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Business Transformation Through Sustainability

A study of strategic operations and management decision making in the global wine industry.

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1. Introduction

In the Fall of 2015, the United Nations (U.N.) adopted the 17 Sustainable Development Goals (SDGs) as signifying moment in the growth over the last 30 of sustainability as a recognized and essential approach to responsible development and business. Given the scope and necessity of the SDGs, businesses are working to understand the complexity of both their contribution to the SDGs, and to identify concrete and practical methods for improving their impact. This research aims to explore this issue of sustainability in business through a case study on the global wine industry. The ambition is to understand how firms who adopt sustainability principles and practices can strategically approach the implementation process through management systems. Two research questions serve as the over-arching guidance:

- How have firms successfully adopted sustainability into operations and management?
- Are there strategic techniques, actions, and policies that make a firm more successful than another in the implementation process?

The goals of this research are the following:

- Establish the Business Case for sustainability in the wine industry.
- Explore and build a Conceptual Framework that can help inform and design implementation strategies and measure their effectiveness.
- Test what elements of the Conceptual Framework are utilized by wineries and vineyards, and whether they have been beneficial or had a positive impact.

To accomplish these goals, this paper has been sequentially in four core sections. 'Why Sustainability and Wine' covers the scale and scope of the wine industry, it's social and environmental footprint, and outlines how sustainability is applied in the industry. This section establishes firm motivations and actions regarding sustainability. 'Building the Business Case' aims to answer why a wine business would adopt sustainability, and demonstrate through case studies the financial and non-financial benefits of adoption. 'Managing and Implementing Sustainability' reviews existing strategy, and management and operations literature with direct comparisons with case studies in order to design a Conceptual Framework. The final section, 'Survey and Analysis' tests the conceptual framework through an online survey, and identifies the actions firms have taken and to what degree have actions been successful or impactful. This final section provides a thorough review on how survey respondents have utilized different elements within the Conceptual Framework, identifies areas for further research, and assesses the overall effectiveness of the framework.

1.1 What is Sustainability?

Sustainability is the generic concept that will be used throughout this research to summarize environmental, social, and economic externalities from business activity and operations, and simultaneously, the efforts by firms, governments, and society to correct negative externalities through best practices, governance, and innovative technology. The United Nations (U.N.) Commission on Environment and Development's (1987) publication of 'Our Common Future', commonly known as the 'Bruntland Report' is frequently cited for popularizing notions of sustainability by defining the concept of 'Sustainable Development' as development "that meets the needs of the present without compromising the ability of future generations to meet their own needs" (U.N. Commission on Environment and Development, 1987, Chapter 2). For this research, this definition is a starting point to briefly examine how the concept of sustainability given its broad potential definitions and applications, has been defined and applied within business theory. Businesses drive economic growth and create value; however, the process of value creation in most forms has externalized social and environmental costs where "natural resource depletion, environmental degradation, disruption of communities, worker displacement, and health and safety can be negative by products" (Galbreath, 2011, p. 91).

To address these issues, sustainability as applied by firms has evolved in the last 30 years. John Elkington (1994) introduced sustainability as a "win-win-win" business strategy that was later refined into the Triple Bottom Line (Elkington, 1997) of profitability, environmental quality, and social justice or as it is more conventionally referred, 'people, plant, profit'. Harvard economist Michael Porter (1991) argued that "conflict between environmental protection and economic competitiveness is a false dichotomy based on a narrow view of the sources of prosperity and a static view of competition" (p. 96) and with Mark Kramer defined the concept of 'shared value' (Porter & Kramer, 2006). Shared value views business and society as interdependent and perceives social responsibility as a mutually beneficial for society and business, thus creating a competitive business strategy. Porter and Kramer (2011) argued that businesses focused on creating 'shared value' will generate economic value in a manner that simultaneously creates value for society. Sustainability, summarized by Galbreath (2009), can be understood as a business approach that seeks to create long-term value for stakeholders by embracing the opportunities and managing the risks associated with economic, environmental, and social development" (p. 304).

2 Why Sustainability and Wine?

First, the wine industry is large, and the scale of production and global distribution networks inevitably creates negatives externalities; wine production generates a significant environmental and social footprint throughout its value chain. Second, winegrape growing is very sensitive to climate change, and the industry has become increasingly vocal about combating climate change.[1] Third, the wine industry faces increasing pressure to change. Consumers, stakeholders, retailers, and regulators are demanding more transparency about the practices behind, and inputs in, products at nearly every level of the value chain. These first three points are elaborated in the following section and demonstrate an evident Business Case to address these issues through the adoption of sustainable practices, technology, and policies. Fourth, the process of strategically designing an implementation plan to adopt and implement sustainability presents an opportunity to explore how firms have made decisions, acted, and evaluated success or impact. Fifth, the wine industry is vertically integrated with a global scale so sustainability issues touch on a wide range of topics, practices, and technologies that are applicable to other agribusiness and the insights from the wine industry can generally be applied to businesses interested in adopting sustainability into their management systems and operations.

Finally, sustainability is a mechanism for continuous improvement, not a panacea, with the potential to help businesses address their environmental footprint, and create business models that generate positive impacts. The focus on the wine industry provides a wide scope and is an opportunity to evaluate potential conceptual management frameworks that improve implementation success and impacts simultaneously.

2.1 State of the Wine Industry

The global wine industry has grown in terms of market value, export value, and raw production numbers of both wine and winegrapes (industry facts below). Consumer preferences and purchasing behavior is constantly evolving. In Europe, the once reliable top consumer of fine wine, consumption of wine has stagnated, and now the U.S. is the largest export value market. Wine consumers are getting younger, and are more engaged with the story and

[1] Gelles, D. "Falcons, Drones, Data: A Winery Battles Climate Change." *The New York Times*. 5 January 2017. Retrieved from: https://www.nytimes.com/2017/01/05/business/california-wine-climate-change.html?_r=0

production practices behind wine. The current state of the industry and its history emphasizes the competitive nature of the global wine market that demands producers be innovative, flexible and creative (Sampedro et al., 2010).

2.2 Size and Scale

In 2016, the global area under vines, including vineyards planted, but not yet in production or harvested, covered 7.5 million hectares (OIV, 2017) which is roughly equivalent to 6,250,000 football fields.[2] Area under vines has been decreasing since 2003, mainly in Europe, but total growth over the same period outside of Europe has been positive led by high growth in China (OIV, 2017). Grape production from global vineyards totaled 7.8 million quintals, and wine grapes counted for 47.3% of total grape production. Wine production in 2016, was 267 million hectoliters (mhl), excluding juice and must, with growth occurring in four of the five largest producing countries: Italy (2%), Spain (4%), United States (10%), and Australia (9%) (OIV, 2017). Growth in global wine consumption has been relatively minor, continuing a trend since 2008 of hovering around 240 mhl annually with a margin of error +/- 4.3 mhl (OIV, 2017). The United States is the largest domestic market of 31.8 mhl and saw a growth in consumption from 2012-2016 of 1.8%. The Chinese market has been the fastest growing since the early 2000's but growth has stalled to 1.1%. Wines produced for exports continues to grow at 104 mhl (about 38% of total production) in terms of total volume and wine exports have been valued at 29 billion EUR, with increasing value of exports from the U.S. and countries in the southern hemisphere (OIV, 2017). The U.S. remains the largest value importer of wines despite increases in domestic production.

MarketLine (2015) estimates the global wine market revenue from 2014 at $28,086 million with a compound annual growth rate (CAGR) of 3% between 2010 and 2014. Over 80% of revenues were generated through the sale of still wine and Sparkling wine contributed 10.5% of the market's aggregated revenue (MarketLine, 2015). The market forecast anticipated a CAGR of 4.3% over a five-year period from 2014 – 2019. Detailed statistics on global wine business statistics like total employment figures are difficult to aggregate without a central database, and most of the data is reported at the regional or state level in economic impact reports. Since 61% of the survey respondents in this study represent U.S. wineries and

[2] Assuming a standard English football pitch is equivalent to 1.2 hectares.

vineyards, firm level statistics for the U.S. wine industry will be reviewed in Section 5.5 for direct comparison with the respondent demographics.

2.3 Environmental and Social Impacts

The wine industry today is a part of the modern agricultural system, and as such it faces similar environmental and social issues. The increasing use of chemicals, fertilizers, and mechanized equipment in agriculture combined with land development for agriculture has damaged ecosystems, polluted water, depleted fisheries, created ocean dead zones from agricultural run-off, and has had long-term health complications for farm workers, surrounding communities, and consumers (Rodriquez et al., 2004; Delmas et al., 2008).

Wine too has become increasingly dependent on the same chemicals, fertilizers, and mechanization, increasing the negative footprint of the industry. In France, the issue of chemical use in vineyards has been regularly featured in the press over health concerns[3], lawsuits over chemicals,[4] or growers refusing to spray chemicals.[5] On top of vineyard level inputs, the wine industry's impact spreads across a vertically integrated production and a global distribution chain. From the vineyard to the winery, and to the end customer, the external costs, the social and environmental impact of wine adds up (Delmas et al., 2008). Prigge and Whatley (2016) summarize the social and environmental impacts of wine production succinctly,

> "every value-added step in the wine production process has an environmental and societal impact – grape growing, wine making, label and battle manufacturing, supply chain transportation both upstream and downstream, energy use, and a multitude of waste sources create throughout the lifecycle – all add to resource depletion, environmental degradation and human health consequences." (p. 296)

The negative environmental impacts can be significant: soil erosion, toxicity in both soil and local bodies of water from pesticide and fertilizer use, air quality degradation (Delmas et al.,

[3] Wasley, A., & Chaparro, A. (2015). "French wine industry's love affair with pesticides blamed for worker health problems." *The Guardian*. 29 October 2015. Retrieved from https://www.theguardian.com/sustainable-business/2015/oct/29/france-wine-pesticides-organic-workers-vineyards-lawsuits-cancer

[4] Anson, J. (2014). "French vineyard worker wines pesticide illness case." *Decanter*. 24 April 2014. Retrieved from http://www.decanter.com/wine-news/french-vineyard-worker-wins-pesticide-case-13283/

[5] Castaing, Y. (2015). "French biodynamic winemaker facing court for refusing to spray vines." *Decanter*. 11 May 2015. Retrieved from http://www.decanter.com/wine-news/french-biodynamic-winemaker-facing-court-for-refusing-to-spray-vines-530/

2008), and loss of fertility in the land (Sampedro et al., 2010). Additionally, winemaking is an "energy intensive process, and the wine industry consumes over 400 GWh of electricity annually, the second largest electricity-consuming food industry in California (Wu et al., 11).

Energy is used for refrigeration, warehouse and office lighting, irrigation pumps, winery pumps, heating and cooling of facilities and of water, or consumed as fuel by the distribution fleet, vineyard tractors, or on-site generators. The California Sustainable Winegrowing Alliance (CSWA) in a two-year study with PE International of California wine's carbon footprint, broke down the sources of carbon for 9L case of packaged wine, cradle-to-retail gate; packaging accounted for the largest proportion of greenhouse gas (GHG) emissions at 38% (the bottle glass alone accounted for 29%), followed by vineyard operations (34%), winery operations (14%), and transport (13%).[6] Other than energy, wine also uses a considerable amount of water for irrigation, application of fertilizers, agrochemicals and pesticides, the treatment of wastewater, and for all cellar activities like cleaning (Bonamente et al., 2015). The environmental footprint of the wine industry has been well documented, and the desire to correct inefficient or wasteful processes that consume resources or create a negative impact have helped drive the industry's approach to sustainability.

2.4 Sustainability in the Wine Industry

By looking at sustainability in a specific industry, like the wine business, it is possible to explain how firms have internalized concepts like the Triple Bottom Line or Shared Value and defined sustainability as it relates to everyday business activity. Given the size and scale, and the social and environmental impact of the wine industry, the industry's collective efforts on sustainability are an example of how business has worked through the complexities of sustainability to produce standards, and best practices related to specific geographical, political, social, and environmental contexts.

The California Sustainable Winegrowing Alliance (CSWA) applied the concept of the Triple Bottom Line to its definition of sustainability in the context of winegrowing. CSWA defines sustainable winegrowing as growing and winemaking practices that are

[6] CSWA. (2014). *California Wine's Carbon Footprint: Study objectives, results and recommendations for continuous improvement.* Retrieved from http://www.sustainablewinegrowing.org/docs/California_Wine_Executive_Summary.pdf

'Environmentally Sound, Socially Equitable, and Economically Feasible (The 3 E's).[7] The California Code of Sustainable Winegrowing, a self-assessment workbook, contains 15 different issue area chapters from soil management on up to air quality and these chapters contain over 191 criteria, or best practices, that can be specific as rootstock selection and integrated pest management (IPM), and as broad as reducing carbon emissions and improving community engagement.[8] For reference, an IPM is a "ecosystem-based strategy that focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties."[9] Each criteria contain additional requirements specifying the level of adherence that will ultimately be used to determine whether a winery of vineyard can be certified as 'sustainable' (CSWA, 2012). Utilizing such a self-assessment tool has practical applications according to Nick Palumbo of Palumbo Family Vineyards & Winery, "it makes you think about the long-term implications – cost wise and environment wise – of short term decisions. I definitely found dollar value by going through the process, especially in terms of water and energy efficiency."[10] In another case, Alexander Valley Vineyards (AVV) also cites the CSWA self-assessment process for helping uncover inefficiency in irrigation lines and practices, which when corrected generated an estimated savings of 15-20% in water volume.[11]

Even though the California Code of Sustainability Winegrowing can be considered the state-wide 'sustainability' workbook it is not the only one. Other wine sustainability standards in California alone includes: The Lodi Rules for Sustainable Winegrowing, Sustainability in Practice (SIP), Napa Green, and other 3rd party standards that have similar, but varying criteria like California Certified Organic Farmers, USDA Organic, and Demeter Biodynamic. There are wine sustainability programs around the world from South Africa to the United Kingdom (U.K) and New Zealand to Chile. According to Hoffman (2011) these sustainability programs:

[7] CSWA. (2017). Sustainable Winegrowing Program. Retrieved from: http://www.sustainablewinegrowing.org/sustainable_winegrowing_program.php

[8] CSWA. (2011, Summer). *Sustainable Winegrowing Highlights: The Social Equity of Sustainable Winegrowing*. Retrieved from http://www.wineinstitute.org/files/Social_Equity_Summer_2011.pdf

[9] University of California: Statewide IPM Program. *What is an IPM?* Retrieved from http://www2.ipm.ucanr.edu/WhatIsIPM/

[10] CSWA. (2015, Spring). *The Business Case for Self-Assessment: Self-Assessment Helps Design Energy-Saving Winery at Palumbo*. Retrieved from http://www.sustainablewinegrowing.org/docs/CSWA_Newsletter_Benefits_of_Self-Assessment_Spring_2014.pdf

[11] CSWA. (2014, Spring). *Assessment Process Cares Out Time to Problem Solve Improving Irrigation Efficiency at Alexander Valley Vineyards*. Retrieved from http://www.sustainablewinegrowing.org/docs/CSWA_Newsletter_Benefits_of_Self-Assessment_Spring_2014.pdf

> "encourage and require growers to reflect on their definition of sustainability, set short- and long-term sustainability goals and initiate strategies, increase attentiveness to their vineyards and employees through detailed record keeping and data analysis, make systematic decisions, and requires that growers be familiar with the sustainability practices outlined in workbooks." (p. 8)

The wine industry organizations that manage sustainability programs play a key role in educating growers about the technical aspects of sustainable winegrowing, and in demonstrating the benefits and impacts of best practices to both growers and winemakers, and the wider audience of customers, non-profits, and governments.

2.4.1 Certifications and Standards

An 'Eco-Certification', which past research has used as an umbrella term to cover Organic, Biodynamic, and Sustainable certifications, insures that management practices meet minimum codified standards and certification of adherence (Terlakk, 2007; Delmas & Gergaud, 2012). In the wine industry Demeter Biodynamic, USDA Organic, or Biodyvin in Europe are all third party 'eco-certifications'. There are also wine industry certifications like Low Input Viticulture and Enology (LIVE) in Oregon, or Certified Sustainable Wine of Chile. Since the wine industry standards also include social standards on human resources, or community and neighbor relations, wine businesses can also adhere to non-industry specific certifications like Fair Trade, Certified B-Corporation, LEED, or ISO. Given that wine industry certifications include mange social and economic elements, this research will refer to 'certifications' rather than 'eco-certifications' as the umbrella concept to indicate that a wine business has adopted some type of sustainability or certification framework. Furthermore, Heras-Sairzarbitoria et al. (2016), imply that "certification should be considered not as an end in itself but rather as a tool for continual improvement and communication." Embracing this logic, references throughout this research of a "certification" is associated also with the tools and best practices imbedded in the standard.

Sustainable

Wineries and vineyards can be 'Certified Sustainable' by a 3rd party auditor for compliance with a local and regional industry standard like LIVE, Lodi Rules, or Chile Sustainable Wine. The practices and policies can vary across different issue areas as discussed above but typically the standards follow the principles of 'The three E's' (CSWA, 2017). Cliff Ohmart (2011) suggests that the goal of sustainable winegrowing is continual improvement

along a sustainability continuum from less sustainable to more sustainable in which the definition of sustainability is always evolving toward a receding horizon. Certified sustainable has less stringent requirements on the use of chemicals, fertilizers, or pesticides than Organic or Biodynamic, but it does included practices for monitoring, controlling, and reducing use or utilizing non-synthetic inputs.

Organic

Organic farming grew out of concerns over the "long-term viability of conventional agriculture" (Ohmart, 2011, p. 6) and eschews the use of synthetic fertilizers and chemicals. The U.S National Organic farming standard is a "farming method prohibiting the use of additives or alterations to the natural seed, plant, or animal including, but not limited to, pesticides, chemicals or genetic modifications" (Delmas & Gergaud, 2012, p. 5). Organic certifications can cover both vineyard operations and finished wine. A distinct difference between the USDA and EU Organic standards is the use of sulfites. Sulfites are prohibited by USDA Organic in finished wine but allowed within limits by EU Organic. Wines can also be 'made with Organic grapes' which means that the finished wine is not Certified Organic, most likely because it contains a certain level of sulfites, but the grapes use to make the wine were Certified Organic.

Biodynamic

Biodynamic framing grew out of a series of lectures from Rudolf Steiner, a scientist and philosopher, who took a holistic approach to farming, blending spiritual-scientific principles and knowledge to practical use (Ohmart, 2011). Biodynamic farming follows similar practices as organic farming, but adds special plants, animal, and mineral preparations, and the rhythmic influences of the sun, moon and plants, emphasizing the creation of "a self-sufficient and healthy ecosystem" (Delmas & Gergaud, 2012, p. 5). Demeter International manages the Demeter Biodynamic® Farm and Processing Standards based on Steiner's philosophies as it applies to winegrape growing. Biodynamic is the most stringent of the sustainability standards due to the specific procedures be followed in the sourcing, preparation, and application of the natural vineyard inputs to combat pest, invasive species, and promote healthy soil and ecosystems. Out of the sustainability standards it is also the least widely adopted.

For this research, it not necessary to consider which certification standard is the most sustainable or has the greatest impact, but rather to view them as example of practices of common and varied practices that frame wine sustainability in a standardized format.

3 The Business Case for Sustainability and Wine

The wine industry faces external and internal pressure from a diverse group of stakeholders, like governments, regulators, customers, competitors, local communities, employees, and environmental interest groups impose coercive pressure on firms (Delmas & Toffel, 2004). This pressure Delmas and Toffel (2004) suggest could be, depending on firm level characteristics like size and market position, influential in motivating a firm to adopt environmental standards. The pressure faced by wineries and vineyards around the world is similar as are the general production methods but there is variation due to local contexts of stakeholder pressure and ecosystem demands. The following examination of wine businesses motivations to adopt sustainable practices and technology emphasizes Delmas and Toffel's (2004) implication that firm adoption of environmental management practices depends on both the reaction to external or institutional pressure, and the organizational structure and strategy of the firm to respond to such pressure.

This section examines the key pressures faced by the wine industry, like climate change or consumer and retail demand, and the potential positive impacts to the firm, stakeholders, and the environment, of addressing such pressures. This examination provides context on why wine businesses adopt sustainability standards for two reasons. First, understanding firm motivation provides the foundation to analyze the firm's strategy and decision-making. Second, understanding firm motivation further defines how the firm potentially measures, or values the impact of adopting sustainability. This section relies on recent case studies, largely from the California Sustainable Winegrowing Alliance (CSWA), to demonstrate how wineries and vineyards have implemented sustainable practices and technology successfully and how to measure, in some but not all cases, both the financial benefit, and the environmental impact of adoption.

3.1 Climate Change

Wine has an asymmetric relationship with local ecosystems; the production process impacts the environment, and the environment through weather and climate impacts the production process (Sampedro et al., 2010). This interaction gives wine a distinct character (Jones & Schultz, 2010). With changing annual weather conditions, no two vintages are identical, which while it raises distinct challenges for growers and produces, appeals to consumers who are drawn to product that they trust in terms of quality, but appreciate based on

distinct annual character. Overtime, the relationship between climate and seasonal weather have created certain levels of predictability about temperatures, precipitation, sun exposure, or wind that will help make a 'Bordeaux a Bordeaux', but also how these conditions can elevate the same Bordeaux to 'greatness'. Such predictability within narrow zones of climate and weather is a fundamental aspect of wine production (Jones & Webb, 2010), marketing, and sales. Consumers know what to expect of wines from certain regions, and producers understand how to manage the grape growing and winemaking process to deliver quality despite any unpredicted seasonal weather challenges.

However, climate change has the potential to disrupt that balance, and overturn the predictability of production and quality. "Climate change…will transform the [wine] industry and upend conventional wisdom. This transformation has profound implications for the environmental footprint of the industry and conservation" (Hannah & Apaugh, 2016, p. 3). Warming trends have been observed in the last 50-60 years in many viticulture areas that thrive on a low threshold of 12-13°C and a high threshold of 22-24°C with increasing intensity in the last 20 years (Jones & Schultz, 2010). The wine industry has aptly been described by researchers as the "canary in the coal mine for climate change" (Goode, 2012); given winegrapes extreme sensitivity and need for specific range in temperature and climate, small changes or variability will upset the winegrowing process in a measurable manner (Jones & Schultz, 2010), meaning that winegrapes will be among the first crops to detect climate changes.

