in this area (Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; McWilliams & Siegel, 2000). Firms may also need to craft innovative HRM policies and practices. In fact, according to Taylor, Osland, and Egri (2012), innovative HRM policies can act as both a means and an end to embedding and achieving sustainability goals.

As for stakeholder engagement and management, and ethical considerations, first, Starik (1995) argues firms have a moral obligation to treat the natural environment as a stakeholder. This is because they depend on the natural environment. Virtually all business activity depends on the resource and economic inputs the natural environment provides (Dyllick & Hockerts, 2002). If the resources and inputs nature provides are disrupted, run out, or are otherwise put at risk (e.g., through climate change), economic activity could be constrained (Stern, 2007). Firms' depend on environmental resources to produce goods and services, which suggests their stewardship of these resources is essential, as is a respect for non-human nature's bounty and limits.

Second, Haigh and Griffiths (2009) argue that the natural environment can be affected by business activity. For example, recent corporate scandals like the Volkswagen case demonstrate that firms can flout the law to circumvent emissions standards (in the end, Volkswagen was charged and fined USD$4.3B). According to Carroll (1979), obeying the law is part of a firm's social responsibility. In this sense, for Volkswagen (and others like them), ignoring or circumventing legal requirements can lead to activities that can damage, or create negative externalities related to, the natural environment (Stead & Stead, 2000).

Third, a growing cohort of customers is looking to purchase environmentally friendly products. For example, wine drinkers are increasingly turning to sustainably-produced products

(Delmas & Grant, 2014). In the automotive sector, sales of hybrid and battery powered cars are increasing (Spross, 2014; Vorrath, 2016). Hence, various stakeholder cohorts have expectations about how firms should act towards the natural environment (Delmas & Toffel, 2005; Kassinis & Vafeas, 2006; Sharma & Henriques, 2005), and to adapt to the changes in natural systems that can impact on business activities, operations, and products and services (Haigh & Griffiths, 2009). Further, firm's face ethical considerations with respect to their policies and actions directed towards the natural environment. Firms can ignore calls for environmental sustainability, they can meet minimal obligations (e.g., legal requirements), or they can develop and demonstrate an ethic of social responsibility, taking a position of leadership and stewarding the natural environment beyond any legal requirements (Carroll, 1979).

Do Women in Leadership Roles Predict Environmental Sustainability?

With respect to gender, women in leadership roles offer unique and valuable human capital that would be expected to influence innovation capacity, stakeholder engagement and management, and ethical values. For example, from a gender perspective, evidence suggests that women add to a firm's innovation levels (Calabrò, 2011). In their study, Torchia, Calabrò, and Huse (2011) find that women leaders are linked to firm-level innovation, including both product and process innovations. Similarly, Miller and Triana (2009) find that women in leadership roles have a positive effect on investment in innovation (practices and routines). In another study, Díaz-Garcia, González-Moreno, and Sáez-Martínez (2013) find that gender diversity within R&D teams leads to greater levels of innovation. All three studies assert that the human capital of women in leadership roles differs from that of men, thereby increasing the availability of new alternatives, ideas, information, and creativity and perspectives, which ultimately improve a firm's innovation capacity.

Women are also believed to be endowed with certain traits and characteristics that could improve stakeholder engagement and management (Wood & Eagly, 2009). For example, relative to men, women possess more communal traits: affection, helpfulness, kindness, sympathy, interpersonal sensitivity, nurture, and concern for others' welfare (Eagly, Johannesen-Schmidt, & van Engen, 2003). These more communal characteristics appear to lead women to take into account a broader range of stakeholders, unlike their male counterparts who tend to focus more on shareholders and economic concerns (Adams, Licht, & Sagiv, 2011; Smith Wokutch, & Harrington, 2001; Zelechowski & Bilimoria, 2006). Further, because they have more of a relational orientation than men (Eagly et al., 2003; Wood & Eagly, 2009), women may be more willing to build relationships with a broader set of firm stakeholders, or at least to expend the effort required to better understand these stakeholders' interests (Rosener, 1995). Ultimately, due to their broader stakeholder focus, and empathy and concern about the well-being of others (Learned, 2011; Wood & Eagly, 2009), women are believed to be more concerned about the natural environment and environmental sustainability (Davidson & Haan, 2012; Diamantopoulos et al., 2003).

