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## Article

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# Assessing environments of commercialization of innovation for SMEs in the global wine industry: A market dynamics approach

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## Abstract

Small and medium enterprises (SMEs) can play an important role in the diffusion of wine innovation. Employing a market dynamics approach where the interaction of producers (supply) and buyers (demand) are seen to influence innovation creation, a conceptual framework is applied to the global wine industry to identify commercialization strategies for SMEs. The framework identifies four commercialization environments or clusters; Innovation Nirvana, Innovation Push, Innovation Pull and Innovation Wasteland as determined by the principle market dimensions of wine supply (innovation-push) and wine demand (market-pull). A k-means cluster analysis is undertaken on twenty-two wine-producing member countries of the OECD to determine which jurisdictions occupy each of the four clusters. The study results is a diverse distribution of old world and new world wine producing countries across all of the identified commercialization environments. Conclusions about national commercialization environments and related strategies for wine industry entrepreneurs are presented. These findings have implications for wine industry SMEs, investors and agri-policy makers.

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**Keywords:** Innovation; Global wine industry; OECD

## 1. Introduction

In an attempt to stimulate economic growth, numerous countries and regions have initiated policies that promote innovation by entrepreneurs within specific industries or sectors (Autio et al., 2014). While the existing literature on technology entrepreneurship and commercialization strategies is abundant (Gans and Stern, 2003; Kaplan, 1999; Walsh et al., 2002; Katzy and Crowston, 2008; Thukral et al., 2008; Chen, 2009; Markman et al., 2008; He et al., 2006; Kasch and Dowling, 2008), much less can be said about the commercialization of innovation in the global wine industry. What the limited research has shown is a dichotomy between

commercializing new wines using small-scale, locally-based, artisanal methods and the commercializing of new wines using large-scale, industrial modes of production, the latter eschewing the subtleties of place, terroir, and generations of expertise and empathy in favour of chemicals and new techniques (Banks and Overton, 2010; Aylward, 2003; Aylward and Zanko, 2008; Campbell and Guibert, 2007; Luczkiw et al., 1999).

Small and medium enterprises (SMEs) can play an important role in the diffusion of wine innovation and the main objective of this paper is to apply a conceptual framework for helping wine SMEs identify the various environments of commercialization for wine innovation. Adapting the framework first put forward by Walsh (2012) in identifying commercialization environments for renewable energy technology we apply the framework to the commercialization of innovation in the global wine industry. Our intent is to classify countries where small and medium firms in the wine industry

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can employ particular commercialization strategies for the innovation environment they find themselves in.

The SMEs choice of strategy is influenced by the type (disruptive, discontinuous, and sequential) of innovation being introduced into the market and by the level of commercial risk (cost risk, product risk, and market risk) facing wine industry firms. Innovation-push and demand-pull drivers are representative of certain market dynamics that define the commercialization environment with each of these environments distinguished by certain types of innovation, levels of product and financial risk and, dependence upon third parties.

In determining if certain countries encourage or discourage entrepreneurial opportunities within the wine industry, we produce certain wine market metrics that help identify which environment of innovation commercialization exists within 22 OECD wine-producing countries. Walsh's framework establishes market measures related to market-sophistication (innovation push) or, for the purpose of this research, and wine demand (demand-pull). Innovation push was measured by identifying metrics related to the respective wine industry's contribution to gross domestic product (GDP), growth, their improvements in wine productivity, and the presence of institutional education in wine production. Wine consumption data from 2011 to 2014 was used to measure market demand.

A number of contributions are made. Firstly, we add to the literature on innovation commercialization environments in the context of the global wine industry. Secondly, we identify commercialization strategies for wine industry entrepreneurs from a market dynamic perspective and lastly, this research employs the developed framework to suggest appropriate commercialization strategies that are best used in certain wine-producing countries around the world.

The Aim of the paper is to apply Walsh's conceptual framework in order to help wine producers identify the various environments for commercialization of wine innovation and to classify countries where innovative wine producers can employ particular commercialization strategies for the innovation environment they find themselves in.