Since winegrapes demand such narrow microclimate conditions, the potential destabilization from the following factors is high: changes in temperatures thresholds (Nicholas Cahill & Field, 2008; Keller, 2010; Jones & Schultz, 2010), sun exposure (Jones &Schultz, 2010), wind (Jones & Schultz, 2010), fog, humidity (Jones & Schultz, 2010), day and night time temperature variations (Keller, 2010; Santisi, 2011). "If these conditions are not met consistently, wine grapes do not perform well" (Galbreath, 2015, p. 6). On top of changes in growing conditions, changes in temperature could increase the presence of pests, invasive species, and insect-borne diseases, and reduce the natural ability, like cold winters, to combat or slow the spread of any (Tate, 2001). Temperature rise alone could make it more difficult and expensive to cultivate current varieties (Hannah & Apaugh 2016); if temperatures rise above the ideal threshold to grow Pinot Noir in Oregon, growers will have to replant or apply extensive, but temporary adaptive strategies. 62% of Oregon vineyard production comes from

Pinot Noir[12], and the value of Oregon's wine industry economic activity is estimated at $3.35 billion[13]; the threat of climate change to the industry is a significant area of concern. To put temperature change into perspective, Nicholas Cahill and Field (2008) point out that with an average lifetime of 20 years for California vines, the vines in the ground now, and future vines need for replacement could experience completely different climate regimes that affect their growth and quality.

3.1.1 Threat and Impact

Climate change is shifting the suitability for winegrape growing from Mediterranean to non-Mediterranean climates (Hannah & Apaugh, 2016), opening new areas for vineyard establishment where none currently exist (Sampedro et al., 2010). Hannah et al. (2013) found that the expansion of vineyards into new regions presents a problem for biodiversity and land conservation. Yet, the shifting production zones is not necessarily bad for growers and producers in the U.K., Germany, Tasmania, or northern Michigan where warmer than average seasons could make it easier to grow certain kinds of grapes. However, average temperatures are not the only factors that influence winegrapes, and warmer temperatures alone do not tell the whole story. In Michigan, one of the top ten wine producing regions in the U.S., over the last 30 years the average annual temperature has risen roughly 2˚F,[14] yet harsher than normal, and unseasonal, rain, frost, hail, cold winter, and intense storms over two years decimated up to 90% of the crop in some regions[15] for industry that contributes nearly $800 million to the state economy.[16] As a result of higher temperatures, but less rainfall, output in leading winegrowing regions could be reduced by as much as 85% in some locations (Hannah et al., 2013). Climate change has the potential for a range impacts like higher frequency of extreme climate events, shifting heat and rain patterns, and changing precipitation frequency and duration (Nicholas Cahill & Field, 2008).

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[12]Oregon Wine Board (OWB). (2015). *Oregon Vineyard and Winery Census Report*. Retrieved from http://industry.oregonwine.org/resources/reports-studies/2015-oregon-vineyard-winery-census-report/

[13] Full Glass Research. (2015). *The Economic Impact of Wine and Wine Grapes Industries on the Oregon Economy*. Retrieved from http://industry.oregonwine.org/wp-content/uploads/OR-EconReport-2014-FINALnetrev2.pdf

[14] National Oceanic and Atmospheric Administration (NOAA). (2017). National Climate Data Center: State Annual and Seasonal Time Series. Retrieved from https://www.ncdc.noaa.gov/temp-and-precip/state-temps/

[15] Harger, J. (2015). "Wine from Northern Michigan vineyards may be scarce in next few years." *MLive*. 6 October 2015. Retrieved from http://www.mlive.com/business/west-michigan/index.ssf/2015/10/wine_may_be_scarce_from_northe.html

[16] Michigan Grape and Wine Industry Council. (2017). "About the Michigan Wine Industry." Retrieved from http://www.michiganwines.com/about

3.1.2 Mitigation and Adaptation

The sensitivity of winegrapes to changes in micro and macro climates suggest that climate change mitigation and adaptation strategies are necessary elements of wine business strategy to secure future wine production (Galbreath, 2015). Adaptation measures like dry farming can help reduce the negative impacts on production. "Dry farming involves careful management of the soils accumulated moisture via minimal tilling and widely spaced vines with deep root systems" and could mitigate the vulnerability of Mediterranean winegrowing regions to climate change by reducing water dependency for irrigation (Hannah & Apaugh, 2016). In the following Section (3.2), case studies from Halter Ranch and Ridge demonstrate how advanced soil moisture monitoring and optimized irrigation also reduces water demand and cuts costs. Wineries and vineyards are utilizing technology and new practices to reduce greenhouse gas emissions (GHG) through reduced fuel use, light weight bottles, renewable energy, alternative packaging, and energy efficiency. Other adaptive measures include new trellising techniques, precision irrigation, planting new varieties, and breeding heat tolerant strains (Nicholas Cahill & Field, 2008). These examples of adaptation and mitigation techniques demonstrate the level of concern on climate change from the industry, and further support the Business Case for why wineries and vineyards are motivated and invested in adopting and implementing sustainability.

3.2 The Business Case for Sustainable Winegrowing

The Business Case for sustainable winegrowing depends on different factors related to the firm motivation to adopt sustainability, the potential benefits of adoption, which could be environmental, social, or financial, and the potential competitive advantage to be gained in the market that could result from an effective sustainability strategy. These considerations frame the pressures and opportunities faced by firms in the wine industry. A careful evaluation of these different factors highlights the decision-making process that could shape the success of implementing and adopting sustainability into the firm's strategy and management systems.

3.2.1 Motivations

Past research has examined the different motivations behind the adoption of sustainability generally, and within the wine industry. Motivations for adoption were a key point of research for the Lodi Winegrape Commission (Hoffman, 2011) to better understand how to increase the adoption of sustainability. Increasing understanding and knowledge about

the impact of society and business on nature has made it necessary for business to take environmental issues into account due to pressure from society and a desire to avoid paying fines for existing laws (Sampedro et al., 2010). Darnall et al. (2008) found that facilities are more prone to adopt an environmental management systems (EMS) based on the complementary resources and capabilities, or benefits rather than based on institutional (society or government) pressure. Bansal and Roth (2000) categorized motivations as ethical, competitive, and relational. All three motivations overlap the drivers behind wineries and vineyards decision to adopt sustainability. The key drivers from the wine perspective are regulatory, market based, family succession or business longevity, and social and environmental benefits and impacts. From the Perspective of Bansal and Roth (2000) family legacy, for example, is both a relational motivation and one that can be accomplished through ethical actions, whereas market considerations are both competitive and relational in the desire to differentiate and improve relationships with key segments of customers.

Regulatory

Government influences firms' adoption of environmental practices through legislation and regulatory action (Delmas & Toffel, 2004). Governments drive the adoption of strong environmental standards through standards based endorsement, like ISO or Energy Star labels in the U.S., financial penalties for non-compliance, or cost incentives. Government actions can also include "coercive legal mandates for organizations to use pollution control technology, attend to pollution thresholds, and to report…pollution emissions to reduce [the] impact to the natural environment" (Darnall et al., 2008, p. 366). Failure to comply with standards, or rules, results in legal action, loss of operating permits, or incurring fines and penalties (Darnall et al., 2008). Compliance with regulation creates a more stable structure for predicting regulatory costs, or limiting disruptions to operations, and in cases where firms are pro-active in adopting legislation, firms can achieve a competitive advantage. Sampedro et al. (2010) found that firms are motivated by compliance with regional and national regulations to adopt environmental issues into strategic decision-making. Given the list of potential negative externalities outlined in Section 2.3 the wine industry does face pressure from government regulation to control or limit outputs like wastewater, chemical run-off, air emissions, as well as controlled the use of inputs like water and chemicals. Sustainability certifications included compliance measures with local and national regulations (CSWA, 2012), which allows the winery or vineyard to stay on top of, or ahead of, regulations and thus, reduce non-compliance risk, and the associated reputational and financial risks.

Consumer and Retail Demand

Wine customers are key stakeholders who wineries and vineyards want to attract and influence, and who firms listen to closely. Wine consumers are following major global trends regarding consumer demand for sustainable products. The Brookings Institute found that up to 89% of Millennials are more likely to buy from a company that supports social issues.[17] When they buy, Millennials check the packaging 50% of the time for sustainability credentials (Nielsen, 2014). Nielsen (2014) found that over a two year period firms who include sustainability claims on packing have a 1% higher sales growth rate, and firms who actively market their sustainability efforts have a 4% higher sales growth rate than a brand without sustainability claims or marketing.

Wine Institute's (2013) survey on consumer and retail behavior related to sustainability found that 34% of wine consumers across all segments consider environmental or sustainable attributes when making wine purchases and 66% of those consumers identify the sustainable credentials at the point of purchase. Klohr et al.'s (2013) study of consumers in Germany found that respondents most related to the following statements: 'I don't buy products from companies that act socially irresponsible', 'I don't buy products from companies that disregard environmental protection', and 'I have switched brands because of social reasons.' Furthermore, research has found that consumers are not just interested in purchasing sustainable products but willing to pay higher prices for those products (Barber et al., 2009; Forbes et al., 2009; Thach & Olsen, 2010; Berghoef & Dodds, 2011; Ogbeide et al., 2014; Lopes et al., 2016).

Consumer demand for sustainable products puts pressure on retailers to increase their procurement of sustainable products. As a result, wineries are under pressure from retailers and buyers to demonstrate their sustainability credentials. Supermarkets and hypermarkets are the largest wine buyers globally since they distribute 46% of the market value (MarketLine, 2015). Supermarkets have created sustainability procurement strategies for wines; Marks & Spencer created a list of approved sustainability schemes for wines that meet their Plan A product

[17] Morley, W. & Hais, M. (2014). "How millennials could upend Wall Street and corporate America." *The Brookings Institute.* Retrieved from https://www.brookings.edu/wp-content/uploads/2016/06/Brookings_Winogradfinal.pdf

requirements.[18]According to Ryan Decker, a winegrower for Rodney Strong Vineyards, "the consumer wanted to hear the word 'certified' Our sales reps told us that. Especially with larger buyers, like Costco and Walmart…retailers putting that wine on their shelves care about it."[19] When explaining why sustainability factored into their purchasing decisions, 72% of retail respondents indicated that there is increased consumer demand for sustainably certified wine (Wine Institute, 2017). 21% of retailers frequently make purchasing decisions based on sustainability practices, and 52% occasionally factor sustainable practices into their purchasing behavior (Wine Institute, 2017). After examining existing research on the pressure firms face from customers, Delmas and Toffel (2004) suggested that retail consumers exert more pressure on firms to adopt environmental management practices than commercial or industrial customers. Furthermore, Delmas and Gergaud (2012) suggested that wineries are motivated to adopt 'eco-certifications' based on market consideration and wineries as a result pursue higher percentages of certifications. Delmas and Gerguad (2012) assume that a higher percentage of certifications is an indication of the firm's commitment and dedication of resources to sustainability. A higher level of certification, as a measure of the commitment to sustainability, is one way that wineries and vineyards can communicate and target concerned market segments.

Family Legacy

Research regarding firm motivation to adopt sustainability practices and technology has indicated that family legacy or succession of business ownership and management between generations is a driving force behind firm decision-making on sustainability (Delmas & Gergaud, 2012; Hoffman, 2011; Slawinski & Bansal, 2009). "Ecological health, social equity, and economic viability are the short- and medium-term goals [of sustainability], but all three are viewed [by winegrowers] as playing a cumulative and supporting role in achieving the long-term goal of generational succession" (Hoffman, 2011, p. 4). Hoffman (2011) concluded further that the desire to preserve the family legacy between generations motivates growers to participate specifically in the Lodi Rule Sustainable Winegrowing program. Similarly, Delmas and Gergaud (2012) point out the influence of intergenerational ties as a driver to adopt an 'eco-

[18] Marks and Spencer Group PLC. (2015). *Plant A Report*, p. 13.

[19] Wine Institute. (2016, December). *Winery's Practice Mitigate Risks.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Dec.'16.pdf

certification' and found that motivation to pass on the wine business positively impacts the adoption of certifications.

Succession planning is significant enough that The California Code of Sustainable Winegrowing (CSWA, 2012) includes best practices on succession planning as a part of the self-assessment workbook, and succession planning is included in CSWA's 2nd edition of its risk management guide for winegrowers.[20] Karl Wente, a fifth generation winegrower, defines succession planning as "preparing for the future across all positions, from ownership, to the board, to the senior leadership, to finance, operations, sales and marketing."[21] Wente vineyards established a Family Business Council to clearly define how company policies and practices could improve and guide the transition process between generation.

Impact on Winery and Vineyards

Wineries and vineyards are motivated to adopt sustainable practices for a range or combination of reasons like regulatory pressure, consumer demand, or maintaining a family legacy. These motivations become more varied when evaluating the motivation to adopt of different practices. The California Sustainable Winegrowing Alliance (CSWA) carried out a study (2009) to identify the motivations to adopt sustainable vineyard management practices and the perceived impacts of those practices. The research found that motivations for adoptions varied by practices for both economic and environmental reasons. Among the top five adopted practices, the respondents were motivated based on cost effectiveness for pest monitoring practices (60%), environmental motivations were highest for practices to reduce risk from pesticides (62%) or reduce tillage (80%), the motivation to improve production was highest for leaf pulling (67), and the motivation based on the scientific proof of the practice was highest for pest monitoring (39%). Additional reasons for adopting these practices included request from buyers, worker health and safety, or government regulation (CSWA, 2009). The variation in the motivations for practice adoption demonstrates the diversity of influences behind winery and vineyard decision making, and further suggests that the potential benefits of adoption, like the motivations, will vary on a case by case basis.

[20] CSWA. (n.d.). *A winegrowers' guide to navigating risks.* Retrieved from http://www.sustainablewinegrowing.org/docs/Risk_Guide_Second_Edition.pdf

[21] Wine Institute. (2016, September). *Down to Earth Newsletter: Family Values.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Sept.'16.pdf

3.2.2 Benefits

Regardless of the driving motivation, the decision to adopt sustainability into firm strategy and operations is still a 'business decision'. As such, the decisions will often depend on the potential quantified impact on costs, operational efficiency, sales, and quality or based on less direct impacts like employee engagement and local biodiversity. Generally, sustainability should provide a decent return on the investment (ROI) either in financial or non-financial terms that can be measured and valued by the firm.

Project ROI (Rochlin et al., 2015), launched by Verizon, the Campbell Soup Company, IO Sustainability and the Lewis Institute for Social Innovation at Babson College, summarizes the potential financial and non-financial impact of sustainability on business performance. Rochlin et al. (2015) studied over 300 academic research papers and business case studies on link between 'Corporate Responsibility (CR)' practices and the potential to deliver financial returns, and related business and competitive benefits. Rochlin et al. (2015) suggest that a well-designed and committed CR program is a value creating asset that has the potential to:

- Increase market value by up to 4-5%
- Increase revenue by up to 20%
- Increase price premium by up to 20%
- Reduce staff turnover rate by up to 50%
- Increase productivity by up to 13%

An important caveat of the Rochlin et al. (2015) study is that the potential ROI is based on the CR practices for large, publicly traded companies. While several wine businesses fit this category most wineries and vineyard do not, so these potential benefits should be viewed cautiously. However, small to medium wine business have demonstrated that measurable benefits, financial or otherwise, from adopting and implementing sustainability are not exclusive to large corporations.

Wineries and vineyards have demonstrated the value in implementing through sustainable best practices and upgrading or installing innovative technology, and adopting stronger governance measures. In addition to improving the firm's environmental and social footprint, sustainability practices and technology have also generated savings through cost reductions. Examples of these impacts and benefits are outlined based on case studies from wine industry reports, newsletters, and company websites below.

Cost-Benefit

The costs of implementing sustainable practices and policies can influence the ability and decision by wineries and vineyards to adopt. Lubell et al. (2011) suggested that "economics comes first in viticulture management…the environmental benefits of different practices must be balanced against the overall profitability of the business" (p. 8). Hoffman's (2011) survey of grower motivations further supports the emphasis on economic viability. Hoffman (2011) found that respondents include economic viability in their definition of sustainability and indicated that economic viability is a key factor in resource conservation. CSWA (2009) surveyed participants in the California Sustainable Winegrowing Program (SWP) about topics they would like to see included in SWP and the most requested topic was tools and information on the cost effectiveness or profitability of sustainable practices (CSWA, 2009, p. 25); following up on that study, CSWA recently published a 'Certification Cost Benefit Evaluation Tool' to help participants estimate the full financial value of their sustainability efforts and certification.[22] The request from the SWP participants for cost effectiveness tools and the response by CSWA to commitment resources to a two year development of such a tool indicates an interest and need for winegrowers to have a clear understanding of sustainability's cost, and potential financial benefits. For projects or practices that will have a clear financial impact, like the cost saving from installing LED lights (PG&E & CSWA, 2013a March; PG&E & CSWA, 2013 November), the impact calculation is clear, but for other practices that might impact grape quality, or customer loyalty could be more challenging to quantify. Despite these potential limitations, research has indicated that not only can most cost/benefit analysis be quantified, but that sustainability practices have had direct positive economic impact.

CSWA's (2009) study on grower motivation for adopting sustainable practices also evaluated the perceived impact of different practices. Half of the respondents adopted pest monitoring, reduced tillage, energy conservation, and renewable energy technologies and recognized that they are better for the environment and reduce cost. Practices like reduce risk pesticides or solar energy could increase costs. In another survey of grower benefits from sustainability, Lubell et al. (2011) interviewed winegrape growers who have adopted sustainable practices and found three types of main economic benefits: reduced input costs,

[22] CSWA. (2017). "Certification cost benefit evaluation tool". Retrieved from http://www.sustainablewinegrowing.org/economic-tools.php

improvements to winegrape quality and vineyard health, and easier compliance with environmental regulations. Respondents in the Lubell et al. (2011) study indicated that disease management practices are the most economically beneficial practices whereas water management and energy practices were the most environmentally beneficial. These responses suggest that winegrowers utilize two categories to evaluate the benefits of sustainability practices, economic and environmental, and responses further suggest that a combination of both economic and environmental benefits is used; respondents indicated that both economic and environmental benefits outweigh the costs for disease, water, pest, and weed management practices (Lubell et al., 2011).

3.2.3 Cost Savings

In the following summary of case studies, wineries demonstrate how despite the initial high capital costs of a technology like solar as just one example, sustainable practices and technology can provide a significant ROI to wineries over time. Waste management, energy efficiency (PG&E & CSWA, 2013a March; PG&E & CSWA, 2013 November), water efficiency (PG&E & CSWA, 2013a December), renewable energy (PG&E & CSWA, 2013b March; PG&E & CSWA, 2013 November), and vineyard management practices have generated financial returns for wineries and vineyards.

Waste Management

- Fetzer Vineyards' waste management program generated more than $700,000 in savings and revenue from avoided landfill fees and recycling. (Prigge & Whatley, 2016)
- Selling used yeast (lees) reduced water use and earned Fetzer $48,000 through sales to a third-party. (Prigge & Whatley, 2016)
- Livermore Valley Winery saves $144,000 a year in recycling costs through an on-site recycling system for packaging waste.[23]
- Francis Ford Coppola saved 80% on costs by updating their wastewater treatment system.[24]

[23] Wine Institute. (2016, March). *Taking the Macro View of Sustainability*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_March.pdf

[24] CSWA. (2013, Winter). *The Business and Environmental Benefits of Sustainability*. Retrieved from http://www.sustainablewinegrowing.org/docs/Case%20Studies_Business%20&%20Environmental%20Benefits_Winter%202013.pdf

Energy Efficiency

- LangeTwins investments in energy efficient technology produced annual savings from $1,212 for variable frequency drives for well pumps up to $47,904 for wine tank insulation, totaling nearly $90,000 in energy savings across all the projects (PG&E & CSWA, 2013a)

- Asti Winery had reasonable ROI for energy efficiency upgrades from 1.2 years for lighting, fans and compressors and up to 3 years for winery tank insulation. (PG&E and CSWA, 2013 November)

Alternative Energy

- Trinchero Family Estate's 400-kilowatt fuel cell system not only reduced GHG emissions, but also saved $192,437 in energy costs during its first year of operation (PG&E & CSWA, 2013b).

- In total, Jackson Family Wines estimates that it has saved $8 million since 2008 on electricity costs from energy savings projects, and has invested those savings into solar arrays that will generate an estimated $1.5 million in annual savings.[25]Also a combined solar and Tesla/EnergNoc battery system has lowered the winery's energy bill by 40% in 2016 (Winston et al., 2017).

- Alpha Omega estimates energy savings of $200,000 over 7 years from a combined on-site solar and battery storage system.[26]

- Vineyard 29 installed a cogeneration systems that utilizes natural gas for electricity and captures waste heat for heating and cooling which saves up to $39,000 a year.[27]

Vineyard Impacts

The savings generated by practices that address water and energy use are significant and often have a noticeable environmental impact, but they are not the only way sustainability is helping wineries and vineyards save money. Respondents to Lubell et al.'s (2011) survey suggested that controlling pests, disease, mildew, fungus, and improving soil health all pay off economically. In Lodi California, the ability to delay, or eliminate powdery mildew, a common problem in most vineyards, avoids an estimated $65,000 to 75,000 in labor, fuel, and treatments

[25] Wine Institute. (2017, April). *Green Medal Leader Announced*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_April.pdf

[26] Wine Institute. (2017, March). *Winery Innovates with Solar Powered Microgrid*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/27/docs/D2E%20News%20Print_March.'17.pdf

[27] CSWA. (2011, Winter). *Data to Determine Industry Averages for Water, Energy and Nitrogen Use*. Retrieved from http://www.wineinstitute.org/files/CSWA_Performance_Metrics_Winter_2011-12.pdf

costs.[28] Cover Crops at Terra d'Oro vineyards provide 10-15 pounds of nitrogen per acre alongside potassium and calcium, reducing the need for conventional fertilizer for a savings of $80 per acre.[29] In the vineyards managed by Vineyard Professional Services savings per acre from nutrient practices reach up to $100 per acre on average.[30] Cover crops are a key element of an Integrated Pest Management (IPM); Jordan Vineyards, through a holistic IPM strategy, reduced treatments to combat invasive species saving up to $70 per acre for specific pests, and in one two-acre section of a larger vineyard with concentrated pest issues, the company saved over $1,300.[31]

3.2.4 Environmental Impacts

The previously mentioned benefits of sustainability focus on the financial return, and while they do provide a financial ROI, many of the practices were implemented to address ecological and social issues related to wine production. For instance, cover crop management strategies help vineyard managers reduce cost from resource input and affect soil and local biodiversity. Soil health and biological diversity are crucial factors in "maintaining or increasing the sustainability and stability of farming systems" (CSWA, 2008, p. 1).

Sustainability practices in the vineyards apply ecological science and ecosystem management through "practices that protect or enhance ecosystem 'services' normally provided by nature" (CSWA, 2008, p. 2), which includes, but is not limited to, habitat and plant conservation around vineyards, protection of riparian habitat, maintenance of cover crops, insectaries, compost and soil amendments (CSWA, 2008) and incorporating and attracting animals for weed control and pest management.[32] Another CSWA (2009) study evaluated the perceived benefits of adopting sustainable practices and of 15 out of 16 practices surveyed, 50% or more of respondents indicated that the practices were better for the environment.