With respect to ethical values, differences between the beliefs and values of men and women have been identified. For instance, women have been shown to have a higher level of moral reasoning than men (Elm, Kennedy, & Lawton, 2001). Such reasoning is a cognitive skill that individuals use in resolving moral dilemmas (Elm et al., 2001). Alternatively, women appear to tolerate unethical practices less than men (Kennedy & Kray, 2014; Wong & Wan, 2011), which could, in part, explain why women appear to be more sensitive to issues related to the environment, as such issues can have moral and/or ethical considerations (Carroll, 1991). For example, women demonstrate a higher concern for the natural environment than men (Carlsson-Kanyama, Julia, & Röhr, 2010; Diamantopoulos et al., 2003), while engaging more frequently in

environmental behavior than men (Davidson & Freudenburg, 1996). Thus, as women appear to be more conscious of firms' social responsibilities, and have values and beliefs that lead them to take action in these areas, they would be expected to advocate on behalf of stakeholders for more ethical responses in areas such as environmental sustainability.

Women's distinct set of human capital resources is one contributor to their influence over a firm's environmental sustainability. Yet, perhaps a more interesting issue regards *which* leadership roles are likely to most influence environmental sustainability. For this study, I explore two distinct categories: women in *professional* leadership roles and women in *technical* leadership roles. Women in professional leadership roles would be expected to be well positioned to exert influence over a firm's environmental sustainability practices. For example, the CEO is a professional role which is charged with setting strategy, influencing the values and culture of the firm, communicating and engaging with stakeholders, making major corporate decisions, and undertakes the overall management responsibility of employees, among other key responsibilities (Hambrick & Mason, 1984). The CEO is therefore expected to not only have influence over decisions related to environmental sustainability, but also to set the cultural tone that directs the firm to be attuned, or not attuned, to the natural environment. Alternatively, those who have authority over marketing have responsibility for marketing communications, sales management, channel management, and pricing, among other areas (Germann, Ebbes, & Grewal, 2015). Individuals leading a firm's marketing efforts would therefore be expected to be in a position to influence the extent to which firms engage in environmental sustainability, as a marketing orientation can impact on a firm's brand and reputation for social responsibility, as well as gain insight into consumer demands for environmentally-friendly products (cf. Maignan, Ferrell, & Hult, 1999; Maignan & Ferrell, 2001).

Women in technical leadership roles would also be expected to be well positioned to have influence over environmental sustainability. Technical roles refer to those roles which tend to be more technically or operationally focused (e.g., product development, operations management, etc.). For example, product development is a role in which individuals design, create, and develop new products (e.g., environmentally sensitive products) whereas operations managers take charge of the production process and redesign and reengineer production processes to improve efficiency, to respond to market demand and conditions, or to lessen environmental impact (Katehakis & Derman, 1989; Krishnan & Ulrich, 2001). Given technical complexities (Hart, 1995), firms require strong, environmentally-focused leadership over product functions and production and operational processes in order to achieve environmental sustainability.

Following resource-based perspectives of the firm, I have argued that women in various leadership roles have human capital which would be particularly important to developing a firm that can demonstrate environmental sustainability. This leads me to posit:

Hypothesis 1: A firm with women in professional leadership roles is environmentally sustainable.

Hypothesis 2: A firm with women in technical leadership roles is environmentally sustainable.

The Complementarities of Women in Different Leadership Roles

Scholars have argued that isolating on individual resources can be limiting in resource-based research (Dierickx and Cool 1989; Foss 1998; Teece 1986). Accordingly, Foss (1998, p. 143) suggests that concentrating on individual resources overlooks potential "strong relations of complementarity and co-specialization among individual resources, so that it is not really the individual resources, but rather the way resources are clustered and how they interact, that is important to competitive advantage" (Foss 1998, p. 143). For example, to commercialize the

design of a new product profitably, a firm needs access to manufacturing and distribution on favorable terms (Teece 1986). Without such complementary resources, the new product design is of little value. Hence, when complementary resources work well, the value they create is expected be greater than that which could be created by any individual resource in isolation (Dierickx and Cool 1989; Teece 1986). The value creation argument between complementary resources, according to Foss (1998), represents an important "systems" perspective of resource-based theory.

With respect to environmental sustainability, there are both strategic and technical considerations (Galbreath, 2009a,b; Hart, 1995). Hence, when there are women in both professional and technical leadership roles, their complementarity is expected to incrementally influence environmental sustainability. For example, women in professional leadership roles construct strategies around and set the cultural tone for environmental sustainability, as well as influence the extent to which firms seek to meet consumer demand for socially responsible products and image. Alternatively, women in technical leadership roles help to actualize strategies through new product development and through influencing operational systems and processes to embrace and enhance sustainability. Hence, for women in professional and technical leadership roles, their inherent traits and characteristics not only are expected to influence outcomes, but so too is their acquired skills in the form of different disciplinary backgrounds and experiences (Hewlett, Marshall, & Sherbin, 2013). The combination of inherent and acquired traits and skills across different leadership roles is expected to have even greater authority and discretion over how a firm addresses environmental sustainability (cf. Konrad and Kramer, 2006; Hewlett et al., 2013).

To maximize the extent to which firms achieve environmental sustainability, they are likely benefited by the complementary resources of women in professional and technical leadership roles. Hence:

> **Hypothesis 3:** After accounting for their individual, independent effects, the interactive, co-joint (complementary) effect of women in both professional and technical leadership roles explains higher levels of environmental sustainability.

Methods

Sample and Data Collection

The sampling frame included wine producers in Australia. The wine industry was chosen for three reasons. First, the wine industry has historically been dominated by men in all types of roles (Bryant & Garnham, 2014). This provides an opportunity for contrasts between men and women in leadership roles to be made evident. Second, studying a single industry affords the opportunity to contribute significantly to existing knowledge by deepening or widening current understanding (Oxley, Rivkin, & Ryall, 2010). Given that women on boards of directors generally attracts most of the academic attention, this study presents an opportunity to expand horizons. Third, the wine industry consists of firms of all sizes, from micro (>999 annual case production) to very large (<1,500,000 annual case production). This stands in contrast to previous studies in the stream, which have generally relied on very large firms (e.g., Galbreath, 2011; Glass et al., 2015; Post et al., 2011; Walls et al., 2012).

The sample consisted of firms listed in the Winetitles annual directory database, the *Australian and New Zealand Wine Industry Directory* (https://winetitles.com.au/wid/). Winetitles is a specialist publisher for the wine industry and offers complete coverage of all Australian wine producers, with the database updated and published annually. I constructed an unbalanced panel

dataset from 2007–2014, collected from the sources described below. Observations were deleted if information was missing. The final sample contained 2,006 firms (11,369 firm years).

Dependent Variable

To measure environmental sustainability, I relied on data from the Winetitles database. The Winetitles database tracks certain indicators of environmental sustainability. These include: 1) organic vineyards; 2) biodynamic vineyards; 3) organic vineyard certification; 4) biodynamic vineyard certification; and 5) organic wine products. Organic vineyards consist of grapes that are grown without the use of artificial or synthetic chemicals, such as herbicides or pesticides. Rather, in such vineyards, the biodiversity is increased as the principal means of deterring weeds and bugs, with the longer term intention of, the vineyard becoming a self-regulating ecosystem. Biodynamic vineyards use similar practices but also includes paying attention to the natural order, including phases of the moon and the position of the sun as they affect microorganisms in soil and plant receptiveness. Both organic and biodynamic techniques appear to reduce environmental impacts (Delmas & Lessem, 2015).