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[28] CSWA. (Spring 2011). *The Business Case for Sustainable Winegrowing*. Retrieved from http://www.wineinstitute.org/files/CSWA_IPM_Spring_2011.pdf

[29] CSWA. (Winter 2013). *Nutrient Accounting at Terra d'Oro*. Retrieved from http://www.sustainablewinegrowing.org/docs/Case%20Studies_Business%20&%20Environmental%20Benefits_Winter%202013.pdf

[30] CSWA, 2011 Winter.

[31] CSWA, 2011 Spring.

[32] Wine Institute. (2015, October). *Down to Earth Newsletter: Animal Farm*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Oct._v2.pdf

Ecological Impacts

This type of "ecologically sound land management can improve soil quality, nutrient content and moisture holding capacity and farm productivity" (Delmas & Gergaud, 2012, p. 10). The CSWA (2008) case studies in partnership with the National Fish and Wildlife Foundation covered five North Coast vineyards that had already implemented sustainability practices over a one and a half year period; none of the sites suffered "economically significant damage from insects" without the use of insecticides, the habitat maintenance at all sites correlated with a high density of beneficial arthropods, and while not specifically studied in these cases, researchers noted a high level of diverse wildlife species in the vineyards (CSWA, 2008). Benziger Family Vineyards maximizes non-vineyard space for insectaries to increase biodiversity and increase the presence of natural predators to combat invasive species.[33] More diverse wildlife matters for vineyards because it helps crowd out intrusive species like gophers that damage; Bronco Vineyard estimates that they replace 3,000 vines a year from gopher damage, and have installed owl boxes instead of using poison traps to control the gopher damage and reduce vine death;[34] Bargetto Winery estimated that gopher damage costs $6,000 in lost income for every 36 vines damaged without considering the labor cost of replacement.[35]

Laetitia Vineyards & Winery utilizes cover crops improve soil structure, reduce weeds through competition, enhance biodiversity, for erosion control, and to make it easier to manage nutrients and nitrogen use.[36] Cover drops contribute nitrogen to the soil and help lock in nitrogen applications into the top two feet of soil to reduce potential run off into nearby watersheds. Cover crops also increase water penetration, which Nord Vineyard Management has used in combination with new management practices and technology to reduce water use in the vineyard by 50%.[37] In another example, Nord Vineyard Management uses reclaimed wool carpets along vineyard hillsides to better control soil erosion, which demonstrates how simple innovations, and a multifaceted approach to sustainability help wineries and vineyards generate positive impacts.

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[33] Wine Institute, 2015 October.

[34] Wine Institute. (June 2016). *Down to Earth Newsletter: Owl Whisperer.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_June.pdf

[35] CSWA, 2011 Spring.

[36] Wine Institute. (2016, February). *The Benefits of Using Cover Crops.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Feb.pdf

[37] Wine Institute, 2015 November.

Reduce Resource Use

Beyond the ability generate positive ecological benefits, sustainability practices reduce GHG emissions through energy efficiency, renewable energy (PG&E & CSWA, 2013b December; PG&E & CSWA, 2013 November), transportation and packaging:

- Asti Winery's energy efficiency and renewable energy projects have reduced annual energy consumption by 1,682,828 kWh (PG&E & CSWA, 2012 November).
- Fetzer offsets 1,866.3 metric tons of $C0_2$ emissions through the purchase of renewable energy credits (RECs) (Prigge & Whatley, 2016).
- Utilizing light-weight bottles (26% lighter than a standard bottle), Tablas Creek Vineyards reduced their total glass weight by 45 tons a year. Less weight means more bottles per shipment, reducing the number of shipments and the associated GHG emissions.[38]
- Sutter Home switched from glass bottles to PET (Tetra Packs) eliminating 32,000 metric tons of CO_2e annually.[39]
- Solar Thermal for Heating Water can reduce the energy required to heat water, which can be up to 50% of total water use, thus reducing emissions from boiler operations (PG&E & CSWA, 2013b March).

Innovative technologies typically have dual benefits other than reducing GHG emissions and can have significant impacts on both energy and water use, sanitation, and labor costs:

- Pipeline Inspection Gauges (PIGs)[40], at Sonoma Wine Company reduced monthly water use by 10-15% in the cellar practices (PG&E & CSWA, 2013 April).
- Fetzer switched to Peracetic acid to clean tanks and reduced annual water use by 200,000 gallons (Prigge &Whatley 2016); Livermore Valley Winery switched to Chlorine Dioxide to clean large tanks reducing water use for cleaning by 66%.[41]
- High speed roll-up doors regulate barrel room temperature, improve safety and productivity, and reduce energy use; J. Lohr Vineyards saved 32,000 kWh of electricity per year with two high speed roll-up doors, reducing GHG emissions by 20,000 lbs. of $C0_2$ a year (PG&E & CSWA, 2013c March).

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[38] Wine Institute. (2016, July). *Good Neighbor Policy*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_July.pdf

[39] Wine Institute. (2015, September). *With Packaging Less is More*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Sept.Final.pdf

[40] A PIG is a "squishy, synthetic sponge ball" that is pushed through transfer lines with compressed gas and creates a barrier of separation between wine and water reducing the dilution of the wine and helping clean the line simultaneously. (PG&E & CSWA, 2013 April)

[41] Wine Institute, 2016 March.

- Utilizing sap flow and vapour-pressure deficit sensors Ridge Vineyards cut water consumption for irrigation in half [42]and Halter Ranch has seen similar water reductions from sap flow sensors in some vineyard blocks.[43]

- Rodney Strong Vineyards saved 33% of energy demand by switching to more cooling efficient square tanks in the fermentation cellar.[44]

- A water capture system on the roof of Halter Ranch, and a winery grey water system can meet half annual water demand for irrigation in the vineyards.[45]

Waste management practices that specifically target packaging materials or design inefficiency have reduced the amount of waste wineries and vineyards are sending to landfills:

- Korbel Champagne Cellars eliminated a plastic cap utilized in the sparkling wine making process and eliminated 28,000 pounds of waste to landfill annually.[46]

- Domaine Carneros can recycle up to 90% of packaging they use through an effective employee engagement strategy.[47]

These practices further demonstrate that the potential benefits never occur in isolation and will typically have a spillover effect. A clear case of mutual impacts on water and energy use is the reduction in vineyard water consumption through optimizing pump efficiency (PG&E & CSWA, 2013a December; PG&E & CSWA, 2013d March). An inefficient pump that needs repair, was sized incorrectly for the load, or was not correctly installed will use more energy. A 25% improvement in pump efficiency can result in energy savings up to 33% (PG&E & CSWA, 2013a December). Gallo Vineyards utilized flow meters, regular testing and maintenance, variable frequency drives, and uniform drip irrigation distribution to improve pump efficiency, reducing the water required per ton of grapes produced and saved energy through lower pump demand for energy (PG&E & CSWA, 2013d March). The benefits are accumulative, where the combined impact of multiple practices add up to significant resource use reductions; Bien Nacido vineyards utilized covers crops, new soil management practices,

[42] Wine Institute. (2017, January). *New Ways to Save Water*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Jan.'17_v.2.pdf

[43] Wine Institute. (2016, May). *Making Every Drop Count*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_May.pdf

[44] Wine Institute, 2016 December.

[45] Wine Institute, 2016 May.

[46] Wine Institute. (2016, August). *Historic Winery Thrives on Change*. http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Aug.'16.pdf

[47] Wine Institute. (2015, December). *Early Adopter*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Dec.pdf

optimized irrigation, and drought tolerant rootstocks collectively to increase water use efficiency by 50% compared to the previous generation, reducing water use by 15%.[48]

3.2.5 Social Impacts

When designed effectively, facility upgrades for sustainability that incorporates employees in the management process can also improve working conditions. Facility design that incorporate energy efficient and renewable energy systems benefit employees; LangeTwins Winery installed 20kw PV solar panels above the crush pad that provides shade to employees (PG&E & CSWA, 2013a March). Similarly, Silver Mountain Vineyards installed a 'triple green' roof utilizing roof space for solar panels, shading equipment to help protect deterioration, and to collect rainwater.[49]

Employee Engagement

Employee engagement on sustainability goes beyond improving working conditions to include benefits, access to education, training, volunteer opportunities, and involvement with measuring, and tracking progress on key sustainability goals. Engaging employees can have two important impacts on winery or vineyard operations, improved satisfaction and lower turnover rates. When it comes to continuing education, Livermore Valley winery offers college scholarship for employee's children and grandchildren[50] and Nord Vineyard Management reimburses college courses for employees; one employee who took advantage of English language and math classes is now the head manager.[51] McManis Family Vineyards benefits structure has resulted in a low turnover rate where 60% of employees have been with the company for more than 20 years.[52] Rodney Strong Vineyards winegrower Ryan Decker claims that sustainability reduced the risk of employee turnover and created clear communication between management and employees, "we have a ton of employees who have been here longer than 20 years."[53] According to HALL President Mike Reynolds, employees at HALL are

[48] Wine Institute, 2015 August.

[49] Wine Institute. November 2016. *Winery Finds the Silver Lining.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Nov.'16.pdf

[50] Wine Institute, 2016 March.

[51] Wine Institute. (2015, November). *Good-Neighbor Grapes*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Nov.pdf

[52] Wine Institute. (2016, January). *Harvesting Family Values.* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print_Jan.pdf

[53] Wine Institute. December 2016.

intrinsically motivated to engage in resource conversation efforts, "One thing people enjoy about working here is our commitment to environmental responsibility. They know they work for a company that's trying to do the right thing."[54] Sustainability creates a positive feedback loop in which it can improve employee well-being and satisfaction, which in turn improves engagement, and then the effectiveness of sustainability efforts. At Jackson Family Wines Family Representative Katie Jackson found that "employees are inspired by our sustainability program. More engaged employees are more efficient employees, so we think we're getting more profitability from that as well."[55]At Domaine Carneros, employee training and engagement related to sustainability is cited as one of the key reasons that they have a recycling rate of 90% and a water recycling or recapture rate of 50%.[56]

3.3 Market Benefits

For a firm investing time and resources into sustainability, engagement extends beyond employees and internal stakeholders to customers through targeted marketing and communication since consumers and retail purchasers are increasingly concerned about sustainability. Society is pushing business to "move beyond narrow, money-making self-interest by focusing on broader issues of sustainability" (Galbreath, 2009, p. 316). Firms who respond to pressure for increased commitment to sustainability have a justified financial case for doing so; Rochlin et al. (2015) found that sound corporate responsibility management has the potential to:

- Increase revenues up to 20%
- Enhance firm's brand and reputational value by 11%
- Increase price premiums up to 20%
- Affect variation in customer satisfaction by 10% or more
- Motivate purchasing behaviors of up to 60% of customers

While these summarized benefits are largely associated with multinational corporations, wineries and vineyards have taken note because selling wine depends heavily on the ability to engage consumers around quality, price, and the story behind the wine. As Kent Mann from Sutter Home points out, "today's consumers are more informed and want to be part of the

[54] Wine Institute. (2016, October). *No Shortcuts. No Regrets* Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News%20Print_Oct.'16.pdf

[55] Wine Institute, 2017 April.

[56] Wine Institute, 2016 December.

environmental movement. They want to feel like they're partnering in your sustainability."[57] By addressing the pressure from consumers and retail to adopt sustainability, and by engaging with potential customers on sustainability efforts, wineries and vineyards can benefit from a higher willingness to pay (WTP), consumer behavior patterns that preference sustainability, and higher market share among key wine buying demographics.

3.3.1 Willingness to Pay (WTP)

Researchers have found that customers are generally more willing to pay for a bottle of wine that has a sustainability claim or certification (Berghoef & Dodds, 2011; Barber et al., 2009; Forbes et al., 2009; Lopes et al., 2016; Ogbeide et al., 2014; Thach & Olsen, 2010). How much consumers are willing to spend varies throughout the research:

- Forbes et al. (2009) found consumers willing to spend 5-10% more
- Australian consumers were willing to pay a $1-$4 premium (Ogbeide et al., 2014)
- On a $23 bottle, consumers were willing to pay a $7 premium (Berghoef & Dodds, 2011)

Even though Lopes et al. (2016) found that consumers had a higher WTP for sustainable wine, the research also found that Biodynamic and Organic certifications negatively affect price. This discrepancy between price trends and WTP for Organic and Biodynamic wines could be from an unwillingness to trade perceived quality for ethical or environmental reasons; organic and biodynamic are often confused by consumers (Lopes et al., 2016; Delmas et al., 2008) or consumers are unfamiliar with sustainability terminology (Zucca et al., 2009), which could negate the price premium potential. However, other research (Veal, 2009; Forbes et al., 2009; Peattle, 2001; D'Souza et al., 2006) found that the majority of consumers do not see 'green' wine to be of a lower quality. Forbes et al. (2009) found half of survey consumers did not expect sustainability to impact quality, and 36.7% believed it would increase quality. Wineries are not the only beneficiaries of price premiums for their products; wineries like Bogle Vineyards (LWC, 2014), Michael David (LWC, 2014), Jackson Family Wines, and Francis Ford Coppola Winery all pay wine grape growers premiums or incentives for sustainably certified fruit.[58]

[57] Wine Institute, September 2015.

[58] Quackenbush, J. (2017). "Sustainable' Sonoma wine could fetch $7-a-bottle more, survey says" *North Bay Business Journal*. Retrieved from http://www.northbaybusinessjournal.com/events/6542237-181/sustainable-sonoma-wine-consumer-sales?artslide=0

3.3.2 Consumer Behavior

Wineries with well marketed sustainability efforts could benefit from a higher willingness to pay, and from an increased ability to attract consumers and influence purchasing behavior. Rochlin et al. (2015) estimate that the core customers that will motivate purchasing behavior based on a firm's sustainability reputation represents up to 20% of customers; this segment identifies with a firm's sustainability ethos and is willing to promote that brand over another. Consumers with a pre-disposition to purchase 'green' products will move the market in favor of products considered sustainable compared to those that are non-sustainable (Barber et al., 2009). While Lopes et al. (2016) found that Organic and Biodynamic Certification negatively affect consumer purchasing intent, researchers also found that sustainability claims can positively impact consumer purchasing intent (Berghoef & Dodds, 2001; Delmas et al., 2008; Forbes et al., 2009) The Natural Marketing Institute in partnership with the Wine Institute found in a national survey of over 4,000 adults that 34% of wine consumers indicated that environmental or sustainable attributes are often/sometimes a factor in wine selection (Wine Institute, 2013).

3.3.3 Market Share

According to Rochlin et al. (2015) the potential market benefits for wineries and vineyards also depends on the effectiveness of the firm's communication or marketing. Barber et al. (2009) found that nearly half of survey respondents would do 'more for the environment' (buy more green products) if they knew how. Delmas et al. (2008) found that consumers are confused by certifications claims. Combined, these trends indicate the need for marketing and communication around sustainability that is educational. Customer loyal, purchasing behavior, or WTP could be more difficult to motivate if wineries and vineyards cannot connect with customers about their sustainability efforts.

Conversely, both Millennials and the LOHAS (Lifestyle of Health and Sustainability) or eco-conscious consumers have demonstrated a knowledge and an interest in sustainability. LOHAS have showed a large and growing interest in information on sustainable practices at wineries and vineyards. 52% of LOHAS respondents in the Wine Institute (2013) survey indicated that environmental or sustainable attributes are often/sometimes a factor in their wine selections. Additionally, LOHAS were also the largest wine purchasing demographic surveyed. 43% of LOHAS purchased wine for the household in the prior three months (Wine Institute, 2013). For wineries to potentially increase their market demand with these segments they can

concentrate their marketing efforts accordingly rather than trying to educate the less concerned buyers (Klohr et al., 2013).

3.4 Understanding the Business Case

The case studies and examples from the wine industry on the benefits of sustainability outline a wide range of potential impacts regarding firm finances, natural resources, market trends and local communities. In certain cases, wineries and vineyards have been able to successfully implement a sustainable practice and technology that benefit both society or the environment and the firm's bottom line. However, such shared valued (Porter & Kramer, 2011) creation is not the norm, and wineries and vineyards have to weigh options to make investments into specific issue areas like whether to invest in wastewater treatment, light weight bottles, or adopt comprehensive cover crops. While most operations would likely benefit from implementing all of these strategies resources are limited, and firms based on capacity have to make strategic decisions on how to design and then implement a sustainability strategy. Taking into consideration the preceding examples, the next section will take a high-level analysis of firm's strategic choices and challenges to identify a framework or a path forward for wineries and vineyards who are planning to adopt and implement sustainability in their operations.

4 Managing and Implementing Sustainability

Wine businesses are faced with external pressures like increasing consumer demand, or regulation, and with the knowledge of the potential benefits for proactively addressing that pressure through sustainability. Management, operations, strategy literature, and wine industry research and case studies have outlined various approaches that could be applied by a vineyard or winery to define and manage sustainability implementation. These approaches have been organized into frameworks that define a process by which a firm can systematically evaluate its strategy, and actions related to the implementation of sustainability.

4.1 Evaluating Management Systems

Management systems are tool for firms to define and organizes the implementation process. "A management system is the way in which an organization manages the inter-related parts of its business in order to achieve its objectives."[59] The adoption of a management system like ISO14001 could "simply mean having strong leadership from the business owner, providing a clear definition of what is expected from each individual employee and how they contribute to the organization's overall objectives."[60] Regarding sustainability, a management system can help set out the strategy process in a step by step manner including actions like performance measurement, progress reporting, and stakeholder engagement. Given the range of potential management systems or sustainability standards that could be applied by wineries and vineyards, one management system has not been isolated for study. Instead, this research takes an inclusive approach evaluating multiple types of management systems and certifications standards that will be referred to as a framework unless specified as an Environmental Management Systems (EMS) or a sustainability standard. This section will establish a Conceptual Framework to evaluate how a company has successfully implemented sustainability by reviewing existing research on sustainability and management strategy, and case studies. The common themes have been cross referenced with practices and policies included in wine sustainability standards (CSWA, 2012; LWC, 2014; USDA, 2011), and with interviews of sustainability specialists at wineries and industry groups who have established themselves as leaders on sustainability in the industry (Eden, R. Personal Interview. 24 Mar.

[59] International Organization for Standardization (ISO) Definition of Management Systems. Retrieved from https://www.iso.org/management-system-standards.html

[60] Ibid.

2017; Jordan, A. Phone Interview. 3 April 2017; Ohmart, C. Phone Interview. 4 April 2017; Olsen, R. Phone Interview. 11 April 2017; Prigge, J. Phone Interview. 14 Feb. 2017).

The common elements woven throughout the different frameworks and measurement systems have been condensed into the outline below that covers: Vision, Leadership, And Strategy; Managing Implementation; Employee and Stakeholder Engagement; Measuring Performance and Impact; and Assessing Success and Value. These categories are prevalent throughout wine industry standards and certifications, and have been chosen specifically because of their applicability to the wine industry. Key research and theory that encompasses these topics have been chosen for deeper review:

Kaplan and Norton (1992) – The Balanced Scorecard

Kaplan and Norton (1992) introduced The Balanced Scorecard (BSC) as a set of measures to give "top managers a fast but comprehensive view of the business". The BSC includes financial and operational measures from four perspectives: financial, internal business, innovation and learning and customer. The process of defining and understanding those perspectives is based around building measures through a process that defines the company mission and vision, sets strategic objectives, identifies key success factors, creates a strategic improvement plan, and utilizes a feedback mechanism for the evaluation of strategy and performance measures. The BSC establishes a clear process for strategic planning, cascading objectives, measuring performance, and providing feedback that is prevalent in management systems.

Darnall et al. (2008) – Environmental Management Systems (EMS) and Business Performance

Using international data on manufacturing facilities, Darnall et al. (2008) evaluated whether business motivations for an EMS influence the extent to which an organization benefits from EMS adoption. Darnall et al. (2008) found that companies who are motivated to adopt a more comprehensive EMS based on complimentary resources and capabilities observed a greater level of facility performance that those who adopted based on institutional pressures. In addition to introducing motivating pressures, the research provides insight on the benefits of EMS, and outlines specific components of an EMS like a written environmental policy, employee training, employing internal environmental audits, and performance measure that can affect the comprehensiveness of adoption and potential benefits.

Cordano et al. (2010) – How do SMEs Go 'Green'?

Cordano et al. (2010) examined "managers' attitudes, norms, and perceptions of stakeholder pressure to assess their intentions to implement" an EMP, another term for a EMS. The research found that SMEs with simple structures are more responsive to internal pressures and that established EMP's increase the success of the implementation in energy conservation and recycling. Cordano et al. (2010) provides specific examples of the benefits of sustainability in the wine industry, an evaluation of motivations, and a suggested informal EMS framework that includes goal setting, designated responsibility, employee training, dedicated budgets for innovation, and environmental criteria for suppliers.

Aflaki et al. (2013) – Finding and Implementing Energy Efficiency Projects

Aflaki et al. (2013) provide a framework for finding and implementing profitable energy efficiency projects as a critical foundation for sustainable operations. The identified process for evaluating energy efficiency projects can be to evaluate similar types of sustainability projects. Aflaki et al. (2012) link energy efficiency with company strategy and implementation with two case studies on Philips and Pfizer, establishing how a sustainability project like energy efficiency can be effectively integrated by establishing a vision and strategy, engaging a sustainability team, and creating review procedures. In the case of Philips, the authors describe a hybrid top-bottom, bottom-up approach to strategy development that will be expanded on further under Cascade and Feedback.

Prigge and Whatley (2016) – Sustainability and Regenerative Leadership

In a case study on Fetzer Vineyards, Prigge and Whatley (2016) examine how a large winery and vineyard evolved from a traditional to sustainable, and most recently, to a regenerative company. This case study provides concrete examples of the decisions, practices, and policies that a wine business evaluates in the process of implementing sustainability. The case identifies key areas for successful implementation that have been referenced in the preceding literature: establishing vision and value, creating goals, gaining top management support, establishing a sustainability team, employee training, and performance measurement.

4.1.1 Comparing Approaches

The referenced literature is not exhaustive, but has been chosen due to either the relevance to the wine industry, or the use of a framework for evaluating the implementation of sustainability and EMS. The commonalities between the literature highlight the importance of

vision, leadership, and strategy, employee engagement, and performance measurement. Further examination of these topics follows, and includes areas like team formation (Aflaki et al. 2013; Prigge & Whatley, 2016), goal setting (Kaplan & Norton, 1992; Cordano et al., 2010; Prigge & Whatley, 2016), performance measurement review (Kaplan & Norton, 1992; Cordano et al., 2010; Aflaki et al. 2012; Prigge & Whatley, 2016) and other key features of the outlined management systems. Key differences between the literature mater less that one framework referenced the value of internal environmental audits (Darnall et al., 2008) and another focused in the influence of stakeholder pressure (Cordano et al., 2010) and more about the differences in the research approaches. Kaplan & Norton (1992) was a high level strategic paper, whereas Darnall et al. (2008) and Cordano et al. (2010) tested hypotheses, Prigge and Whatley (2016) is a case study, and Aflaki et al. (2013) blends elements of each. Collectively, the different approaches yet similar use of key topics within strategic, management, and operations literature validates the further exploration of these topics and presents a potential structure to build a survey around for further testing.