Environmental certification looks at the extent to which a producer has any environmental certifications, such as ACO or NASAA, which are Australian-based certification programs for organic and biodynamic farming. Lastly, organic wine is made without the use of any additives or preservatives, such as sulphites, in the production process. Each one of these categories can be considered a proxy of environmental sustainability (Delmas & Grant, 2014; Delmas & Lessem, 2015). Items were coded 1, 0 otherwise.

To assess the validity of the environmental sustainability construct, I took two steps. First, I conducted factor analysis. One component with an eigen value over 1 explained 65.11 percent of the variance. Second, I ran a reliability test. The Cronbach alpha for the environmental sustainability measure was .84. This indicates sufficient reliability (Lance, Butts, & Michels,

2006). Hence, codes were summed to create an overall environmental sustainability variable, which ranged from zero to five.

Independent Variables

Leadership has been conceptualized in many different ways (Avolio, Walumbwa, & Weber, 2009). Leaders have traits or styles of leadership (e.g., transactional or transformational) and hold positions of authority over employees, groups, organizations, or activities and functions (Avolio et al., 2009; Damanpour & Schneider, 2008; Hambrick & Mason, 1984; Hambrick & Pettigrew, 2001). In the case of this study, the interest is in leaders in certain roles or positions of authority rather than styles of leadership.

In their seminal article on "top" leadership roles, Hambrick and Mason (1984) mention the Chief Executive Officer (CEO) role, with minor reference to financial and operations roles. Yet, no explicit definition of what constitutes a leadership role is offered. Certainly, in large firms, leadership positions such as the CEO, chief financial officer (CFO), chief operating officer (COO), and chief information officer (CIO), among others, can be common. However, leadership roles can vary across firms and industries. In the case of the wine industry, in a small winery, the key leadership roles could consist of a CEO, a winemaker, a viticulturist, and a sales/marketing person. In principle, this comprises the leadership team and each role would be considered a leadership role. Hence, this study employs a broad definition of leadership roles as consisting of those positions of authority. Yet, importantly, these roles are contextually determined: what defines the type (or title) of such a role can vary from firm to firm and from industry to industry (cf. Carpenter, Geletkanycz, & Sanders, 2004). My conceptualization of top leadership roles therefore is broader than that of the so-called "dominant coalition" of the early literature on upper echelon teams, which typically included only those top leaders who also serve on the board of directors (Carpenter et al., 2004).

As a proxy for professional leadership roles, I relied on CEO and marketing management roles—both relate directly to strategy, resource allocation decisions, setting goals and objectives, creating an ethical culture, marketing and promotion, and product sales (Damanpour & Schneider, 2008; Hambrick & Pettigrew, 2001; Talke, Salomo, & Rost, 2010). As a proxy for technical leadership roles, I relied on the winemaker and viticulturist roles. Winemakers are involved in all aspects of the technical side of making wine including crushing and pressing grapes, fermentation, filtering, quality control, and new product development such as new blends (Unwin, 1991). Viticulturists oversee the vineyard and the technicalities of grape growing. They monitor soil quality and control pests, have responsibility for irrigation, watering, and canopy management, monitor fruit development and characteristics, oversee harvest (fruit picking and handling), and increasingly rely on technical and scientific techniques to produce optimal grape quality (Giuliani, 2007).

Relying on the Winetitles database, for each firm, I took the combined, overall percentage of women in each role (i.e., a women in the specified role = 100 percent, otherwise 0 percent) that make up the respective leadership categories—professional and technical (maximum of 200 percent in each leadership category).[1] To test Hypothesis 3 (complementary effects of women in professional and technical leadership roles), I followed Galbreath's (2016) lead to testing complementary resources by calculating an interaction term.

Control Variables

Given the context of the study and the methodological approach, four critical control variables are accounted for. Larger firms may have more resources to commit to environmental

[1] I used a percentage in order to ultimately create an interaction term. More specifically, using a dichotomous variable (1, 0 otherwise) for gender representation, where the possibility of the interaction term (1 x 1) would yield 1, is not statistically useful.

sustainability (de Villers et al., 2011). Therefore, first, as a proxy for firm size, sourced from the Winetitles database, a binary variable was created where 1 = 200,000 or more cases produced annually, 0 otherwise (200,000 cases of wine produced annually is a good proxy for large firms in the wine industry—see Marshall, Akoorie, Hamann, & Sinha, 2010). Second, I also included tonnes of grapes harvested as an additional proxy for firm size, where 1 = over 20,000 tonnes harvested annually, 0 otherwise. Grape tonnage is a common indicator of firm size in the wine industry and was assessed by examining the vintage reports on company websites. Third, older firms may have temporal orientations that affect environmental sustainability (Slawinski & Bansal, 2015). Firm age was controlled for by examining company websites to determine the year the winery was founded, and then calculating the age.

Other control variables include export intensity and wine ratings. For example, firms that export more may face grater pressures to address environmental sustainability (Galbreath, 2016). Hence, fourth, for export intensity, firms were coded on the basis of their annual percentage of export sales with a binary variable, where 1 = 51 percent or more export sales, 0 otherwise. Over fifty percent is considered a high rate of exports. Export orientation was sourced from the Winetitles database. Fifth, some research (e.g., Delmas & Lessem, 2015) suggests that wineries that have highly rated wines may be correlated with environmental sustainability. To account for this possibility, I relied on data from Halliday (e.g., 2014). Halliday's (2014) annual publication is generally regarded as the most authoritative, definitive, and best-selling guides for Australian wines. Each yearly edition of the guide provides a quality product rating for Australian wineries. I took the average score, on a 100-point rating system (100 being the highest quality rating), for each winery across all varieties assessed (e.g., red, white). Lastly, dummy variables for the individual years are included in the models to control time effects.

Results

With respect to correlation analysis (Table 1), the highest correlation of .65 ($p < 0.01$), while relatively high, suggests that collinearity does not appear to represent a problem, given that this is below the multicollinearity indicator of .80 (Licht, 1995). Alternatively, the highest variance inflation factor (VIF) of 3.16 was well below 10, which also indicates that multicollinearity is not likely present (O'Brien, 2007).

[Insert Table 1 about here]

To test the hypotheses, I used a fixed-effects model as a Hausman test ($\chi^2 = 339.79$, $p < 0.001$) indicated that random-effects estimates were inconsistent. Fixed-effects models account for unobserved, idiosyncratic factors which may influence simultaneously their dependent variables. Hence, fixed-effects models help reduce concerns over endogeneity (Adams, 2016). Hypothesis 1, that a firm with women in professional leadership roles is environmentally sustainable, does not find support. Table 2, Column 1, demonstrates that the coefficient, while positive, is not significant (0.011, n.s.). Hypothesis 2 posits that a firm with women in technical leadership roles is environmentally sustainable. Table 2, Column 1, demonstrates that the coefficient is significant and positive (0.018, $p < 0.01$). The results therefore offer support for Hypothesis 2.

Hypothesis 3 states that after accounting for their individual, independent effects, the interactive, co-joint (complementary) effect of women in both professional and technical leadership roles explains higher levels of environmental sustainability. Table 2, Column 2, presents the results. The interaction term is significant and positive (0.226, $p < 0.001$). To test if the interaction term adds to the explanatory power of the model, I conducted a likelihood ratio test. The likelihood test demonstrates that the fit of Column 2 increased in a statistically

significant manner over Column 1 (χ^2 = 13.49, p < 0.001).The results are consistent with Hypothesis 3.

[Insert Table 2 about here]

Robustness check

Because the fixed-effects model compares differences within a firm over time, rather than across firms, concerns over endogeneity are reduced (Adams, 2016). However, I took steps to address the robustness of the results. Accordingly, I add the lagged value of environmental sustainability to the regression in Table 2, Column 2. The results are reported in Table 3, Column 1. Under the lagged value model, the results remain qualitatively similar. The direct effect of women in professional leadership roles is not significant while in technical leadership roles, significance is achieved. The interactive, co-joint (complementary) effect is highly statistically significant. A likelihood ratio test demonstrates that the interaction effect adds to the explanatory power of the model (χ^2 = 8.94, p < 0.01).