4.2 Vision, Leadership, and Strategy

The implementation of sustainability begins with a high-level overview that sets firm priorities, strategic goals, and outlines the mechanisms by which information flows throughout the firm. Additionally, it establishes how data and information can be utilized to re-assess progress toward sustainability targets, and firm strategy and objectives. A company vision on sustainability, executive or owner leadership, and clearly defined strategic objectives can help make the implementation process more successful; the combination of vision, leadership, and strategy set up the high-level firm values and business case for implementing sustainability.

4.2.1 Vision

Firm vision is a key element included in both management and assessment frameworks on sustainability (Kaplan & Norton, 1992; Loch & Tapper, 2002; Aflaki et al., 2012; Prigge & Whatley, 2016). According to Graham (2014) a “vision statement says what the organization wishes to be like in some years’ time…drawn up by senior management, in an effort to take the thinking beyond day-to-day activity in a clear, memorable way.” A defined vision provides clarity to the firm motivations for adoption which will impact the implementation process and the potential benefits of adoption (Heras-Sairzarbitoria et al., 2016).

4.2.2 Leadership

The company vision, once defined, needs top management or ownership support to lead and communicate the intent and actions embedded in the company vision to both internal and external firm stakeholders (Thomas & McElroy, 2016). Leadership key initiatives is a crucial factor to facilitate the implementation of sustainability, and ultimately help determine the effectiveness of implementing the associated changes (Darnall et al., 2008; Prigge & Whatley, 2016; Galbreath, 2016). Without a clear vision that can be communicated by leadership to employees at all levels, most change efforts, like adopting and implementing sustainability, will fail (Loch & Tapper 2002). Leadership by top management or ownership also makes it easier to allocate firm resources and budgets to sustainability initiatives and establishes a company culture that prioritizes sustainability (Prigge, J. Phone Interview. 14 Feb. 2017). Executive leadership on sustainability communicates a belief in the company vision, which though seemingly very simple, can be one of the most important factors in why some firms successfully implement sustainability and others do not. (Eden, R. Personal Interview. 24 Mar. 2017).

If top management fails to demonstrate and support the internal value for questioning the status quo and proposing new ways of working, the lack of authority will block the transformation of a new idea into action (Thomas & McElroy, 2016). To encourage action, leaders, especially managers, can infuse their values throughout the firm (Marshall et al., 2015) which enables followers to create their own ways of working (Thomas & McElroy, 2016). This increases progress toward the firm's sustainability goals by improving managerial awareness of the benefits of sustainability (Atkin et al., 2012).

Winston et al. (2017) make the case that corporate strategy on energy issues depends heavily on leadership and argue it "will be hard to implement without explicit engagement from the CEO and a clear governance structure". Winston et al. (2017) found that the companies progressed less on strategic energy issues when they did not have an organization with strong leadership engagement and governance. Galbreath (2016) also examined the role of leadership in industry clusters and suggests that trust and embeddedness, shared between a cluster of women in leadership roles in the wine industry would lead to a freer exchange and transfer of knowledge about practices surrounding environmental sustainability. Aflaki et al. (2012) suggest that knowledge transfer of technical skills in operations is a key success factor in project implementation.

4.2.3 Strategy

Vision and leadership guide the formation of firm strategy on sustainability implementation; Leaders communicate vision and values through a strategy that defines the processes for the flow of information and knowledge, the firm's strategic priorities and sets sustainability targets goals that are linked to both the flow of information, typically in the form of performance measures (Section 4.5). This is a process popularized by Kaplan Norton (1992) Balance Scorecard as a performance management tool.

Defining Priorities

A firm's strategic planning should include the identification of social and environmental issues that are material to the firm (Aflaki et al., 2012; Kaplan & Norton, 1992; Prigge & Whatley, 2016), which will help define the areas were action should be prioritized. Materiality is an accounting concept that formally, as defined by the U.S. supreme court, considers information to be material if "substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available."[61] Though it is a financial or accounting concept, materiality assessments have been adopted by major reporting standards, like the Global Reporting Initiative (GRI) or the Sustainability Accounting Standards Board (SASB), which has made the use of the concept widespread across the sustainability field. Generally, an issue, like factory wastewater or air emissions, is material if the effect, in this case the resulting pollution, has significant financial or operational risks to a firm. Material social and environmental issues are those immediately related to the firm activities. Materiality can also be identified by looking at the asymmetrical relationship by which company action effect the environment, and second, how the environment affects the firm's activity (Sampedro et al., 2010). For instance, carbon emissions would be material if a firm could face regulatory action or fines, but also if the firm's operations are sensitive to a changing climate that is driven by carbon emissions.

Strategic planning makes it possible to determine what social and environmental issues are material to the company, what potential solutions exist given company resources, and how to define and carry out an implementation plan for the strategy. The more clearly defined the strategy, the easier it becomes to implement sustainability or an Environmental Management

[61] TSC Indus. v. Northway, Inc., 426 U.S. 438, 449 (1976).

System (EMS). The firm strategy can establish how strategic targets and knowledges cascades into operations, and how that process feeds information back to better inform strategy (Sampedro et al., 2010). Strategy must incorporate materiality otherwise a company might risk disconnecting sustainability from the company mission or vision (Galbreath, 2009).

Furthermore, materiality helps a firm establish which social and environmental issues are most relevant to the firm and the issues that are most important to their primary stakeholders (Galbreath, 2009; Galbreath, 2011). When firm strategy incorporates social and environmental sustainability as a priority, it may, depending on the current state of operations and policies, be necessary to implement a completely new internal process (Sampedro et al., 2010). Galbreath (2009) categorizes the three types of action that would establish new process around sustainability as:

1. Market based - actions directly affect economic sustainability through products that address social or environmental issues

2. Regulatory/standards based - compliance, or non-compliance with government regulations and standards, including measures that anticipate future regulation

3. Operational based – focused on costs and externalities generated throughout the value chain from finance and accounting, research and development, human resources management, procurement, production, logistics, sales and services.

In the case of the wine industry, all three types of actions apply and firm strategy guides which action to take. Compliance with government pesticide spray requirements is a 'regulatory action,' adhering to ISO 14001 within the winery is an 'operational action,' and Organic certification is a 'market action.' These different types of potential actions leave the firm with options to determine which best aligns with the company materiality and resources. While some practices and projects, like energy efficiency upgrades, are "no brainers because they [have] low up-front investment, relative certainty of direct benefits, and short payback periods" (Aflaki et al., 2012, p. 510), others could have higher-up front cost, difficult to measure or indirect benefits, and long payback periods. Firm vision, leadership, strategy, and materiality will provide weight to the cases when the impacts and benefits are less clear, and may justify prioritizing a higher up-front cost because the long-term benefits align closely with the firm's sustainability vision. For instance, respondents in CSWA's (2009) study of grower motivations, indicated that solar energy was, at the time, less financially attractive to implement because of the high up-front cost; Jackson Family Wines prioritized on-site renewable energy generation

despite the high costs because it aligned with their strategic goals, and now the winery is saving up to $1.5 million annually in energy costs.[62]

Setting goals

Goals provide strategic objectives to material issues and frame the actions needed to address those issues. (Aflaki, 2016; Cordano et al., 2010; Kaplan & Norton, 1992; Prigge & Whatley, 2016). "Changing the goals of a system is the third-greatest leverage for change in a social system because it reorients the purpose – the intentions – of an organization" (Prigge & Whatley, 2016, p. 298), and without goals any strategic reorientation will fall flat. Goals enable a cascade effect from vision and strategic planning to action, creating a link between top level management and employees at the operations level who carry out the necessary changes. Employees can interpret goals based on how they contribute to the wider firm strategy on sustainability and managers can then in turn use goals to measure progress.

Cascade and Feedback

Successful integration of sustainability into strategy requires a balance between the top-down vision and a clear mechanism for employee knowledge transfer (Galbreath, 2016), feedback, participation, and employee autonomy to lead initiatives (Loch & Tapper, 2002; Aflaki et al., 2012; Prigge & Whatley, 2016). Effective strategy creates a continuous cascade of the firm vision to management and operations utilizing a feedback process for employees to inform strategy and report progress on strategic goals (Sampedro et al., 2010); the effect is a hybridized top-down, bottom up approach. (Aflaki et al., 2012). Additionally, firm vision, and strategy need to be cascaded down to the department level in operational terms that employees can relate to and can explain in terms of their roles within the company (Loch & Tapper, 2002). Done effectively, the cascade and feedback process can impact employee engagement (Section 4.4), which can be a crucial factor in the successful implementation of sustainability as demonstrated by the cases at Francis Ford Coppola,[63] Jackson Family Wines,[64] Rodney Strong Vineyards,[65] and Domaine Carneros[66].

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[62] Wine Institute, 2017 April.

[63] Wine Institute. (April 2017). *Coppola Sees Value in Certification*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/27/docs/D2E%20News%20Print_April.'17.pdf

[64] Wine Institute, 2016 April.

[65] Wine Institute, 2016 December.

[66] Ibid.

4.3 Managing Implementation

After exploring issues around how and why vision, leadership, and strategy influence the implementation of sustainability projects, the next relevant issue to examine is how firms imbed strategic sustainability targets into operations in a manner that affects change and progress toward accomplishing goals.

Environmental management systems (EMS) is the most often used term for a general management system on environmental issues that defines the implementation of practices and policies according to sustainable business strategy and goals. Darnall et al. (2008) summarizes an EMS as "a collection of internal polices, assessment, plans and implementation actions (Coglianese & Nash, 2001) that affect the entire organizational unit, or company, and the firm's relationship with the natural environment" (p. 1). It is a standard through which a firm can pursue sustainability objectives in an organized manner. A widely-implemented example of an EMS is the International Organisation for Standardization's ISO standards like ISO 14001 Environmental Management and or ISO 2200 Food Safety Management.[67] The ISO standards are issue area guidelines for operations and management to follow, and if implemented comprehensively, firms can choose to seek ISO Certification which verifies practices and policies through a third-party audit. The certification helps communicate a transparent message about the firm's action on the issue and legitimizes its sustainability efforts. For instance, both a winery facility, as encouraged by Entwine in Australia[68], or any generic manufacturing facility can be certified according to ISO 14001. Both operations are certified for utilizing the same tools and implementing the practices contained within the standard regardless of their respective industries.

An EMS can contain mandatory practices, specific to an industry or issue, or regulations from a governmental body. However, most EMS, especially those in the wine industry, are voluntary codes that have a third-party verification framework if the firm choses to pursue additional transparency requirements and be audited for certification. Many, if not all, of the wine industry sustainability standards fall under the voluntary category, where wineries and vineyards can adopt the practices and principles of the standard as fits their operations and strategy, and may pursue a 3rd party audit to be certified. Even though these types of EMS are

[67]International Organization for Standardization (ISO). Retrieved from https://www.iso.org/home.html.

[68] Entwine Australia. Retrieved from http://www.awri.com.au/industry_support/entwine/

voluntary they still follow "procedural requirements concerning the types of policy, plan, organizational practice and control mechanism to be adopted by the companies so that they can better manage activities that have a significant environmental impact" (Heras-Sairzarbitoria et al., 2016, p. 545).

Strategic planning and materiality assessment are potential pre-requisites to selecting an EMS (Aflaki et al., 2012; Cordano et al., 2010; Kaplan & Norton, 1992; Prigge & Whatley, 2016). To identify what type of EMS is appropriate, wineries should "identify how their activities interact with the environment, the type of environmental impacts that emanate from different operations, and alternative means of preventing environmental pollution" (Darnall et al., 2008, p. 365). Ideally, this process is accomplished during the strategic planning process. Using materiality, and goal setting, firms can select an EMS that best fits their needs and resources, or build an informal EMS system that pulls best practices and technologies from existing standards accordingly.

In the wine industry, implementing sustainability through an EMS is done typically through the existing industry sustainability standards and certifications, like the California Code of Sustainable Winegrowing (CSWA, 2012), and relevant 3rd party certifications, like Demeter Biodynamic or USDA Organic (USDA, 2011), or ISO 14001 and LEED for green buildings. In all cases, the standards contain specific practices that are used by the wineries and vineyards for self-assessment, which allows the firm to easily identify what they are doing well, and areas in which they can improve. Contained within these standards are the instructions, background information, and tools on how to improve practices or adopt new technology. In effect, these standards or self-assessment workbooks are a type of management system since they contain a codified set of policies and practices, and have blended in many of the operations and management components identified in the literature like goal setting, and performance measurement.

4.3.1 EMS Benefits

Due to its wide adoption, ISO 14001 has extensive research on the potential benefits of adoption (Delmas, 2001; Delmas, 2004). As an example of an EMS Delmas (2001) describes it as an 'intangible resource that improves the quality of management in order to provide operational efficiencies.' The business case for implementing an EMS like ISO 14001 is clear; Research has demonstrated that firms who implement an EMS can benefit in number ways; an EMS helps management delegate responsibility with supervision, control, and surveillance

(Sampedro et al., 2010), create opportunities for innovation to drive new methods for preventing waste from inefficient systems (Cordano et al., 2010), and generate cost savings by addressing inefficiencies in energy, water, or waste use for instance (Alberti et al., 2000; Cordano et al., 2010; Atkin et al., 2012).

In the wine industry, both Cordano et al. (2010) and Atkin et al. (2012) found that wineries and vineyards with clear and developed management systems are more likely to be successful at implementing sustainability practices and realizing the benefits of doing so. Cordano et al. (2010) found that firms with more developed management systems are more successful in implementing energy conservation and recycling initiatives, while Atkin et al.'s (2012) survey of the U.S. wine industry suggests that respondents with a clear business case for sustainability experience greater operational efficiency, and supply chain optimization which can lead to cost leadership. Additionally, when it comes to realizing the benefits, Cordano et al. (2010) implies that the positive attitude of owners toward the potential benefits of implementing a EMS will affect their likelihood of adoption. The benefits of sustainability for wine businesses has already been presented in the Business Case but it is worth noting that those benefits are likely to be impacted by the design and effectiveness of the firm's EMS.

Challenges

Despite research that shows improved environmental performance from adopting an EMS, it is less clear according to Darnall et al. (2008) how EMS strategies improve overall business performance and create value. One difficultly in understanding the value derived from adopting an EMS stems from the firm's system and ability, given firm resources and local ecosystem demands, for measuring performance on environmental targets. Even though an EMS, like ISO 14001, is a global standard that fits across industries, a firm that adopts the standard will have to adjust the principles and practices in manner that best suits their capabilities, resources, and materiality. This need to apply an EMS according the context of the firm presents a difficulty for research to assess the general or aggregated benefits of adoption because minor changes or adaptations at the firm level could be significant factors in explaining a firm's success on environmental improvement rather than the EMS standard itself. These unclear causal relationships between adoption and performance results depend on how some firm choses to manage different aspects of the EMS implementation. The following sections will highlight the different decisions firms will have to consider in the process of implementing an EMS, and how those decisions will could affect the success of implementation.

4.4 Employee and Stakeholder Engagement

The successful implementation of a sustainability strategy, and a well-designed EMS, depends on the involvement of engaged employees throughout the company (Aflaki, 2012; Cordano et al., 2010; Darnall et al., 2008; Prigge & Whatley, 2016). Employees and stakeholders play a key role in making the implementation process circular instead of linear so that strategy cascades down throughout the firm, employees are given responsibility enact change, and empowered to contribute to firm goal. Implementing sustainability requires change. Change, or 'change management', is a problem for managers because it's "unlike any other managerial task they have ever confronted…the critical task is understanding how pieces balance off one another, how changing one element changes the rest" (Duck, 1993). For a firm to balance the process and develop new values, Thomas and McElroy (2016) suggest that firms must empower people to "develop and adopt new ways of thinking and new ways of working" (p. 22).

Employee engagement is a crucial element of the change process. Employee engagement on company goals increases both the likelihood of a EMS being maintained over time and the ability of the EMS to reduce environmental impacts (Darnall et al., 2008). Employee engagement helps overcome resistance to change and can improve the success rate of new projects or practices. To overcome employee resistance to change, employers can engage employees by asking for input, explaining why changes are made, and set clear expectations for what the change will accomplish (Loch & Tapper, 2002). On sustainability practices or policies like recycling employee engagement is an essential element to design an effective program and to insure the progress toward implementing a sustainability initiative like a recycling program.[69] Employee engagement also matters the firm's bottom line where researchers have demonstrated that strong sustainability efforts can improve employee retention and attraction which can reduce the cost of recruitment and human resources (Rochlin et al., 2015).

[69] Cheeseman, G.M. (2017). "P&G and Microsoft Demonstrate How to Move Beyond Recycling". *Triple Pundit*: Corporate Responsibility. April 12th. Retrieved from http://www.triplepundit.com/special/waste-management-covanta/procter-gamble-microsoft-recycling/

4.4.1 Forming a team

One mechanism for successful employee engagement is creating a sustainability team which serves as the conduit through which employees can regularly communicate, and collaborate on company strategy and goals setting with employees across departments, and at various levels of firm seniority (Aflaki et al., 2012; Loch & Tapper, 2002; Prigge & Whatley, 2016). A team gives employees more autonomy to diagnose and find improvements on sustainability issues,[70] increasing trust and engagement with the company sustainability strategy (Loch & Tapper, 2002). Additionally, a team helps transfer the company strategy and vision into operations by setting and reviewing best practices (Loch & Tapper, 2002; Galbreath, 2009; Prigge &Whatley, 2016). A team assigns responsibility and sets accountability which is one of the most important aspects of any effective management system (Aflaki et al., 2012). A sustainability team creates flexibility to adopt and address challenges that arise with an EMS.

Additionally, flexibility can increase the impact a sustainability strategy and management system has on employee satisfaction, and productivity; for instance, at Fetzer Vineyards, the sustainability team identified a company garden as a worthwhile sustainability project, and now the garden is producing vegetables for the employees (Prigge, J, Phone Interview. 2 Feb 2017). Similarly, Francis Ford Coppola engaged employees on sustainability by creating an internal 'Green Case Award' that is selected by the company's Green Team, a cross departmental group of 25 employees that reviews progress on sustainability and evaluates opportunities for improvement.[71] In another example of how employee engagement on sustainability drives innovation that can cut resource consumption, Kendall Jackson's winemaking team designed a barrel wash-water recycling system that cuts water used for washing barrels by 45% or 700,000 gallons of water a year.[72]

4.4.2 Skills and Training

If implementing sustainability is about change management, then it is fundamental to train staff to prepare for changes in operations that align with sustainability (Sampedro et al., 2010). "It is critical that sustainability training and education be established to reinforce leaning until employees are able to conduct their normal work duties guided by sustainability principles

[70] CSWA, 2013 Winter.

[71] Wine Institute, 2017 April.

[72] Wine Institute, 2016 April.

and concepts" (Prigge & Whatley, 2016, p. 299). Employee skill training on sustainability issues impacts their ability to manage change within their role, adapt to new practices, and provide useful feedback and ideas to the sustainability team or the strategic vision. Knowledge transfer on sustainability and skills is another method to enables employee contribution to the firm vision, and progress on goals. Beyond knowledge of broad sustainability issues and company goals, technical qualifications for the maintenance and operational readiness of facilities are prerequisites for successful project implementation (Aflaki et al., 2013). Also, skills specific to sustainability issues matter for both the implementation cost and effectiveness. According to Darnall and Edwards (2006) existing skills in quality management and pollution prevention incur lower implementation costs. In a similar example, Sampedro et al. (2010) summarized how training on sustainable pesticide application can lead to cost savings in fuel and chemical use while also reducing the environmental impact from pesticide use. At Domaine Carneros, employee engagement has been crucial to the success of their recycling program; according to CEO Eileen Crane employees needed to understand why they were recycling and how to do it. As a result, Domaine Carneros recycles 90% of packaging that they use and reclaims 50% of their water use.[73] These are specific examples where the success of a new practices, like recycling packaging or chemical applications, and the degree of its environmental impact, depends heavily on employee training and engagement.

4.4.3 Stakeholder communication

Employee training and skill development is one method to communicate the firm's vision and the impact of sustainability. Communicating with stakeholders like employees or investors, local communities, regulators, and costumers helps create internal value to the firm through stakeholder engagement. Communicating results of sustainability performance to employees reinforces value to the company (Aflaki et al., 2012) and vice versa where employees need constructive feedback about how their contributions impact the high-level vision (Loch & Tapper, 2002). Clear communication helps overcome issues of cross functional confusion and responsibility between employees. Instead of employees working in siloes or spread out over too many activities, employees should be able to explain how what they do fits into to the strategic sustainability vision of the company (Loch & Tapper, 2002). Both the

[73] Wine Institute, 2016 December.

sustainability team and regular workshops for training and skill development provide platforms for regular communication with employees about sustainability.

Workshops for employees, the local community, and suppliers that cover regular reports on social and environmental goals convey firm performance and values, increasing knowledge and awareness of firm's efforts (Prigge & Whatley, 2016). Local communities are a key stakeholder for wineries and vineyards since much of the pressure they face comes from the firm's contribution to, or impacts on, local ecosystems, economy, and communities. Local communities also hold considerable power to influence wine business activities through voting in local and national elections and coordinating with environmental or social NGO's (Delmas & Toffel, 2004); as such the wine industry, even with an admittedly chequered past[74] on community engagement or workers' rights has begun to internalize the necessity of strong community relations and stakeholder engagement. In the case of South Africa worker's rights remain an issue, but Sustainable Wine South Africa (SWSA) has incorporated health schemes and safety efforts to protect full time and temporary workers through the Integrated Production of Wine (IPW) scheme, and is working with the Wine Industry Ethical Trade Association (WIETA) to improve working conditions throughout the wine value chain.[75] The majority of the wine industry sustainability standards globally include practices related to community relations that go beyond employee volunteer efforts and philanthropy[76] and focus on engagement on difficult environmental issues like ground water withdrawal, zoning and licensing, land conservation,[77] or providing living wages[78] and housing[79] to employees. According to Jason Haas, Partner and General Manager of Tablas Creek Vineyards, "When there's an issue facing the larger region or communities we're part of, we don't stay on the sidelines."[80] For Haas, the success of the Paso Robles wine region, a lesser known but rapidly growing California winegrowing region, comes from "working hand in hand with the community".

[74] Smith, D. "South African wine industry rooted in human misery, says report." *The Guardian*. 23 August 2011. https://www.theguardian.com/world/2011/aug/23/south-african-wine-industry-misery

[75] Sustainable Wine South Africa (SWSA). "Ethical Trading". Retrieved from https://www.swsa.co.za/ethical_trading.htm

[76] CSWA, 2011 Summer.