[Insert Table 3 about here]

The use of the lagged value of the dependent variable in panel data analysis can give rise to issues with autocorrelation. Additionally, other control variables associated with firm policies could also be endogenous. To account for these issues, I used a dynamic panel generalized method of moments estimator proposed by Arellano and Bond (1991). The analysis uses their estimator, which treats variables that could be influenced by firm policy in period t as endogenous and those that are not in the control of the firm or are calculated exclusively with respect to t-1 values as exogenous. Results are presented in Table 3, Column 2, which repeat the analysis in Table 3, Column 1. The results remain qualitatively similar: the lagged value of environmental sustainability is positive and significant, the direct effect of women in technical leadership roles is significant (women in professional leadership roles is not significant), while

the interactive, co-joint (complementary) effect is highly statistically significant, and larger than in Column 1 (the likelihood ratio test demonstrates that the interaction effect adds to the explanatory power of the model: $\chi^2 = 11.63$, $p < 0.001$). The additional tests suggest that the results are robust to controlling for endogeneity and reverse causality.

Discussion

This study's objective was to explore further whether or not women in leadership roles impact on firm's environmental sustainability. The demonstration of environmental sustainability is believed to require innovation capacity, stakeholder engagement and management abilities, and ethical values. Following the resource-based perspectives of the firm, I made the case that women have unique and valuable skills and characteristics (human capital) that enable them to be particularly adept at generating innovative ideas, managing stakeholders for firm advantage, and leading ethical cultures. Importantly, women's human capital that impact on environmental sustainability are likely to be best embodied in both professional and technical leadership roles. The findings suggest that women in technical leadership roles are positively associated with environmental sustainability, while women in professional leadership roles are not. However, in line with the complementary resources perspective, the interactive, co-joint effect of women in both leadership roles on environmental sustainability is greater than what their individual effects otherwise explain. The results advance findings on women in leadership roles and environmental sustainability, and therefore make a few key contributions.

First, there is some evidence to suggest that women in leadership roles—women on boards of directors—are positively associated with environmental sustainability (e.g., Glass et al., 2015; Post et al., 2011). Other studies find no relationship between women on boards and environmental sustainability (e.g., Gallbreath, 2011; Walls et al., 2012). Hence, following resource-based logic, there is some question as to whether or not women on boards embody the

human capital necessary to effect environmental sustainability. Further, there remains questions with respect to *which* leadership roles in which women reside may have the most influence.

More specifically, this study posits that environmental sustainability requires both strategic and technical oversight. Accordingly, women in professional and technical leadership roles are examined. However, when women in both leadership roles are individually (yet simultaneously) taken into account in the same regression model, only women in technical leadership roles appear to have a positive association with environmental sustainability. Following Hart (1995), environmental sustainability is technically complex. For example, having a novel *idea* with respect to a product or process related to environmental sustainability is likely of little value unless converted into a reality—this generally requires technical expertise (Hart, 1995). Therefore, firms require strong technical leadership over product functions and production and operational processes. Because women winemakers and viticulturists embody necessary technical skills and competencies, in this sample, their human capital could provide the means necessary to positively impact on environmental sustainability.

In a similar vein, the findings do more broadly raise the issue with respect to *which* leadership roles impact the most on environmental sustainability. Having a robust set of human capital does not necessarily equate to having the level of *influence* needed to "make things happen" (c.f. Gallbreath, 2011; Walls et al., 2012). In this study, because wine production has become a very technical endeavor (Giuliani, 2007), the teams that run wine firms may more readily value their technical personnel, and therefore when compared to women in professional leadership roles, women in technical leadership roles have more of the required—and valued—human capital needed to impact on environmental sustainability. In this sense, having gender diversity in leadership roles is important, but perhaps in some roles more than others. The findings thus contribute to studies on women in leadership roles and environmental sustainability

by moving beyond the examination of one role, to more robustly consider how women in different leadership roles matter.

Second, in their work, Aguilera, Florackis, and Kim (2016) suggest a greater need to more explicitly study how leaders in different top roles interact with and complement each other. Hence, an alternative perspective and contribution considers complementary resources. Taken at the *individual* level, some resources would be expected to have greater influence on firm outcomes (such as environmental sustainability) than others, which is in line with the RBV (Barney, 1991). However, following the complementary resources perspective (Foss, 1998), resources are viewed more as *systems*, such that individual resources work together to impact on firm outcomes, where their potential complementarities offer greater value than their individual contributions can otherwise. For example, Kim and Min (2015) find that for traditional brick-and-mortar retailers to gain performance advantages from adding an online retail business model, they need certain complementary resources (i.e., reputational assets). Christmann (2000) finds that to gain the most out of cost advantages from environmental management technology, firms need complementary best practice assets in process innovation and implementation. In his study of boards of directors, Galbreath (2016) finds that complementarities appear to exist between outsiders and women on boards of directors and their effect on corporate social responsibility (CSR), and that their interaction with a "complementary" senior CSR manager further improves strengths in CSR.

In my study, the findings suggest a potential complementary effect. For example, women in professional leadership roles may set strategic goals that consider care of the natural environment, or uncover insight into consumer demand or opportunity for environmentally friendly products. However, without complementary technical abilities, their influence, or potential impact, may be shortcoming. In this instance, women in technical leadership roles are

expected to act as a complementary because their resources are expected to bridge the gap between the strategic and technical requirements needed to deliver environmentally sustainable outcomes. My study suggests that when considering the interactive, co-joint (complementary) effect of women in both professional and technical leadership roles, environmental sustainability improves over the impact of their individual effects. Hence, I contribute to an emerging research stream that considers how and why top leaders and top leadership teams (e.g., boards of directors and TMTs) might complement each other to deliver even greater improvement in firm outcomes.

Finally, the study has implications for practice. As noted recently by the CEO of Unilever, "(Our) company will never achieve it growth and sustainability targets without getting the gender balance right…unless we recognize the critical role that women play and unless we involve women more directly in developing solutions, then we are never destined to fulfil our [sustainability] potential" (Wittenberg-Cox, 2014). While much focus has been placed on gender quotas for *boards of directors* (e.g., Gregorič et al., 2015), the above quote suggests that to enable action on environmental sustainability, firms may not only need more women on the board, but a better mix of women in [non-board] professional and technical roles, from which they can create the greatest advantages. Consistent with the views of the Unilever CEO noted above, my findings represent areas of opportunity, both for women seeking to advance to leadership roles and for firms seeking to improve gender diversity in leadership and environmental sustainability.

Limitations, Future Research Directions, and Conclusion

This study has limitations. First, due to the lack of available data, I did not discriminate between family and non-family owned firms, which could potentially influence the results (Nekhili & Gatfaoui, 2013). Second, only a single industry was studied. While this does limit generalizeabilty, single industry studies are important in that they can offer a significant

contribution to existing knowledge through the deepening or widening of current understanding (Oxley et al., 2010). Lastly, what constitutes a leadership role may be contextual and open to interpretation. Because this study examines roles in a single industry, and in a wide range of firm sizes, the results must be viewed in light of how leadership roles are conceptualized and measured, which may vary from firm to firm and from industry to industry.