[77] Ibid.

[78] Wine Institute, 2016 April.

[79] CSWA, 2011 Summer.

[80] Wine Institute, 2016 July.

Stakeholder engagement also includes interaction with regulators and university research staff. Regular interaction with regulatory bodies helps business stay current on existing or new policies measures that can impact business operations. Consistent compliance or pre-emptive implementation can help firms accrue political capital with regulators, opening collaborative opportunities for firms to explore non-regulatory or more practical and cost-efficient measures to encourage greater environmental stewardship. (Darnall et al., 2008). By regularly following university research on issues climate change, invasive species, or best practices, wineries and vineyards can improve production processes and the competitiveness of the firm (Sampedro et al., 2010). Hoffman (2011) found that participants in the Lodi Rule program benefited from regular engagement with university extension staff, and cited the regular interaction as a source of improvement for their vineyard operations.

4.5 Measuring Performance and Impact

Employee training and skill development is relevant for the collection and reporting of data on identified goals to demonstrate progress. Once mission, purpose, and goals have been clearly defined, measuring and tracking progress, creating a feedback loop for regular evaluation of practices and performance is practical and useful (Prigge & Whatley, 2016; Altomare & Nattrass, 2001, Loch & Tapper, 2002). Performance measurements are typically referred to as key performance indicators (KPIs); KPI's are "metrics companies use most often to measure, manage, and communicate results" and include "financial measures such as sales growth and earnings per share (EPS) growth in addition to nonfinancial measures" (Mauboussin, 2012). KPIs help define the actions or changes that will be made, and provide managers with clear indications on how various projects are progressing. Measurement is a means to identify and value projects (Aflaki et al., 2012), and can make the link between "objectives and the measures that employees can control through the application of skill" (Mauboussin, 2012). Yet, despite the utility of performance measures in the change process, the design, implementation, and review of KPIs presents a challenge unto itself.

Sir Ian Cheshire points out, in the foreword to the MultiCapital Scorecard (Thomas & McElroy, 2016) that despite the acknowledged need by the business community to transform economy and business models to become sustainable, the greatest difficult is not in convincing management or owners about the necessity of making the change, but a failure in planning and measuring progress to effectively implement change.

Measurement of strategic goals can take many forms, and is often included in an EMS framework, or as a part of sustainability certification. For instance, companies that report to the Carbon Disclosure Project (CDP) achieve higher rankings according to the depth of their measurement and the progress they have achieved.[81] In other cases, like the California Code of Sustainable Winegrowing, the chapters include self-assessment questions about how wineries and vineyards have established measurement systems, trained staff, and how data is utilized in decision making or reporting (CSWA, 2012). Wineries can use established measurement framework, like ISO or a regional wine sustainability self-assessment, to evaluate their performance on sustainability goals, but company resources (financial, strategic objectives, capabilities), activities (type of operations), staff (knowledge and skills) and geography (local growing conditions and regional or national regulations) make it likely that no single type of performance measurement system will fit every firm perfectly.

The purpose of performance measures is to encourage behavior that achieves the goals of the organization (Loch & Tapper, 2002). In the case of sustainability goals, the purpose of performance measures is to encourage the type of behavior through best practices and new technology that improves the firm's impact on targeted social and environmental issues. For example, if a firm has committed to GHG reducing emissions from operations, the firm will typically set a goal to reduce total emissions by a certain percentage over time. A companywide emissions target can be broken up into department goals based on their contribution to the firm wide footprint, which helps break down the corporate strategy on GHG emissions that to a level managers and employees can relate to. Microsoft has set a voluntary internal carbon price across operations so that each unit pays for the carbon they emit. By adding the carbon tax to their P&L statements, Microsoft "eliminated 9.5 million metric tons of GHG emissions, [and] fostered a corporate culture of sustainability."[82] This is an example of how a performance measure helps communicate corporate strategy clearly to employees at an operational level in a manner that employees can measure and then act on. According to Loch and Tapper (2002) operational measures that employees can relate to and control and that are connected clearly to high-level company strategy and goals helps employees take the most desirable action. A performance measure designed in this manner creates clear targets, establishes actions to achieve those targets, and assigns responsibility. When particularly effective, performance

[81] Carbon Disclosure Project (CDP). Retrieved from https://www.cdp.net/en/guidance/guidance-for-companies

[82] Yale Center for Business and The Environment. "Microsoft's Carbon Fee: Going Beyond Carbon Neutral." 19 February 2017. http://cbey.yale.edu/our-stories/microsoft%E2%80%99s-carbon-fee-going-beyond-carbon-neutral

measures are granular enough to provide employees feedback on how they individually or as a department contribute to the overall company goals.

The case for effective performance measure is clear, but as Sir Ian Cheshire indicates (Thomas & McElroy, 2016) it is often not done effectively which limits the impact and the potential benefits. Loch and Tapper (2002) identified key challenges related to measuring performance:

- Effort levels may not be observable
- Consequences of action are not observable
- Results can be delayed beyond manager or team careers
- High uncertainties or uncontrollable and unpredictable events make it difficult to connect specific actions to success

These challenges mirror those in the wine industry as well that are often cited for reasons (C. Ohmart, Phone Interview. 4 Apr. 2017) why the benefits of sustainability are unclear or why impacts are difficult to measures, which both can impede adoption rates. Take for instance, integrated pest management (IPM). All four of Loch and Tapper's (2002) challenges around performance measurement apply to IPM because the effort required covers multiple personnel with different roles, various practices and techniques are applied, the results like soil nitrogen levels or levels of invasive species take time to measure accurately, and changes in weather and climate can make the results difficult to draw a causal relationship with practices. (Ohmart, C. Phone Interview. 4 Apr. 2017).

The difficulty of measuring the benefits and impact of a sustainability practices also highlights another limiting factor. Continuing with the case of IPM, staff need proper training on pest identification, recording and reporting data, and a wider understanding of impact measurement strategies to calculate the potential benefits to soil health or grape quality. Realizing value of a project or initiative like an IPM depends on employees' technical ability or knowledge for success (Aflaki et al., 2013), and emphasizes the need for employees to be engaged and trained accordingly.

4.5.1 Benefits

Despite potential barriers, performance measurement does have distinct benefits. Performance measurement is a system to enable the cascade effect of strategy to operations that combined with a bottom-up feedback loop on implementation and best practices helps draw out new ideas, improve communication within the company, drive innovation, and motivate employees to engage (Loch & Tapper, 2002; Darnall et al., 2008; Prigge & Whatley, 2016).

Both the data and the knowledge developed throughout the performance measurement process can be looped back into top level strategy planning to add clarity and to communicate progress on keys goals; this allows managers to know what is working, and what is not during the implementation phase. As such results need to be carefully monitored, reviewed, and fed back into the management process to create a cycle of accurate measurements, predicted benefits, monitored results, and verified improvements (Aflaki et al., 2013; Mauboussin, 2012). Josh Prigge, the director of Regenerative Development at Fetzer vineyards, has indicated that effective measurement and tracking practices have been one of the key factors in engaging employees in their recycling program; the result has been a 98.5% waste to landfill diversion rate which in 2014 generated a savings of $700,000 where a 1% increase in the diversion rate delivers an estimated $300,000 in savings.[83]

To encourage the adoption of performance measurement, CSWA introduced in 2011 an online performance metric tool for participants in the SWP to "sort real from perceived outcomes and manage resources more efficiency", "meet increasing market demand about how products are made and their impacts", and to "strengthen the credibility of the [SWP] model with regulators, policymakers, retailers, and consumers.[84] The potential benefits of effective measurement, as CSWA claims, have already been realized by some of the programs participants. Simi winery established KPIs in 2007 that helped reduce in the winery's ratio of water used per liter of wine produced from 5.2 to 3.0.[85] Lubell et al.'s (2011) survey results "support the validity of [the] perceived cost/benefit measures being directly related to grower decision making and perceptions of outcomes" (p. 7).

4.6 Assessing Success and Value

This section highlights potential methods that can be applied to measure success or define value, and the challenges of measuring success. Only 22% of respondents in Atkin et al.'s (2012) study on the potential competitive advantage resulting from sustainability indicated that they had a clear business case or proven value proposition for addressing sustainability; yet, 76% of those respondents also indicated that their business was sustainable from the start

[83] Wine Institute. (July 2015). *Tracking Waste at Fetzer Vineyards*. Retrieved from http://www.sustainablewinegrowing.org/amass/library/22/docs/D2E%20News_Print%20version_July_rev.pdf

[84] CSWA, 2011 Winter.

[85] Ibid.

or that they had recently adopted sustainable practices. This apparent disconnect suggests that companies perceive a value to justify the implementation of sustainable practices and technology, but do not have the appropriate methods to measure the potential value, Kaplan and Norton's (1992) Balanced Scorecard (BSC) utilizes four core indicators, financial, customers, internal process, and learning and growth as a method for incorporating traditional financial performance measure with in-tangibles like learning and growth to create a more holistic value measurement system. Under a classic BSC approach practices or policies should be able to measure present and future value creation in target markets, impact on internal capacities, human resources, and systems and procedures to achieve sustained superior performance (Sampedro et al., 2010). This type of valuation provides firms with a more complete picture of the value generated by their activities, which could be useful for firms adopting sustainability where impact measurement could be difficult.

4.6.1 Value

Heras-Sairzarbitoria et al.'s (2016) survey research found that companies with more intensive internal sources of motivation secure greater benefits from the process of adopting an EMS. Logically, if a company has high levels of internal motivation then it is likely that adopting an EMS has relevance to the firm and therefore the perceived benefits will be higher because the EMS has been designed to meet the internal need or pressure (Heras-Sairzarbitoria et al., 2016); for instance, if a winery recognizes issues related to nitrogen run off into groundwater aquifers, an EMS that addresses run-off can be designed specifically to remediate the problem. If the winery or vineyard can monitor the results, assuming performance measure is a feature of the EMS, then the perceived benefit could be higher. Heras-Sairzarbitoria et al. (2016) categorized internal value or perceived benefits in the following groups, improvement of environmental performance, employee involvement, innovation, or cost saving, and categorized external value as improvement of corporate image, marketing, market demand, relationships with public authorities, and competitive position. Cordano et al. (2010), and Silverman et al. (2005), found that companies who respond to internal pressure may be more successful than others in the adoption of environmental practices. Silverman et al. (2005) suggests further that external pressures do not help explain why one winery or vineyard may be more successful than another in adopting environmental practices.

4.6.2 Measures of Success

The list of internal and external value outlined by Sairzarbitoria et al. (2016) suggests that firms have multiple ways to determine the value. This presents a problem from a research perspective for measuring the success of a firm's adoption of sustainability practices and technology. Definitions of success will vary based on the firm's strategy, materiality, resources, and needs; Jackson Family Wines found significant cost savings through on site solar generation which means that they could determine success based on the financial benefit of the project or its ability to reduce GHG emissions, or both.[86] This difficulty is present Atkin et al.'s (2012) finding that only 22% of survey respondents had a clear business case or value proposition for implementation sustainability. Without a clear business case, it becomes challenging to determine whether implementation of sustainability has been successful.

While in most cases the determination of success will be defined at the firm level based on internal metrics like a financial ROI or a reduction in GHG emissions, the firm's total level of certification may be one method to measure success. Cordano et al. (2010) evaluated the different levels or number of components that wineries had adopted to measure the comprehensiveness of a EMS rather than just looking at whether or not they are certified. Cordano et al. (2010) suggest that certification as a binary measure of success is insufficient to measure the success of implementation; for example, a Carbon Neutral Certification can be achieved by offsetting GHG emissions or purchasing RECs. The Certification alone does not indicate if the company has been successful in reducing its GHG emissions. On the other hand, certification can also indicate that a firm has a sound environmental system in place (Atkin et al., 2012) which communicates their level of commitment to stakeholders, and a relative degree of the comprehensiveness. These considerations are useful to determine how a firm's certification or level of certification across their operations can be used to evaluate the success of implementation. If a firm has achieved certification then it can be assumed that to a relatively degree that the implementation of an EMS, or technology, has been successful otherwise the firm might not have been able to meet the audit requirements for certification.

4.6.3 Adoption Rates

While certification rates can be used to measure the success of implementation for the firm, adoption rates provide perspective on success across the industry. At the firm level

[86] Wine Institute, 2017 April.

adoption rates provide further information about the comprehensiveness of an implemented EMS (Cordano et al., 2010). Adoption rates are measured by the number of wineries or vineyards who have achieved environmental certification or who have implemented specific practices. Adoption rates measure how pervasive the impact of sustainability has been in changing operations and policies. For example, New Zealand Sustainable Wine claims that 98% vineyard producing area have been certified as sustainable,[87] and the Sonoma County Winegrape Commission has untaken an ambitious goal to become the first 100% Certified Sustainable winegrowing region in the world.[88] This type of measurement is a useful measure to understand the breadth of sustainability in a particular region, but it does not produce the full picture of how adoption has actually changed a frim.

The achievement of certification indicates that a winery or vineyard has made changes, but to understand the comprehensiveness of those changes a more nuanced approach for evaluating the adopting of sustainability standards is necessary (Darnall et al., 2008). The CSWA (2016) sustainability report breaks down how wineries and vineyards have self-assessed (ranked) their operations. To achieve Certification wineries and vineyards need to demonstrate a specific level (ranked from a 1-4) of achievement on practices and an improvement plan. The differences between a 2 and a 4 (a requirement for certification) may include multiple practices or policies. This allows CSWA to report on the adoption rates of specific practices, but it does not necessarily measure impact of the practices. This nuanced evaluation of adoption rates matters especially for wineries who are concerned about their impact since the impact of the entire business value chain will not be determined solely on the achievement of certification, but on the comprehensiveness and penetration of sustainability measures. This reason helps explain why CSWA goes to such lengths on performance metrics, carbon accounting, and cost benefit tools because it allows wineries who have adopted practices to track progress and measure impact effectively.

[87] New Zealand Sustainable Wine. (2016) *Sustainability Report*. Retrieved from https://www.nzwine.com/media/4188/nzw-sustainability-report-2016.pdf

[88] Sonoma County Winegrowers Association. (2014). *Sonoma County to Become Nation's First 100% Sustainable Wine Region*. Press Release. 15 Jan. 2014.

4.7 Establishing the Conceptual Framework

The review of existing operations and management, sustainability literature, and the Business Case provide a high-level framework that outlines a potential strategic approach for firms to apply in adopting and implementing sustainability. As the different approaches in the reviewed literature exemplify, firms have multiple strategic paths to follow. Yet, there are a few key common strategies that create a Conceptual Framework around Vision, Leadership and Strategy, Employee Engagement, and Performance and Impact Measurement that can be the foundation to establish a methodology for evaluation.

In Vision, Leadership, and Strategy, clearly defined strategic objectives with associated targets and goals that is championed by motivated leadership can help establish priorities, clarify responsibility, and identify an appropriate EMS or standard to act as the implementation vehicle. In Employee Engagement, case studies from the wine industry demonstrate the importance and value of engaging employees throughout the strategic and implementation processes. Firms have engaged employees through clear communication, goal setting and performance measurement, establishing a sustainability team, and regular workshops and training on sustainability. Regarding Performance Measurement, the literature emphasized the need for appropriately designed and clear performance measurement systems to track progress toward sustainability goals, engage employees, and ensure the effectiveness of the targeted impact. The types of measures chosen, staff training, and regular feedback to review progress are all areas that could make a firm more successful in implementing performance measurement as a part of its sustainability strategy. Each of these areas presents the firm with unique considerations that they can utilize to define their overall approach to implementing sustainability. This framework has been transformed into an online survey (Appendix A) to evaluate the decisions firms have made on sustainability, the actions they have taken, and to measure the extent they have been able to track the benefit and impact of sustainability across their operations, for their stakeholders, and on the environment.

5 Survey and Analysis

5.1 Survey Design

Based on both the Business Case, including the motivations and potential benefits, and the Conceptual Framework established from the literature, this research survey set out to evaluate which factors could influence how successful a winery or vineyard is in implementing and adopting sustainability. An online survey (Appendix A) was built around these core framework topics: Vision, Leadership and Strategy, Employee Engagement, and Performance and Impact Measurement. The survey was designed and adapted with input from existing survey instruments and research focused on EMS and sustainability in the wine industry (Cordano et al., 2010; Galbreath, 2010; Sampedro et al., 2010; Atkin et al., 2012). Additionally, interviews with industry professions (Jordan, A. Phone Interview. 3 April 2017; Ohmart, C. Phone Interview. 4 April 2017), and winery or vineyard owners or management staff (Eden, R. Personal Interview. 24 Mar. 2017; Olsen, R. Phone Interview. 11 April 2017; Prigge, J. Phone Interview. 14 Feb. 2017) tested the suitability, and relevance of the questions.

Wine industry professionals responded to 41 questions organized into four categories: Respondent and Company Demographics, Vision and Leadership, Employee Engagement, and Benchmarking, Reporting and Impact Measurement. Each had questions to establish what relevant actions firms have taken, and what has been the impact within that area. Woven throughout the survey were questions within each category that are measures of success, like percentage of certification, success of achieving goals, improvement on employee satisfaction, or the measurable impact on resource use.

5.2 Distribution

The survey distribution approach was one of the limitations to the survey that will be discussed below. The survey was distributed through a combination of direct emails, LinkedIn messages, posts to wine industry LinkedIn groups, and through wine industry organizations who sent direct messages, posted the link on websites, or included the survey link and description in the newsletters. The purpose of this approach was to generate a high response rate among wine industry professionals who were familiar with sustainability topics so that the results would be reflective of practical experience on implementing sustainability. The scattered approach and different delivery format makes it difficult to compute a single response

rate figure that can be compared in a meaningful and accurate manner with similar survey samples. Direct email was the most effective technique generating 50% (22) of the responses, and the next closet was direct messages through LinkedIn at 16% (7) of responses. Wine industry organizations were contacted based on their affiliation with, or management of, a wine industry sustainability program. In various formats, the description and survey link was distributed through the following industry groups: Entwine (Australia), SOStain (Italy), Vinos de Chile, Sustainable Wine New Zealand, Bodegas de Argentina, Low Input Viticulture and Enology (LIVE), California Sustainable Winegrowing Alliance, and the Washington Association of Wine Grape Growers.

5.3 Survey Bias

Survey questions relied on Likert scales that prompted respondents to respond to questions based on their experience or opinion so the results are vulnerable to response bias given that many of the questions dealt with business performance or social and environmental issues. Respondents may have responded more favorably toward these questions since they were assessing their own firm or potentially their own actions. In a similar manner, voluntary response bias is also present since the respondents were not randomly selected but in fact, targeted to respond to the survey. The targeting of winery and vineyard staff also creates a potential over representation of firms who have actively pursued certification as a part of their business strategy or who have consistently implemented sustainability practices since such businesses would have more interest in responding to a survey about the potential benefits of adopting sustainability.

However, these limitations are partially offset by one of the key objectives, understanding how companies have integrated sustainability into decision making and management. Given that objective, such a response bias was expected, and welcomed because it suggests that the respondents answers are reflect practical working experience on issues related to sustainability or on the implementation of new practices and technology directly.

5.4 Survey Limitations

The key limitation to survey was the design and over reliance of ordinal categories and Likert scales which limited the ability to run tests for significance across data without key measures that were nominal and continuous. This limitation was compounded by the low

response rate (44), which is sufficient for analyzing general trends and making high level inferences, but it is not sufficient to confidently extrapolate the results from hypothesis testing as representative sample of the global wine industry. The low response rate also made the intended statistical models weak and inconclusive to such an extent that they have not been included. While the models would have demonstrated the potential insight, they lacked both fit and significance to draw valid conclusions. After re-categorizing the scaled data, and running simple ordered logistic regressions it became apparent that multicollinearity between the categorical explanatory variable also limited the model fit. Correct testing is possible but again the low response rate and added complexity would negate the ability to draw significant or relevant conclusion other than to demonstrate the potential techniques.

Given these limitations, however, solutions for improvement in further research are practical and include the use of mixed ordinal and nominal data, less reliance on Likert scales, and a clearly defined, simple hypothesis that was not reliant on the combination of multiple factors to determine one outcome. Additionally, to overcome response bias and improve the response rate, the survey could focus on one geographical location in a large industry like California that also has wide adoption of sustainability standards. Such a targeted approach could take advantage of random mailing distribution for a more representative sample.

5.5 Respondent Demographics

Respondent and company characteristics provide context to evaluate potential response bias by understanding how respondents relate to sustainability. Respondents were asked to describe their position within the company (Owner, CEO, Sales, etc.), the amount of time they dedicate to sustainability projects, and how sustainability is included in their job description. These characteristics help evaluate respondents' relation to sustainability could potentially influence their responses throughout the survey.

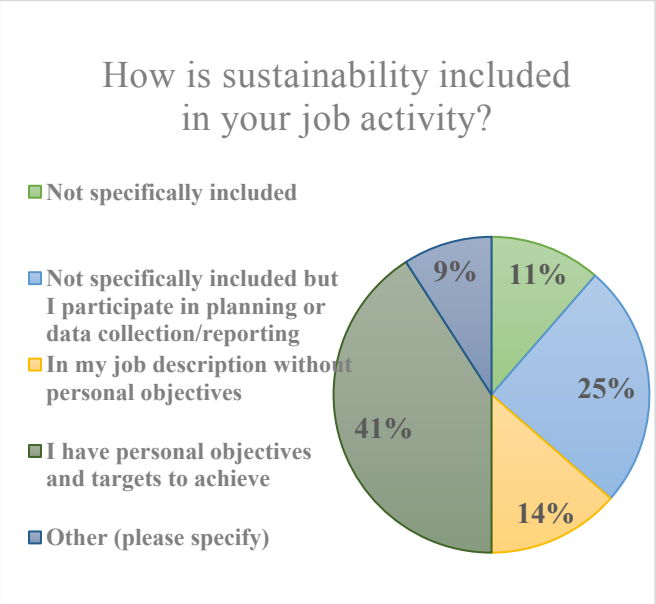
Respondents also provided information on their company's location, number of employees, years in operation, acreage of vineyards under ownership and management, annual winery case production, percentage of certified vineyards and wine production, average bottle price, and average growth rate in the past five years. Company details provide further possibilities to sub-categorize respondents analyze trends.

In total, 44 respondents submitted complete and useable online surveys. Respondents represent wineries from Argentina, Australia, Austria, Chile, Cyprus, France, Italy, and the

United States of America (U.S.). 61% of the respondents are U.S. based and from wine producing regions in California, Michigan, Missouri, and Oregon. The high representation from the U.S. was expected given the researcher's strong professional ties to wine industry there and that the survey was conducted in English, making it easier for native English speakers to complete. Even though the U.S. is the fourth largest wine producer the world (OIV, 2017), European countries still account for an estimated 60% of global production, (MarketLine, 2015) so it is difficult to claim that the survey responses are representative of the global wine industry based on production. Though the responses are more reflective of the U.S. industry.