Future research directions could be three-fold. First, following Aguilera et al. (2016), studies could explore how boards of directors and TMTs interact with and complement each other to effect environmental sustainability, and other firm outcomes. Second, advancing the findings of my study to a deeper level is warranted. For example, by exploring further aspects of human capital, such as functional backgrounds or types of educational degrees, researchers could explore whether *diversity* or *similarity* in human capital drives complementarities (Heyden, Sidhu, & Volberda, 2015). Lastly, a good deal of research tends to argue for diversity on the grounds that women bring unique and valuable human capital that is different to men, and therefore they are expected to have a statistical positive, *independent* influence on certain firm outcomes. Given that boards of directors, and even TMTs, tend to still be majority men, future research could examine how men and women in leadership roles actually *complement* each other, and under what conditions and contexts these complementarities improve outcomes for firms over and above their individual effects.

In conclusion, much research has examined the relationship between women in leadership roles (e.g., boards of directors, CEOs) and firm outcomes (e.g., CSR, firm financial performance, innovation). However, much less is known about how or whether women in different leadership roles in the same firm affect firm outcomes, and whether or not their complementary effect is greater than their individual effects. Relying on a large, multi-year database of the wine industry, this study suggests that when looking at individual effects, only

women in technical leadership roles (as opposed to women in professional leadership roles) positive effect environmental sustainability. However, when combined through an interaction (complementary) analysis, women in both roles explain greater levels of environmental sustainability than their individual effects do. The findings therefore advance research on the study of women in leadership roles and environmental sustainability, while expanding insight into the relatively under-examined complementary resources perspective.

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TABLES

Table 1. Means, standard deviations, and correlations

Variable	Mean	S.D.	1	2	3	4	5	6	7	8
1. Environmental sustainability	0.12	0.59	1.00							
2. Cases produced	0.03	0.16	0.04**	1.00						
3. Tonnes harvested	0.00	0.07	0.04**	0.42**	1.00					
4. Firm age	21.54	23.35	0.02**	0.09**	0.05**	1.00				
5. Export intensity	0.13	0.34	0.02*	0.18**	0.06**	-0.11**	1.00			
6. Wine ratings	91.24	3.20	0.05**	0.00	0.00	0.02**	-0.03**	1.00		
7. Women in professional leadership roles	31.89	52.41	0.02**	0.01	0.01*	0.04**	-0.01	0.42**	1.00	
8. Women in technical leadership roles	14.98	39.21	0.04**	0.02**	0.00	0.02**	-0.04**	0.65**	0.13**	1.00

* $p < 0.05$; ** $p < 0.01$

Table 2. Panel regression results

	Environmental sustainability			
	1		2	
Variables	β	SE	β	SE
Cases produced	0.048**	(0.021)	0.046**	(0.021)
Tonnes harvested	0.000	(0.000)	0.000	(0.000)
Firm age	-0.001***	(0.000)	-0.001***	(0.000)
Export intensity	-0.043***	(0.012)	-0.042***	(0.012)
Wine ratings	0.016	(0.012)	0.014	(0.012)
Year dummies	Yes		Yes	
Women in professional leadership roles	0.011	(0.005)	0.008	(0.004)
Woman in technical leadership roles	0.018**	(0.005)	0.017**	(0.005)
Interaction (x) between women in the two roles			0.266***	(0.015)
Constant	0.101***	(0.022)	0.080**	(0.021)
Overall R^2	0.17		0.23	

Observations = 11,369

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$

Table 3. Robustness tests

	Environmental sustainability			
	1: Fixed effects		2: Arellano-Bond	
Variables	β	SE	β	SE
Environmental sustainability [*t* -1]	0.494***	(0.010)	0.401***	(0.012)
Cases produced	0.021**	(0.019)	0.008**	(0.021)
Tonnes harvested	0.000	(0.000)	0.000	(0.000)
Firm age	-0.001**	(0.000)	-0.017***	(0.000)
Export intensity	-0.000	(0.012)	-0.047***	(0.012)
Wine ratings	0.014	(0.009)	0.065*	(0.010)
Women in professional leadership roles	0.000	(0.004)	0.002	(0.004)
Woman in technical leadership roles	0.014**	(0.005)	0.017**	(0.005)
Interaction (x) between women in the two roles	0.113***	(0.015)	0.223***	(0.015)

* $p < 0.05$

** $p < 0.01$

*** $p < 0.001$