36.4% of respondents described their position as a Manager (Cellar, vineyard, tasting room, etc.) or as an Owner, 31.8% as a Winemaker, and 20.5% as an Executive (CEO, COO, CFO, etc.). Respondents could select multiple options to describe their roles. Respondents also described their roles as sales, business administration, cellar or vineyard, health and safety, consulting, or as a board member.

45% of the survey respondents dedicate 1-24% of their time to specific sustainability related projects with only one respondent dedicating no time, and four dedicating 100% of their time. Additionally, 40.9% of respondents indicated that they have 'personal objectives and targets to achieve' and 25% of respondents do not have sustainability specifically included in their job activity but they do participate in planning or data collection/reporting on sustainability.

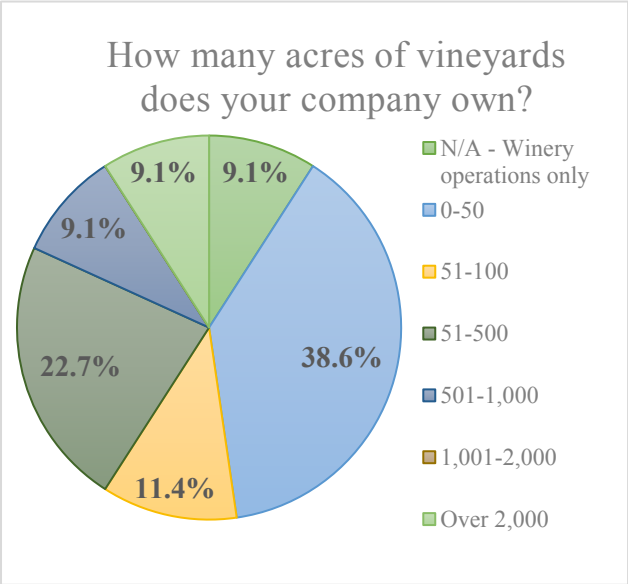


Respondents also noted in open ended responses that sustainability is fully integrated into their work or business strategy, making it difficult to separate time that is non-sustainability related. Logically, since sustainability includes the economic well-being of the business, respondents could interpret any business-related activity as working on a sustainability projects because it supports the economic longevity of the firm. Regardless of this limitation, the high rate of respondents with sustainability related personal objectives and targets and that 40% of respondents dedicate 25%-74% of their time to sustainability related projects suggests that respondents are familiar with sustainability concepts, and work for companies with

sustainability initiatives. This does imply a potential response bias as suggested in the above (5.3 Survey Bias), which may result in answers that view sustainability more favorably, especially given that respondents have personal objectives on sustainability. However, the respondent group does suggest a high level of familiarity and experience with sustainability, adding credible weight to the trends in the responses.

5.5.1 Company Demographics

Where data is available and relevant, company demographics will be compared with global data to evaluate the representation of the whole industry. Where global statistics are incomplete, comparisons have been made with the U.S. industry since 61% of respondents represent U.S. based firms. The largest proportion of respondents (40.9%) work for wineries or vineyards that employ between 1-9 full time employees, and 34.1% for firms with 10-49 employees. Only three respondents, work for companies with over 1,000 employees. In the U.S. 9,901 wineries[89] employ an estimated 78,795 workers[90] which averages to around 9 employees per winery. Even though this estimation does not include vineyards, vineyards only operations make up a very small portion of respondents, so companies do fit the U.S. size by employee closely. The represented firms have been in business between for 6-20 years (43.2%) with four companies operating for 1-5 years, and another four companies for over 100 years. Only four respondents represent winery only operations (no vineyard ownership or management) and five respondents work at for firms that exclusively own or manage vineyards without any winery operations. 38.6% of the respondent's companies own between 0-50 acres, 22.7% own 101-500 acres, and four respondents own over 2,000 acres. By comparison, 85% of U.S. grape farms own bearing acreage between 0.1 to 49.9 acres,[91] which



[89] Wines and Vines. (2017, April). *Wine Industry Metrics*. Wine and Vines Analytics. Retrieved from: https://www.winesandvines.com/template.cfm?section=widc&widcDomain=wineries

[90] SICCODE. (2017). NAICS Code 312130 Wineries. Retrieved from: http://siccode.com/en/naicscodes/312130/wineries

[91] United States Department of Agriculture (USDA) National Agriculture Statistical Service. (2012). Census of Agriculture: Specified Fruits and Nuts by Acres: 2012 and 2007. Retried from: https://agcensus.usda.gov/Publications/2012/Full_Report/Volume_1,_Chapter_1_US/st99_1_039_039.pdf

suggests that the respondents over represent larger vineyard operations compared to the U.S. average. The distribution for vineyard size under management is similar to that of owned vineyards. For the 39 respondents who work for companies with winery operations, the annual wine case (9L) production ranged from up to 2,000 cases (11.4%) to over 100,000 cases (27.3%), with 25% of wineries in the 2,001 to 20,000 annual case production range. The spread of case production is consistent with the U.S. average winery case production of an estimated 38,000 cases a year.[92] Respondents work for firms with an average bottle price (USD) in the $11-$20 range (50%) and $21-$50 (40.9%) range, whereas in the U.S. only 33% of producers have an average bottle price between $11-$19.99, and around 58% have an average bottle price of $20-$59.99. This implies that the survey respondents are potentially over represented by wineries in the $11-$20 category compared to the U.S. average.

Respondents indicated that the companies they work for have achieved varying degrees of either Organic, Biodynamic, or Sustainable certifications. In this section, and the following analysis, a weighted average is used as a measure to differentiate respondent answers to a scaled question; a weighted averaged that falls between two categories does not suggest that the average responses is represented between the two ranges because on Likert scales it is incorrect to assume an equal difference between categories that are subjective. Regarding vineyards owned or managed by the company, 'Sustainable' certification the highest weighted average (where 1 equals 0% certified and 5 equals 100% certified) of 3.79. Following the explanation of the weighted average, the 3.79 weighted average for 'Sustainable' represents the category of certification that received the largest proportion of responses from an upper end (5) range of the scale. For instance, 'Sustainable' had the highest number of wineries or vineyards (16) achieved 100% certification. 'Biodynamic' has the lowest weighted average (2.28) and it had the highest number of wineries and vineyards (20) who have 0% of their operations certified. There is a clear spread between firms with 0% certified vineyards and 100% certified vineyards with fewer operations in between. This trend is consistent across Organic, Biodynamic, and Sustainable certifications where few of the firms have only a percentage of their vineyard operations certified. Such a spread implies that for wineries and vineyards the decision to pursue vineyard certification is an all or nothing decision. To develop further insight on how success, represented by the achievement of certification, differs based on implementation practices, further data from firms with partial certification would be useful.

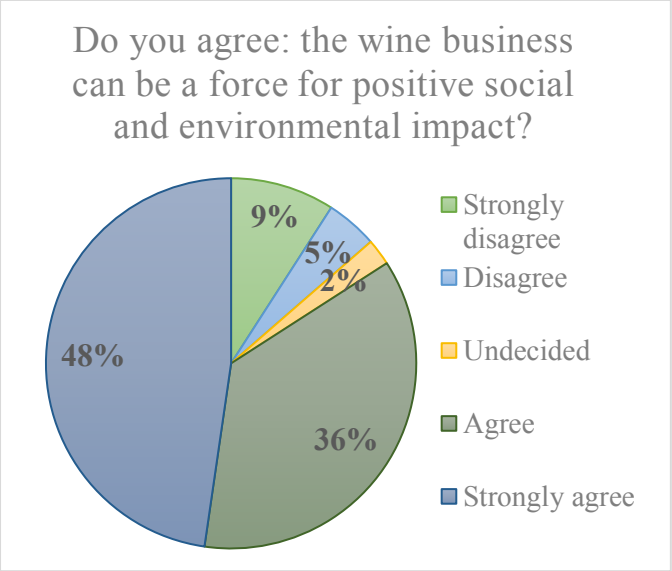
[92] Wines and Vines, 2017.

Regarding the certification of final wine production as Organic, Biodynamic, or Sustainable, a similar divergent spread of responses appeared. Wineries and vineyards have achieved the highest percentage for certified 'Sustainable' (3.46), followed by Organic (2.43), and Biodynamic (2.10). 'Sustainable' had the most firms (13) achieve 100% certification and Biodynamic had the most firms (27) achieve 0% certification. There were a higher number of respondents who selected 0% certified compared to the previous question on the percentage of vineyard acreage certified which could suggest that certification of the final product is harder to achieve, the certification is not as common, or that wineries and vineyards who perhaps have certified their vineyard operations see less benefit in certifying the final product.

Respondents filled in any additional 3rd party certifications for wines or operations not included within the Organic, Biodynamic, or Sustainable categories. 57% of respondents indicated that they have achieved other or additional certifications like ISO, B Corporation, FSC, Fish Friendly Farming, Zero Waste, or Carbon Neutral. The results suggest that wineries and vineyards can, and have, adopted a wide range of sustainability standards. Furthermore, this result implies that the actions, decisions, and issues addressed by wineries and vineyard through these various standards may make it more difficult to identify specific trends; while some practices may be applicable under ISO or B Corp, they may not be under Organic or Carbon Neutral. A gap analysis of the different standards would be beneficial research that could help identify specific practices or technologies that are common 'hot spots' or areas of success and impact within the standards for firms to prioritize.

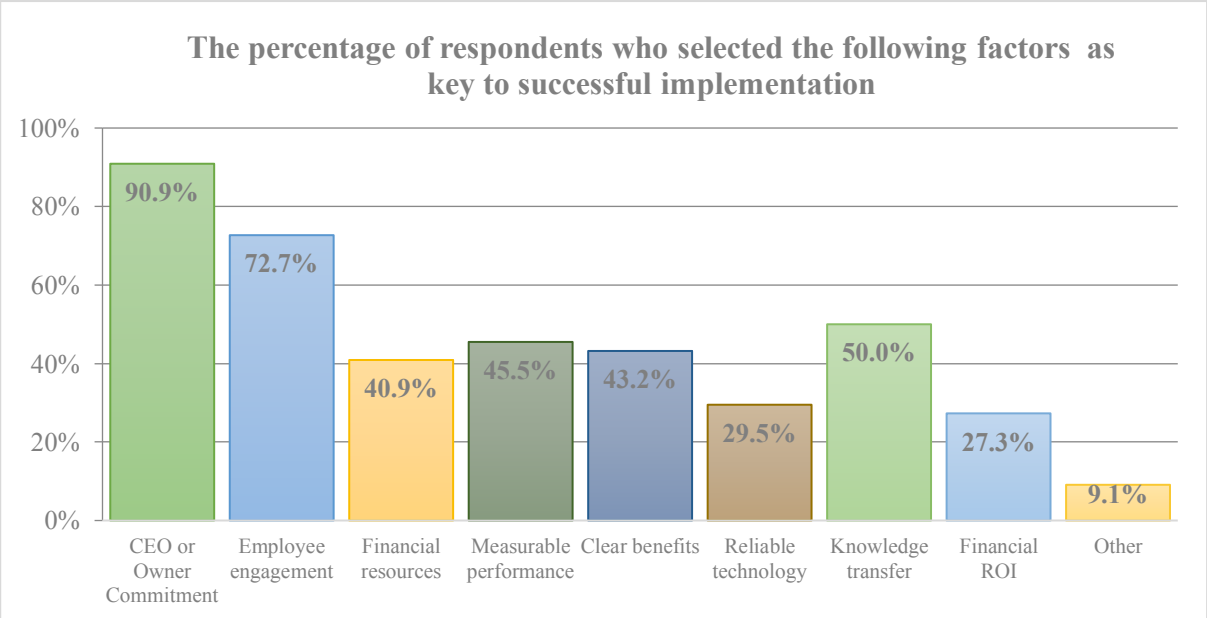
5.6 Vision and Leadership

This section intended to develop insight on how firms make decisions on sustainability projects, and whether the factors behind those decisions influence success and impact. The questions in this section covered what sustainability issues were most relevant to the business, what factors influence decision making on implementation, what factors improve or inhibit successful implementation, as well as questions on mission statements,



goal setting, and perceptions of impact and success. The actions included in this section are the integration of social and environmental goals into firm vision, and goal setting.

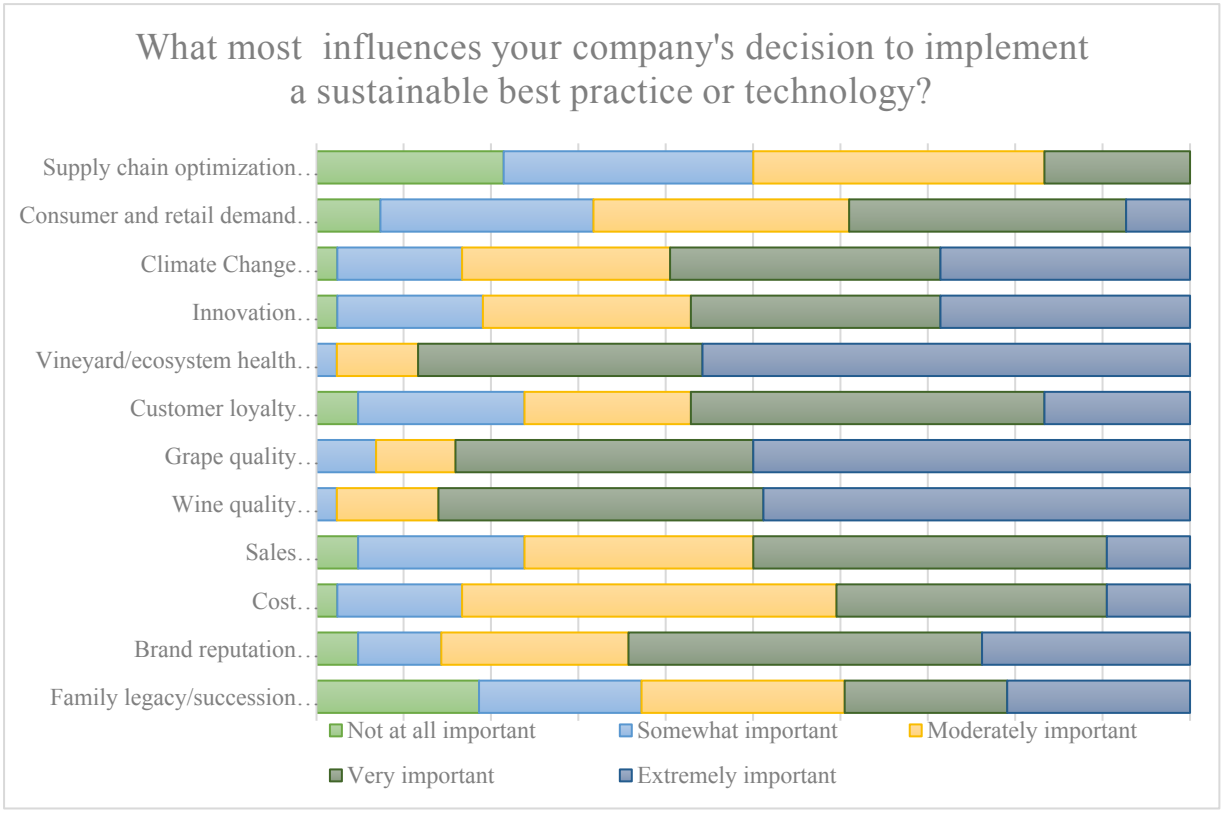
To evaluate how high social and environmental goals have been built into firm strategy, respondents were asked if such goals were included in the firm's 'mission, purpose, or vision.' 79.5% of respondent answered 'Yes' and five (11.4%) of respondents answered that their company does not have one. This high response for the inclusion of social and environmental goals suggests that the represented firms have made a point to single out social and environmental issues in their business strategy. Therefore, it is logical that 47.8% of respondents indicated that their company has set 'Very' to 'Extremely' ambitious sustainability goals. This type of strategy establishment and goal setting follows closely suggested implementation strategy suggested in the Conceptual Framework (Aflaki, 2016; Cordano et al., 2010; Kaplan & Norton, 1992; Prigge & Whatley, 2016). Respondents also suggested that their company has been 'Very Effective' (38.6%) in achieving social and environmental goals. Even though this is a subjective indicator and prone to self-response bias, the positive trend in the responses does imply that the represented firms have successfully implemented sustainability practices or technology to achieve environmental and social goals.



In continuing support of the conceptual framework (Darnall et al., 2008; Cordano et al., 2010; Prigge & Whatley, 2016; Galbreath, 2016), 90.9% of respondents indicated that 'CEO or Owner Commitment' was a key factor in facilitating the successful implementation of sustainability followed by Employee Engagement (72.7%), Knowledge Transfer (50%), and Measurable Performance (45.5%). Respondents consideration of these factors as key to implementation success is aligns closely with key factors suggested in the Conceptual

Frameworks employee on engagement (Aflaki, 2012; Cordano et al., 2010; Darnall et al., 2008; Prigge & Whatley, 2016), knowledge transfer (Loch & Tapper, 2002; Aflaki et al., 2012; Galbreath, 2016; Prigge & Whatley, 2016), and performance measurement (Altomare & Nattrass, 2001, Loch & Tapper, 2002, Aflaki et al., 2012, Prigge & Whatley, 2016), lending further support for the framework structure as a reliable method for testing. Additionally, 61.4% respondents considered 'Time' to be a factor that inhibits successful implementation followed by 'Project cost' (52.3%), and 'Staff Knowledge' and 'Unclear benefits' each with 36.4%. Knowledge transfer has been included in the Conceptual Framework under Employee Engagement, and unclear benefits is examined under Performance Measurement, since performance measurement could clarify benefits. Results regarding potential impact of factors for success highlights the key areas that can be prioritized. Staff knowledge on sustainability is considered by respondents to be both a key factor for success, and thus logically, a lack of knowledge could be inferred to inhibit success. On the other hand, respondents strong support for 'CEO and Owner Commitment' as a key factor for success is contrasted by 'Lack of management support' as one of the less relevant factors that inhibits supports. This contrast suggest that firm leadership could be highly influential in determining if implementation is a success, whereas a lack of leadership is not potentially a crucial a key factor in holding back implementation success.

Respondents were inclusive of the factors that influence firm decision-making. Respondents; on a scale from 1-5, where 1 is 'Not at All Important' and 5 is 'Extremely



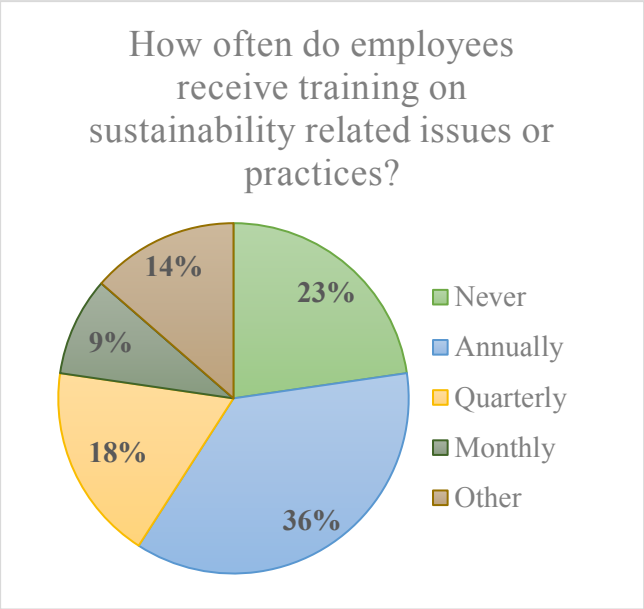
Important' only 'Supply chain optimization' had a weighted average of less than 3 (Moderately Important). Respondent considered 'Vineyard/Ecosystem health' (4.42), 'Wine Quality' (4.33), and 'Grape Quality' (4.27) as the most influential (with higher proportions of answers toward the 5 end of the scale). This pattern of responses suggests that respondents are highly influenced by the vineyard impacts since 'Vineyard/Ecosystem health' can affect 'Grape Quality', which in turn can affect 'Wine Quality.' The relative importance of all factors suggests that respondents face range of issues and considerations in their decision-making process, adding further complexity to the process of strategic prioritization.

Contrary to past research (Delmas & Gergaud, 2012; Hoffman, 2011; Slawinski & Bansal, 2009) on firm motivations to adopt sustainability, 'Family legacy/succession' received the second most responses (8) as 'Not at all Important' and had an average weighted score of 3.05, placing it as the second least influential factor in firm decision making. Respondents suggested additional influences behind their decision making that included land and community stewardship, ethical 'doing what's right' considerations, financial ROI, company culture, and carbon accounting.

5.7 Employee Engagement

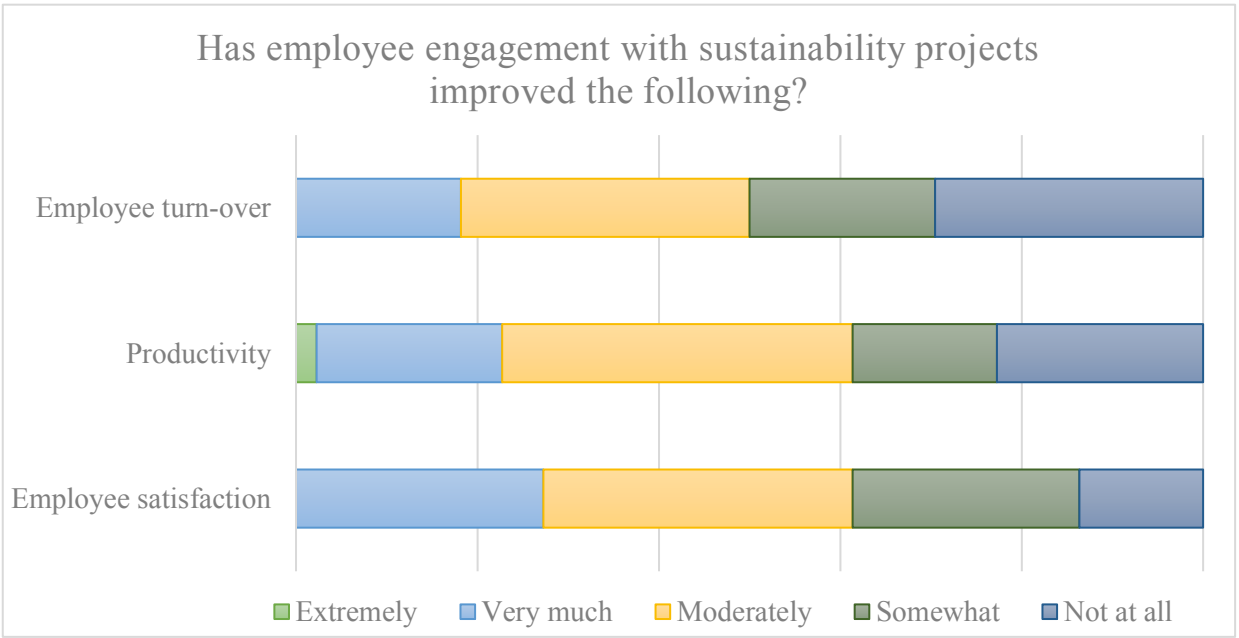
This section had two main functions. First, establish what actions firms have taken, and how and to what extent, do firms have structured methods for engaging employees on sustainability projects. Surveyed actions include the formation of a sustainability team, including non-management employees in strategy formation, training, and employee feedback. Second, this section defines the extent to which employees benefit from engagement with sustainability and whether employee engagement on sustainability has improved employee satisfaction, productivity, or employee turnover as a measure for success.

Responses on forming a sustainability team and including non-management employees in designing sustainability strategy ran counter to suggestions from Aflaki et al. (2012), Loch and Tapper (2002), Prigge and Whatley (2016). Only 36.4% of respondent companies have a group or team that manages companywide sustainability projects. 52% of respondents indicated that non-management employees 'Never' or 'Rarely' contribute to designing company sustainability strategy even though 59.1% of the respondent's companies have a mechanism for employees to provide feedback or suggest new ideas regarding best practices or new technology. Respondent's answers on employee training related to sustainability issues and practices paralleled the suggestions from Sampedro et al. (2010) and Prigge & Whatley (2016).



Only 22.7% of respondents indicated the employees 'Never' receive training on sustainability issues and practices, whereas the remainder of respondents answered that employees receive training Annually (36.4%), Quarterly (18.2%), and Monthly (9.1%) The mixed response trends suggests that companies have different approaches to how they manage employee engagement on sustainability; however, despite potential variation among the approaches to employee engagement, respondents suggested that employees benefit from engagement with sustainability 'Moderately' (38.6%) to 'Very Much' (29.5%). Firms may have different approaches to employee engagement, but they potentially see value in engagement.

To understand further how respondents viewed the benefits of employee engagement, they were asked to what extent has engagement on sustainability improved 'Employee Satisfaction,' 'Productivity,' and 'Employee Turnover.'



Employee satisfaction had the highest weighted average (2.75) where 1 is 'Not at All' and a 5 is 'Extremely'. Productivity had a weighted average of 2.64 and Employee Turn-Over 2.39. The results suggest that the benefits from employee engagement on sustainability are relatively moderate though a more quantified measure of changes in productivity, satisfaction, and

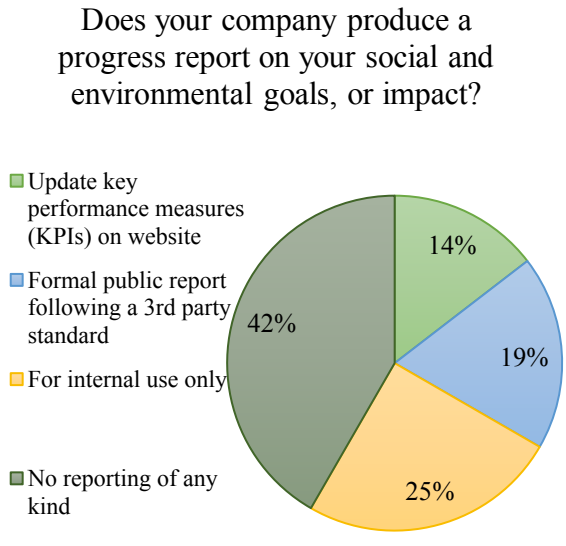
turnover could demonstrate how even moderate improvements to these factors can pay off financially for a firm (Rochlin et al., 2015).

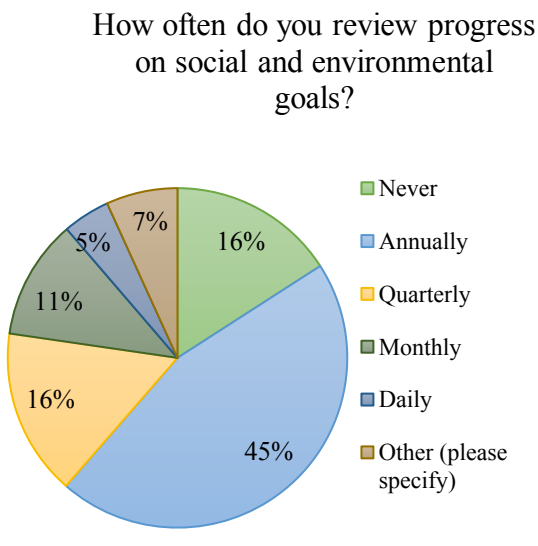
5.8 Benchmarking, Reporting, and Impact Measurement

In the survey, Benchmarking and Reporting, and Impact Measurement were organized into two distinct sections; however, the questions in each section are highly inter-connected as firm actions established through the questions in Benchmarking and Reporting section could influence responses on Impact Measurement. Combining the results from each section provides additional insight. For instance, by organizing respondents by those who utilize KPIs and those who do not and comparing the answers between the groups on the impact of monitoring performance it is possible to evaluate whether the use of KPIs could have a measurable impact on resource use.

When it comes to the actions taken by the firms, respondents were asked about the type of reports the company produces, whether they utilize KPIs, how often progress is reviewed, how often data is used in decision making, and how employees are involved with KPIs. Impact Measurement included two questions that asked respondents to evaluate the extent to which monitoring performance has had a measureable benefit on key resources inputs and outputs, and whether performance measures clarify the benefits.

45.5% of respondents indicated that their companies do not produce any kind of progress report on social and environmental goals or impact whereas 36.4% of respondents produce public facing progress reports through regularly updated performance measures on the website or





through formal public reporting following a 3rd party standard. The remaining 27.3% of respondents produce progress reports that are utilized internally.

Despite the fact that over half (58%) of respondents indicated that their companies utilize some type of reporting and that 84.1% of respondents review progress on social and environmental goals on at least an annual basis, only 36.3% of firms have KPIs to track their progress on social and environmental goals. 54.5% of respondents work for companies that have not set KPIs, and 9.1% of respondents indicated that they find it difficult to measure progress. Cordano et al. (2010) and Atkin et al. (2012) both suggested that performance measurement through KPIs is a key factor in successful implementation and important for understanding benefits. Since 58% of the respondents utilize reporting, it is reasonable to expect the use of KPIs in some form to monitor progress for use in reports. There are a few possible explanations for this divergence between reporting and the use of KPIs. First, respondents may have different definitions for both reporting and KPIs, and it is possible that respondents misunderstood what each meant. Second, the question was poorly worded in that it specified energy, water, and employee satisfaction as examples which could have been leading, and if their company does not track those specific measures they could have selected 'No'. Third, it was a binary question between using KPIs and not using KPIs when in practice companies might utilize informal KPIs, like stories about their community engagement in a sustainability report, rather than reporting on specifically tracked quantitative measures.

This possibility of confusion regarding the definition and use of KPIs is consistent with responses on the frequency at which data and progress toward social and environmental goals in decision making. Where 1 is 'Never' and 5 is 'Very Often', respondents suggested that they personally use (a weighted average of 3.51) data and progress in their decision making more often than it is used within their department (3.20) or by executives or owners (3.21). Again KPIs, could have been utilized in this case for data collection and reporting as was suggested in the conceptual framework (Altomare & Nattrass, 2001, Loch & Tapper, 2002, Aflaki et al., 2012, Mauboussin, 2012; Prigge &Whatley, 2016), but the survey results on KPIs suggest otherwise. The overall trend on performance measures implies respondents are utilizing some type of performance measure, though it may differ from the suggested survey definition, to review progress, make decisions, and complete reporting protocol. Further research on the type of systems wineries and vineyards are using to track progress and collect data, or a different definition of KPIs would be beneficial to provide clarity on how firms are managing performance measurement since research listed above has found evidence supporting the use of performance measures in management systems.

5.9 Evaluating Effectiveness

The survey included questions to evaluate how effective firm strategy and actions have been in implementation, covering financial performance, employee benefits, and impact measurement. Responses on the coverage of certification have not been included here for analysis due to the way in which respondents could select both 100% certified for multiple categories or could select 0% certified under one category and 100% for another, which would distort the perception of those who have zero certification and could potentially double count those with multiple certifications. Certification is still a useful measure of success but based on the results previously outlined, it has been excluded here. The use of multiple success measures is practical because it captures the different ways wineries and vineyards value sustainability, and thus, can justify internally specific courses of action. Furthermore, since sustainable practices and technologies in the wine industry address social and environmental issues, it is necessary to understand if the implementation of these practices and technology have positive impacts on the issues they were designed to correct or improve.

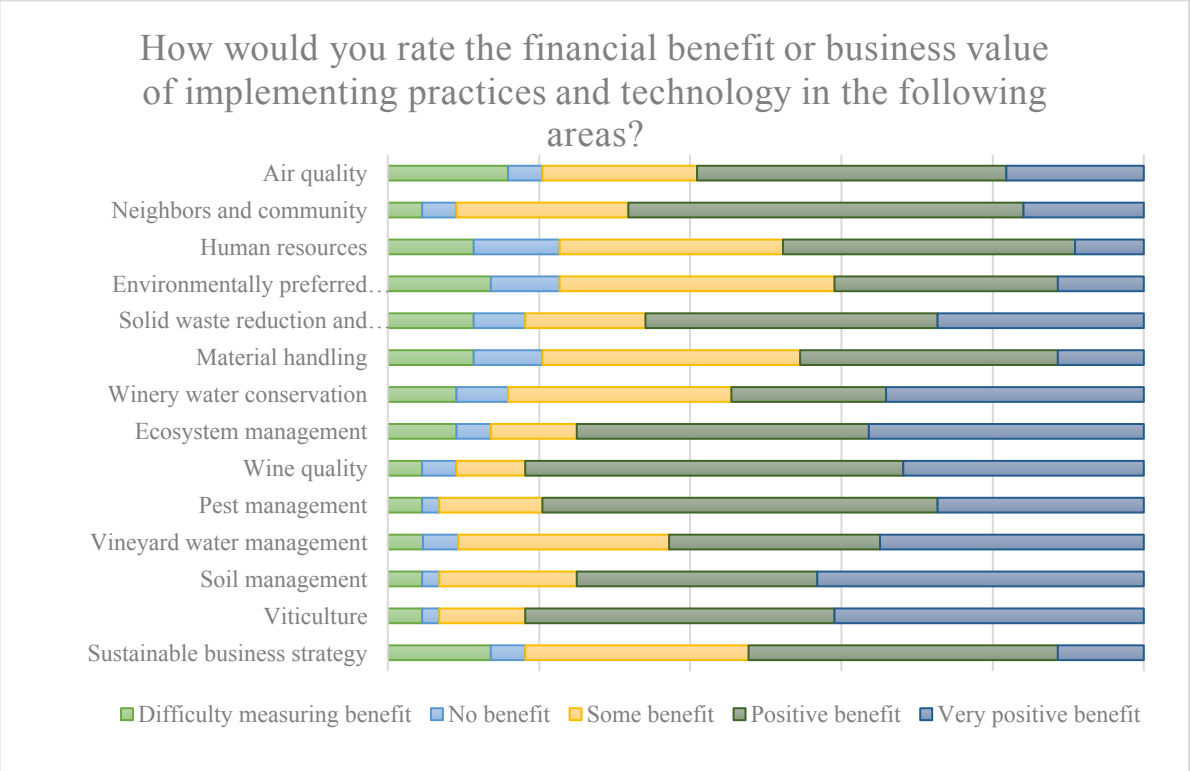
As previously noted, respondents (38.6%) affirmed that their companies have been 'Very' successful in achieving their social and environmental goals. To further understand how respondents would evaluate success, respondents were asked an open-end question on how they define success within their company. Responses varied, ranging from achieving personal goals or company targets to ensuring continued vineyard health. 38.6% of respondents included financial measures like profit, sales growth, budgets, or ROI, followed by wine quality (22.7%), and stewardship (20.5%), which included ecosystem, company, and community stewardship.

5.9.1 Financial Performance

52.2% of respondents work for firms with a profit growth rate in the last five years between 1-10%, and 15.9% of respondents work for firms with a growth rate over 20%. Since only 6.8% of the respondents have had zero or negative profits over the last five years, most of the firms represented by the respondents appear to be financially stable or growing. With over half of respondents indicating a growth rate between 1-10% over the last five years, it is reasonable to assume that the companies have financial growth is at least around or above the industry average CAGR from 2010-2014 of 3%. While an imperfect comparison since the question did not specify CAGR, the comparison does suggest that respondent's average growth rate is at or outperforming the industry average (MarketLine, 2015).

On rating the financial benefits of implementing sustainability practices or technology, favorable responses were expected considering that in the section on Vision and Leadership 43.2% of respondents indicated that ‘Clear benefits’ is a key factor to the successful implementation of sustainability. 36.4% of respondents suggested that ‘Unclear benefits’ were a key factor that inhibits successful implementation.

Knowing this, it is reasonable to assume that respondents appear to more likely to implement projects with clear benefits, financial or otherwise, so when it comes to rating the financial benefits of practices they have implemented, it is reasonable to anticipate favorable ratings.

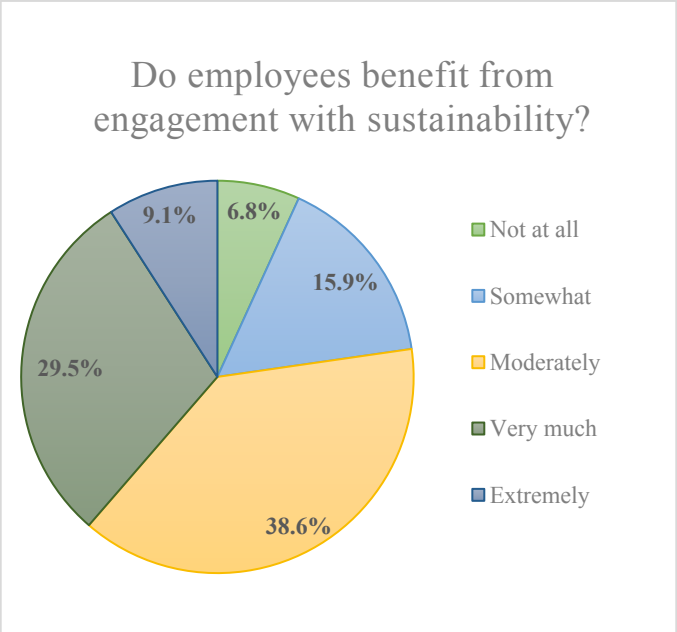


Viticulture (4.11), Soil Management (4.07), and Wine Quality (4.00) were the highest (1 is ‘Unclear or difficulty measuring’ and 5 is ‘Very positive’) rated sustainability areas with a financial benefit. On the other hand, Environmentally Preferred Purchasing (3.16), Human Resources (3.23), and Material Handling (3.25) had the lowest rated benefits. Despite the lower ratings, it is worth noting that none of the issues areas had a weighted average lower than a 3.00, which suggests that generally respondents view at least some financial benefits across different sustainability practices and technologies. Compared with examples brought up in Section 3 the Business Case, the survey responses are consistent with the issues areas where wineries and vineyards have been successful financially, but given the frequency of cases that cited financial benefits from renewable energy, energy efficiency, water management, and packaging, higher ratings for these categories was expected. The overall positive trend of ratings, and case studies regarding the financial benefits of sustainability adds further validity

to the Business Case for sustainability, and the usefulness of including financial measures of sustainability projects within a management system.

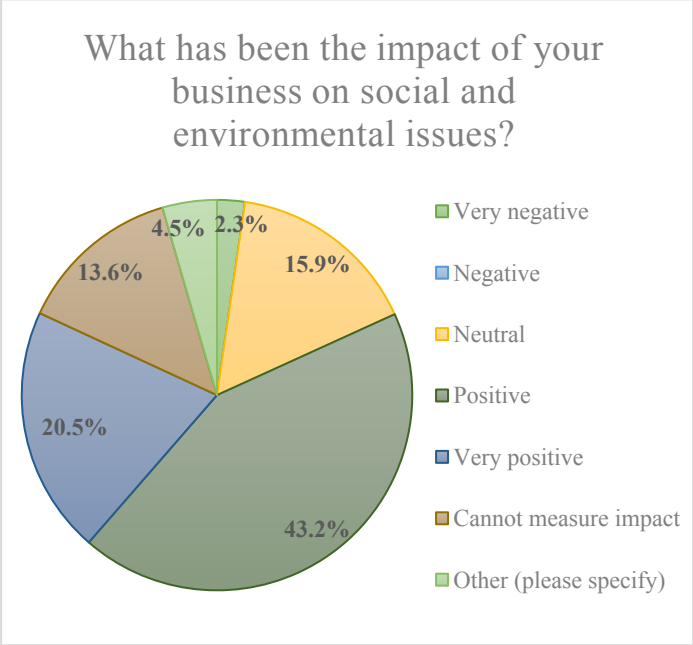
5.9.2 Employee Benefits

The potential improvements to employee satisfaction, productivity, and turn-over were covered in Section 5.7 and the results suggested that the respondents see moderate improvements across all three factors. Given this result, it is logical that respondents also felt that employees generally benefit from engagement on sustainability. 38.6% of respondents indicated that employees benefit 'Very Much' to 'Extremely'.



5.9.3 Impact Measurement

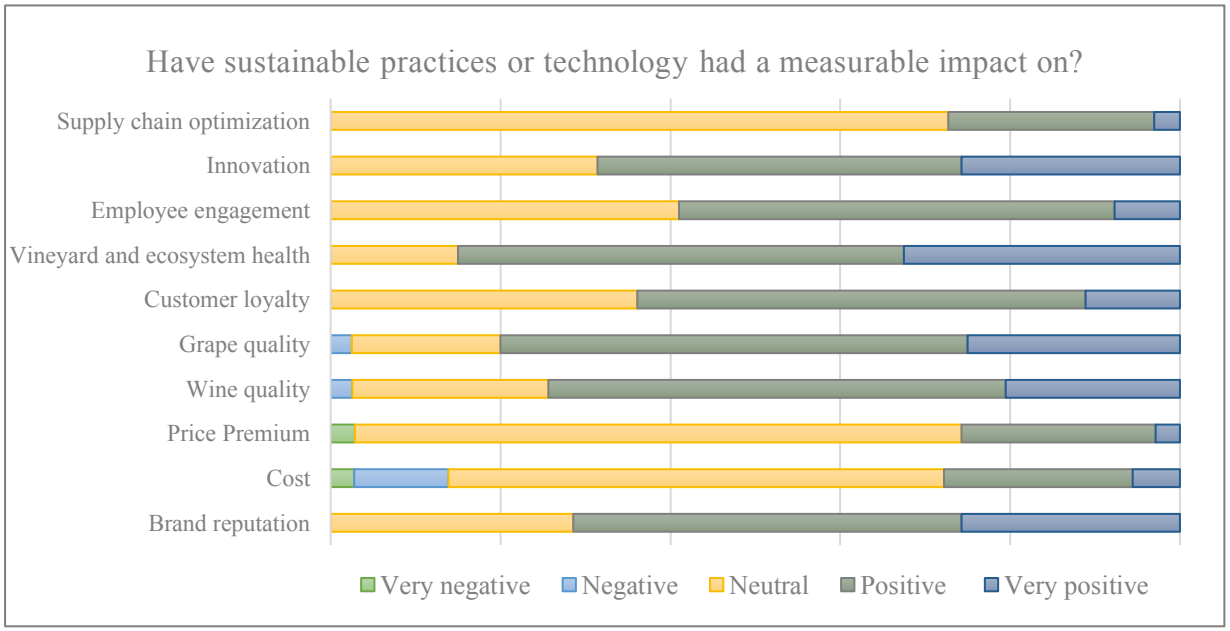
Impact measurement, like measuring benefits, can present a challenge because measurement can be a factor that improves implementation as the survey responses already indicated. To establish attitudes on the potential impact of the wine business, respondents ranked the extent to which they agree is the wine business can be a force for positive social and environmental impact. In the section on employee engagement, respondents were asked to indicate the extent that engagement on sustainability project has improved employee satisfaction, and employee turn-over. Finally, respondents rated the measurable impact of sustainable practices and technology on potential factors that could also influence their decision-making like wine quality, cost, or innovation.



On the overall impact of the firm on social and environmental issues respondents were positive with 63.7% of respondents indicating that the impact has been 'Positive' to 'Very Positive'. Since respondents previously indicated positive benefits, and moderate improvements in satisfaction and productivity from employee engagement with sustainability, it is reasonable to assume that these factors alones could justify a favorable response on the overall impact of sustainability.

In a consistent positive trend, respondents indicated that, in their opinion, performance measures clarified the benefits or impact of sustainable practices of technology 'Moderately' (40%) to 'Very Much' (29.5%). This is coherent with responses in the section on Vision and Leadership where 45.5% respondents suggested that 'Measurable performance' key factor to successful implementation, and further supported by responses on the potential impact of performance measurement on key resource use. Comparing the weighted averages, where a 1 is 'Unclear' and a 5 is 'Very Positive', respondents indicated that performance measurement has the greatest benefits on energy use (3.23), chemical use (3.20), water use (3.18), and solid waste (3.18). Respondents saw the lowest benefits from performance measurement on GHG emissions (2.57), Wastewater (2.82), and Nitrogen Use (2.82).

Following up on the question regarding potential drivers behind decision making on sustainability related projects where 'Vineyard/Ecosystem health' (4.42), 'Wine Quality' (4.33), and 'Grape Quality' (4.27) were considered as the most influential, respondents were asked to rank the impact of sustainability on similar drivers. 'Vineyard/Ecosystem health'



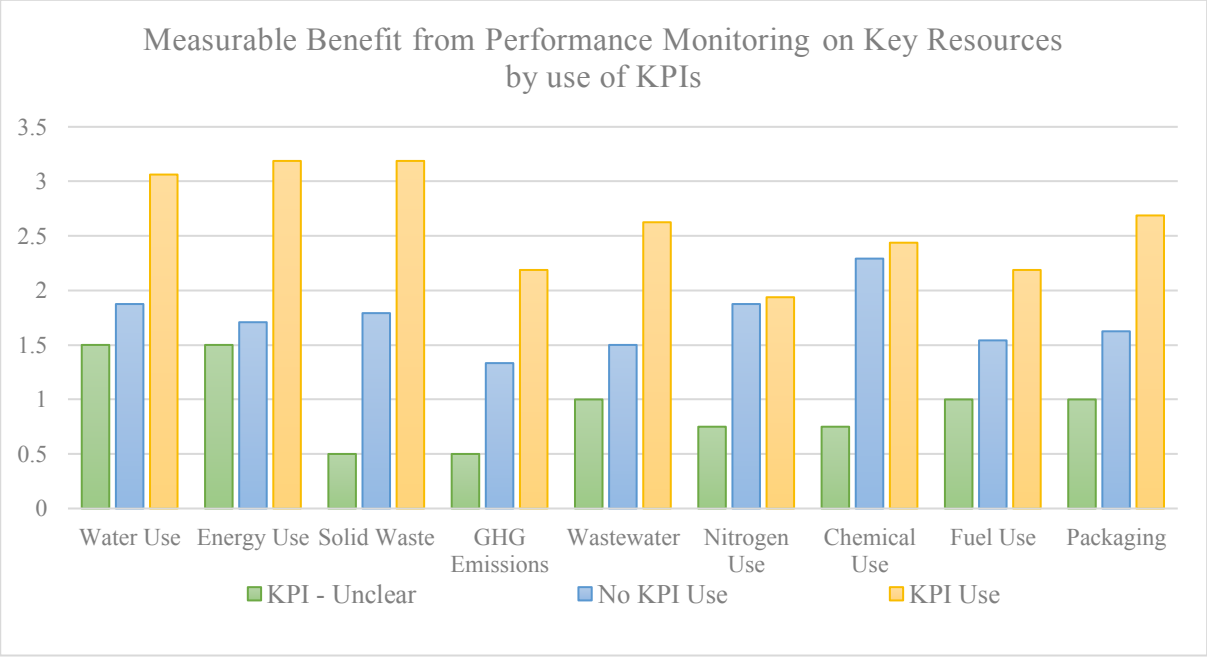
(4.80), 'Wine Quality' (4.66), and 'Grape Quality' (4.48) had the highest proportion of responses toward the '5-Very Positive' end of the scale. This parallel between the factors that

influence decision making, and the areas where sustainability has a measurable impact suggest that the factors considered influential also have a measurable benefit impact, which lends further support for the utility of performance measurement as a tool to support strategic decisions.

5.10 Trend Analysis

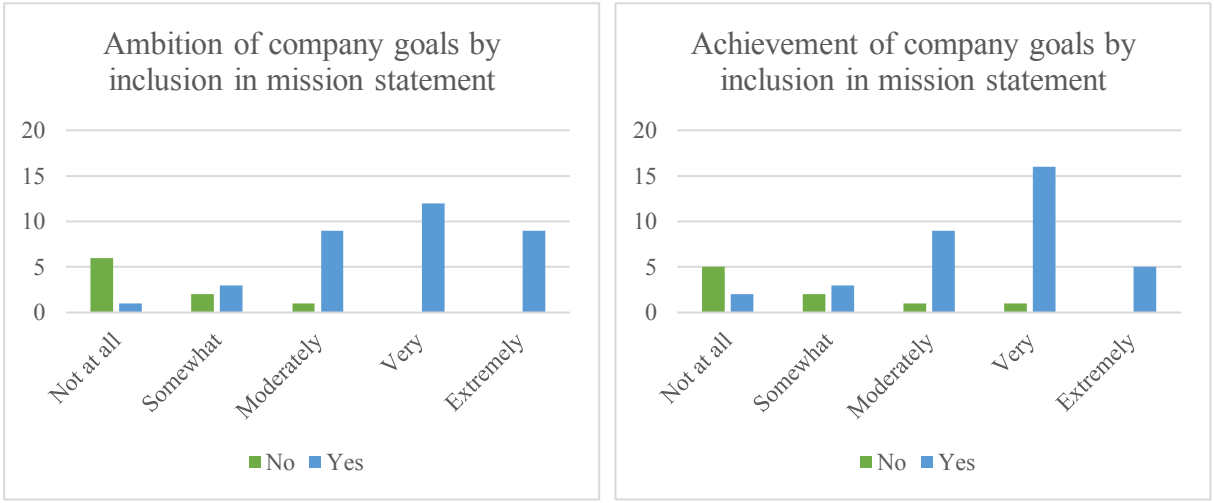
Given the impracticality and limitations to hypothesis testing resulting from the survey design and the low response rate, it is useful to look at sub-sections of the data to compare potential differences between groups of respondents based on their actions. While not statistically significant, this method does provide a deeper look at trends within the data, and presents potential questions for further, more sophisticated hypothesis testing. Ideally, these trends and relationships could be tested using an ordered logistics regression and testing the predicted probability between significant variables. This method would allow for broader conclusions on how the use of KPIs, for instance, could be have a predicted influence on where a firm falls along the benefit scale. It would provide evidence based justification to make broader claims about the implications of this survey to audience outside of the wine industry since many of the management strategies are generic to apply to any business.

While the use of weighted averages is an imperfect measure for comparison of Likert scale results, it is a useful way to compare differences between subcategories within a question, but it is worth noting again that a higher weighted average is representative of a larger proportion of respondents answering more favorably on a Likert scale.



The graph above depicts the weighted averages of Likert scale (Unclear to Very Positive) answers to 'Has monitoring performance had a measurable benefit on?' organized into three groups: those who felt it difficult to measure performance (unclear), those who do not use KPIs, and those who use KPIs. The graphical trend suggests that those who are using KPIs see a higher level of measurable benefits from performance monitoring on key resources than those who do not. It would be possible to draw deeper distinctions between the groups if the benefits of monitoring performance were reported as nominal data so that a test could demonstrates the extent of benefits across categories. While the response spread between groups was fairly consistent between resources, Nitrogen and Chemical use were the two resources in which both the no KPI use, and KPI use groups ranked the benefits similarly. Both groups indicated relatively moderate benefits from monitoring performance in these areas. The similarity could be due to highly regulated nature of both inputs which would render the use of KPIs for additional performance measurement as unnecessary.

The next trend evaluates how the inclusion of social and environmental goals in a mission statement might affect responses on setting and achieving goals. This trend evaluation is skewed by the high number of responses (79.5%) who answered 'Yes' that the company has included social and environmental goals in its mission statement. Ignoring the frequency, however, the graphs do suggest that for both ambition and effectiveness, those who have included are clustered toward the more favorable end of the Likert scale, and those who have



not included are clustered toward the less favorable end. This clustering effect suggests that firms with inclusive mission statements set more ambitious goals, and are more effective in achieving those goals. Though far from perfect, this breakdown of respondents into categories does demonstrate the potential testing that could be done with ordered logistics regressions and probability prediction given a large sample size, more continuous variables, and a properly designed survey. This would allow for a broader conclusion on how the use of environmental and social goals in high-level strategic planning could be a crucial factoring that determine the

degree of success a firm has in achieving those goals. This line of thinking follows closely with the cascade and feedback approach referenced in the literature review that would create a continuous flow of information from management through employees and then feeding the results form performance measurement back into the strategy review process.

5.10.1 Framework evaluation

The survey results provide interesting reflection on the Conceptual Framework for implementing sustainability outlined in Section 4.7. The results confirm that wineries and vineyard have applied elements of the framework successfully, such as the inclusion of environmental goals in a mission statement, setting ambitious goals, and regular employee training. Other elements like utilizing KPIs had conflicting results where respondents indicated that they had regular reporting and used data in decision making, but did not necessarily employ KPIs in that process. As a whole, responses trended positive on goals, achievement, and impact on social and environmental issues and suggested that firms have benefited financially, and from improved employee satisfaction. Reflecting on a few key features of the Conceptual Framework:

- Responses paralleled framework suggestions for strategy measures and identified similar factors for improving or inhibiting success
- Responses viewed employee benefits on sustainability favorably and saw benefits and improvements in productivity and satisfaction despite low response on team formation
- Responses implied consistent support for the value of performance measurement despite potentially contradicting responses regarding the low use of KPIs.

To evaluate the conceptual framework in a conclusive manner it would be necessary to differentiate between respondents and identify clear, statistically significant trends between groups. This type of testing could help explain if the decisions, policies, actions of one firm are determinant of successful implementation, and if they influence the type and intensity of the benefits and impacts from implementation. Overall, the trends in the responses imply that further testing of this framework would be beneficial because it would add clarity to a complex process on an issue that touches many different social and environmental issues. The positive responses across key elements of the Conceptual Framework further validate this approach and indicate that firms are employing these measures to varying degrees.

6 Summary and Conclusion

Reflecting on the three goals of this research provides further context to the analysis and results. The Business Case (Section 3) established a wide range of sustainable best practices and technology implemented by wineries and vineyards and demonstrated the potential financial benefits of such adoption. The review of management, operations, and strategy literature provided further insight into implementation processes and identified priority areas of focus. The Conceptual Framework focused on practices within key areas: Vision, Leadership, and Strategy, Employee Engagement, and Performance and Impact Measurement. The Conceptual Framework was tested through an online survey with 44 complete responses. Despite limitations on the response rate, survey design, and distribution methodology, the survey results suggested positive support for elements within Vision, Leadership, and Strategy, and conflicting results on Employee Engagement and Performance, and Impact Measurement. However, on a whole the responses emphasize the need for effective benefit and impact measurement, and the results suggested moderate success regarding the benefits and impacts of implementing sustainability. The survey results confirmed consistent trends between the Business Case and the Conceptual Framework regarding the practices and technologies that have the most benefit to firms.

On answering the two main research questions, the research was successful on the first question in establishing how firms have adopted and implemented sustainability through the evidence presented in the Business Case, the development of the Conceptual Framework and the survey results. However, on the second question, the survey design, methodology, and low response rate limited the ability to explore in further detail if specific firm actions can be identified as crucial measures for successful implementation.

Further research is needed to address the second question more effectively, and there have been numerous examples cited throughout this study of areas where further research is possible. For this type of research results to be extrapolated as an example to other agribusinesses or industries, significant evidence is needed that links actions and policies with performance. However, the research does provide ample lessons and strategic insights for companies interested in how to define a strategic approach to implementing sustainability.

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Appendix A

1. Introduction

Thank you for taking the time to complete this brief survey on sustainability initiatives at your winery or vineyard. It should take roughly **15 minutes** to complete. All responses will be anonymous and aggregated.

Company email addresses ***will only be used to verify the validity of respondents and to send the final survey results*** .

The purpose of this survey is to identify *how* wineries and vineyards have chosen to integrate sustainability into their operations, management, and production. The ambition is to understand the management, financial, and technical decisions that have either been successful or challenging. The survey covers company information and strategy, employee engagement, benchmarking and reporting, and impact measurement.

You can save your responses at any time and return to complete the survey at your convenience.

All respondents will receive a copy of the survey results in an executive summary format.

The survey is open to winery and vineyard employees at every level. Multiple responses from one business are welcomed and encouraged so feel free to distribute this survey internally or with your colleagues in the industry.

NOTE: I use the term "Sustainability" as the umbrella term to capture the best practices and technology imbedded in organic, biodynamic, and the diverse nature of sustainable principles, environmental, social and economic that apply across the wine business.

Thank you!

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About me:

I have worked in the wine industry for the last 9 years in sales, production, management, and consulting. I have been fortunate to work with wineries and vineyards around the world from my home state of Michigan to South Africa, California, Armenia, and France. As a sustainability and energy consultant, I specialize in helping businesses evaluate their strategic position on sustainability and measure impacts across a wide range of social and environmental issues.

2. Respondent Information

* 1. Professional email *All responses are anonymous
(Used to authenticate responses and send final survey results)

* 2. How would you describe your role?
(Please check all that apply)

- [ ] Manager (Cellar, vineyard, tasting room, etc.)
- [ ] Winemaker
- [ ] Owner
- [ ] Consultant
- [ ] Other (please specify)
- [ ] Executive (CEO, COO, CFO, etc.)
- [ ] Sales
- [ ] Cellar Employee
- [ ] Vineyard Employee
- [ ] Tasting Room Employee
- [ ] Lab Technician
- [ ] Business Administration

* 3. What is the percent (%) of time you dedicate in your role to specific sustainability related projects?

- ◯ 0%
- ◯ 1-24%
- ◯ 25-49%
- ◯ 50-74%
- ◯ 75-99%
- ◯ 100%

* 4. How is sustainability included in your job activity?

- ◯ Not specifically included
- ◯ Not specifically included but I participate in planning or data collection/reporting
- ◯ In my job description without personal objectives
- ◯ I have personal objectives and targets to achieve
- ◯ Other (please specify)

3. Company Overview

* 5. Company Information

Region

Country

* 6. How many people does your company employ full-time?

- ◯ 1-9
- ◯ 10-49
- ◯ 50-249
- ◯ 250-999
- ◯ Over 1,000

* 7. How many years has your business been in operation?

- ◯ 1-5
- ◯ 6-20
- ◯ 21-50
- ◯ 51-100
- ◯ Over 100

* 8. How many acres of vineyards does your company own?

- ◯ N/A - Winery operations only
- ◯ 0-50
- ◯ 51-100
- ◯ 51-500
- ◯ 501-1,000
- ◯ 1,001-2,000
- ◯ Over 2,000

9. How many acres of vineyards does your company manage?

- ◯ N/A
- ◯ 0-50
- ◯ 51-100
- ◯ 51-500
- ◯ 501-1,000
- ◯ 1,001-2,000
- ◯ Over 2,000

* 10. How many cases (9 Liters) are produced annually?

- ◯ N/A - Vineyard operations only
- ◯ Up to 2,000
- ◯ 2,001 to 20,000
- ◯ 20,001 to 50,000
- ◯ 50,001 to 100,000
- ◯ over 100,000

* 11. What percent the vineyards owned or managed by your company are certified as:

	0%	1-24%	25-74%	75-99%	100%	Not sure	Do not own or manage any vineyards directly
Organic	◯	◯	◯	◯	◯	◯	◯
Biodynamic	◯	◯	◯	◯	◯	◯	◯
Sustainable	◯	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯	◯

* 12. What percent of final production certified as:

	0%	1-24%	25-74%	75-99%	100%	Not Sure	Vineyard operations or management only
Organic	◯	◯	◯	◯	◯	◯	◯
Biodynamic	◯	◯	◯	◯	◯	◯	◯
Sustainable	◯	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯	◯

* 13. Have your operations or wines achieved any other 3rd party certifications?
(i.e. Fair Trade, B Corp, Green Building, ISO, etc.)

* 14. What is the average bottle price of your wine? (USD)

◯ $1 to $10 ◯ $11 to $20 ◯ $21 to $50 ◯ $51 to $150 ◯ Over $150

* 15. Please tell us about your business - growth rate in your company's profits over the past five years.

◯ Zero or Negative ◯ 1-5% ◯ 6-10% ◯ 11-20% ◯ Over 20% ◯ Don't know

4. Vision and Leadership

* 16. Does your company mission, purpose, or vision include specific social or environmental goals?

◯ Yes

◯ No

◯ My company does not have one

* 17. Do you agree that the wine business can be a force for positive social and environmental impact?

◯ Strongly disagree ◯ Disagree ◯ Undecided ◯ Agree ◯ Strongly agree

* 18. Which winery sustainability issues are most important for your business?

	Not all important	Somewhat important	Moderately important	Very important	Extremely important	N/A
Sustainable business strategy	○	○	○	○	○	○
Wine quality	○	○	○	○	○	○
Winery water conservation and quality	○	○	○	○	○	○
Material handling	○	○	○	○	○	○
Solid waste reduction and management	○	○	○	○	○	○
Environmentally preferred purchasing	○	○	○	○	○	○
Human resources	○	○	○	○	○	○
Neighbors and community	○	○	○	○	○	○
Air quality	○	○	○	○	○	○

Other (please specify)

* 19. In your opinion, has your company set ambitious sustainability goals?

○ Not at all ○ Somewhat ○ Moderately ○ Very ○ Extremely

○ Other (please specify)

* 20. In your opinion, how effective has the company been in achieving these goals?

○ Not at all ○ Somewhat ○ Moderately ○ Very ○ Extremely

* 21. How do you define success within your company?

* 22. What most influences your company's decision to implement a sustainable best practice or technology?

	Not at all important	Somewhat important	Moderately important	Very important	Extremely important
Family legacy/succession	○	○	○	○	○
Brand reputation	○	○	○	○	○
Cost	○	○	○	○	○
Sales	○	○	○	○	○
Wine quality	○	○	○	○	○
Grape quality	○	○	○	○	○
Customer loyalty	○	○	○	○	○
Vineyard/ecosystem health	○	○	○	○	○
Innovation	○	○	○	○	○
Climate Change	○	○	○	○	○
Consumer and retail demand	○	○	○	○	○
Supply chain optimization	○	○	○	○	○

What other factors motivate your company's sustainability initiatives?

* 23. What are the key factors that facilitate successful implementation of sustainable best practices or technology?
(Please check all that apply)

- ☐ CEO or Owner Commitment
- ☐ Employee engagement
- ☐ Financial resources
- ☐ Measurable performance
- ☐ Clear benefits
- ☐ Reliable technology
- ☐ Knowledge transfer (staff training or expert advice)
- ☐ Return on financial investment
- ☐ Other (please specify)

* 24. What are the key factors that inhibit the implementation of sustainable best practices or technology? (Please check all that apply)

- [ ] Project cost
- [ ] Lack of management support
- [ ] Unable to measure performance
- [ ] Time
- [ ] Unclear benefits
- [ ] Staff knowledge (lack of technical skills)
- [ ] Short-term business strategy
- [ ] Other (please specify)

25. Which vineyard sustainability issues are most important for your business?

	Not all important	Somewhat important	Moderately important	Very important	Extremely important	N/A
Sustainable business strategy	○	○	○	○	○	○
Soil management	○	○	○	○	○	○
Vineyard water management	○	○	○	○	○	○
Pest management	○	○	○	○	○	○
Wine and grape quality	○	○	○	○	○	○
Ecosystem management	○	○	○	○	○	○
Material handling	○	○	○	○	○	○

Other (please specify)

5. Employee Engagement

* 26. Do you have a group or team that manages company wide sustainability projects?

- ○ Yes
- ○ No

* 27. Are non-management employees able to contribute to shaping company sustainability strategy?

○ Never ○ Rarely ○ Sometimes ○ Very Often ○ Always

* 28. How often do employees receive training on sustainability related issues or practices?

Never Annually Quarterly Monthly Daily

Other (please specify)

* 29. Do you have a mechanism for employees to provide feedback or suggest new ideas regarding best practices or new technology?

Yes

No

Not Sure

* 30. In your opinion, do employees benefit from engagement with sustainability?

Not at all Somewhat Moderately Very much Extremely

* 31. In your opinion, has employe engagement with sustainability projects improved the following?

	Not at all	Somewhat	Moderately	Very much	Extremely
Employee satisfaction					
Productivity					
Employee turn-over					

Other (please specify)

6. Benchmarking and Reporting

* 32. Does your company produce a progress report on your social and environmental goals, or impact? (Please check all that apply)

- [ ] Update key performance measures (KPIs) on website
- [ ] Formal public report following a 3rd party standard
- [ ] For internal use only
- [ ] No reporting of any kind

Other (please specify)

33. Has your company set key performance indicators (KPIs) to track progress on social and environmental goals?
*KPIs measure or track progress on issues like water or energy use, or employee satisfaction, etc

- ◯ Yes
- ◯ No
- ◯ Difficulty measuring progress

If it is difficult to measure progress, what specific practices or technology cause issues?

* 34. How often do you review progress on social and environmental goals?

◯ Never ◯ Annually ◯ Quarterly ◯ Monthly ◯ Daily

◯ Other (please specify)

* 35. How often is data or progress on social or environmental goals used in decision making?

	Never	Rarely	Sometimes	Often	Very often
By me	◯	◯	◯	◯	◯
Within my department (vineyard, winery, sales, marketing, etc.)	◯	◯	◯	◯	◯
Executives/Owners	◯	◯	◯	◯	◯

Other (please specify)

* 36. How are employees involved in tracking and reporting key performance indicators (KPIs)
*KPIs measure or track progress on issues like water or energy use, or employee satisfaction, etc

7. Impact Measurement

* 37. In your opinion, what has been the impact of your business on social and environmental issues?

Very negative Negative Neutral Positive Very positive Cannot measure impact

Other (please specify)

38. How would you rate the financial benefit or business value of implementing practices and technology in the following areas?

	Unclear or difficulty measuring benefit	No benefit	Some benefit	Positive benefit	Very positive benefit
Sustainable business strategy	○	○	○	○	○
Viticulture	○	○	○	○	○
Soil management	○	○	○	○	○
Vineyard water management	○	○	○	○	○
Pest management	○	○	○	○	○
Wine quality	○	○	○	○	○
Ecosystem management	○	○	○	○	○
Winery water conservation and quality	○	○	○	○	○
Material handling	○	○	○	○	○
Solid waste reduction and management	○	○	○	○	○
Environmentally preferred purchasing	○	○	○	○	○
Human resources	○	○	○	○	○
Neighbors and community	○	○	○	○	○
Air quality	○	○	○	○	○

Other (please specify)

39. Has monitoring performance had a measurable benefit on?

	Unclear or difficulty measuring benefit	No benefit	Some benefit	Positive benefit	Very positive benefit
Water use (winery or vineyard)	○	○	○	○	○
Energy use	○	○	○	○	○
Solid waste	○	○	○	○	○
GHG emissions	○	○	○	○	○
Wastewater	○	○	○	○	○
Nitrogen use	○	○	○	○	○
Chemical use	○	○	○	○	○
Fuel use	○	○	○	○	○
Packaging	○	○	○	○	○

Other (please specify)

* 40. How often is sustainability integrated into your marketing campaigns or material?

○ Always ○ Very Often ○ Sometimes ○ Rarely ○ Never

○ Other (please specify)

* 41. Have sustainable practices or technology had a measurable impact on?

	Cannot measure impact	Very negative impact	Negative impact	Neutral impact	Positive impact	Very positive impact
Brand reputation	◯	◯	◯	◯	◯	◯
Cost	◯	◯	◯	◯	◯	◯
Price Premium	◯	◯	◯	◯	◯	◯
Wine quality	◯	◯	◯	◯	◯	◯
Grape quality	◯	◯	◯	◯	◯	◯
Customer loyalty	◯	◯	◯	◯	◯	◯
Vineyard and ecosystem health	◯	◯	◯	◯	◯	◯
Employee engagement	◯	◯	◯	◯	◯	◯
Innovation	◯	◯	◯	◯	◯	◯
Supply chain optimization	◯	◯	◯	◯	◯	◯

What other impacts do you consider?

* 42. In your opinion, do performance measures clarify the benefits or impact of sustainability practices and technology?

◯ Not at all ◯ Somewhat ◯ Moderately ◯ Very much ◯ Extremely

8. Submit Responses

Thank you again for taking the time to complete this survey!

I appreciate your insight and I look forward to sharing the results with you in June. Please do not hesitate to contact me with any questions or comments. Feel free to distribute this survey link within your company, industry organization, or with your colleagues.

If you are interested in exploring the survey at greater detail within your company or industry association, please contact me about a unique link to share.

Please remember to complete your survey by clicking submit below.

Cheers!
Cam Brown

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