## 2. Entrepreneurship and innovation commercialization

Schumpeter introduced the role of entrepreneurship and innovation into industrial economics in the early 20th century. His concept of circular flow suggested that the economy is a system that is constantly in motion, with the role of entrepreneurs and entrepreneurial activities acting as agents of change through the introduction of successful innovation in the form of new products and processes that alter the competitive landscape of the market (Hagedoorn, 1996). He asserted the importance of entrepreneurship to the development of innovation, whether by individual entrepreneurs as start-up ventures or through corporate entrepreneurship or intrapreneurship in existing larger firms. Schumpeter's notion of creative destruction where entrepreneurial firms that can successfully innovate will erode the market share and profitability of incumbent market players led to the introduction of the concept of radical or disruptive innovation (Laukkanen

et al., 2008). Innovation of this type are associated with uncertainty on the part of market participants and therefore there is a greater risk of non-acceptance. To the extent that an innovation represents an enhancement of an existing product or service then the innovation can be identified as “discontinuous” requiring only a periodic shift in the learning curve on the part of the market in accepting the innovation (Kishna et al., 2017). As the timing between each iteration of an innovation becomes closer, the process is deemed to be become one of incremental or sequential innovation (Chau and Desiraju, 2016).

The literature into technology entrepreneurship has shown the intersection of innovation and entrepreneurship (Shane and Venkatraman, 2003). Certain research separates these concepts into different fields but that separation limits the usefulness of both approaches for multiple aspects of management and the economy (Baum et al., 2001; Lassen et al., 2006). To quote Shane (2012: 15), the concept of entrepreneurship incorporates “the Schumpeterian (...) notion that entrepreneurs also exploit those potentially profitable opportunities by creatively recombining resources”, that is, through innovation, whether it is incremental or radical (Lassen et al., 2006; Robson et al., 2009), and carried out in a complex context that includes “innovation, venturing and strategic renewal” (Zotto and Gustafsson, 2008 : 97).

Not only does innovation appear as an inherent characteristic of entrepreneurship but innovation and entrepreneurship must go hand in hand, so that the multiple dimensions of the company's relationship with its environment (institutional development, resource allocation, and commercialization) enable innovation to develop (Woolley and Rottner, 2008). Therefore, the choice of commercialization strategy is influenced by the type of innovation and the related commercial risk (cost risk, product risk and market risk) associated with introducing that innovation to the marketplace. In turn, the level of risk will determine whether that strategic choice involves some dependence on third parties or whether the entrepreneur can pursue their strategy independent of other players in the marketplace (Haeussler, 2011).

The innovation capability of an organization is dependent on its competencies and capabilities. Radical innovators are organizations who can consistently deliver new products or services that are unique and useful to the marketplace but require that market to also be sophisticated enough to understand the value being provided to it. Conversely, those organizations whose capabilities are limited to existing operations and organizational knowledge will most likely offer new products or services that enhance the consumer experience without having to require any significant increase of sophistication on the part of the customer (Menguc et al., 2007). This pace of innovation is influenced by the absorptive capacity of the market and must be carefully maintained. The pace of continuous innovation cannot exceed the consumer's ability to understand the value proposition being put forward or otherwise the slope of the product or service enhancement must be flattened in order to maintain market acceptance (Christensen et al., 2003). Conversely, limiting that slope too much can lead

to a “stalling” of innovation that exposes an organization to the development by competitors of innovation that will surpass theirs.

Kelm et al. (1995) described the innovation process as being comprised of two stages; innovation and commercialization. The innovation stage represents those activities prior to the launch of a new product or service such as project initiation, design, and development while the commercialization stage comes about when the new product or service is ready to be introduced to the market. Each stage is characterized by different foci. During the innovation stage the focus is on providing a product or service that provides an optimal solution or solutions to the consumer in order to garner a greater level of market acceptance. This acceptance is dependent on the market demands and the ability of the market to recognize the value of providing such a solution. An organization's focus during commercialization then becomes one of addressing how to compete in that product or service market.

### 3. A market dynamics approach

The innovation literature is resplendent with the concept of technology-push and demand-pull as drivers of the diffusion of technology in the marketplace (Chidamber and Kon, 1994; Howells, 1997; Carayannis and Roy, 2000; Herstatt and Lettle, 2004; Drejer and Jorgensen, 2005; Bernstein and Singh, 2006; Lee and Park, 2006; Crespi and Pianta, 2008; Ibata-Arens, 2008; Brem and Voigt, 2009; Laranja, 2009; Murovec and Prodan, 2009; Walsh, 2012; Costantini et al., 2015). Innovation-push and demand-pull are derived from supply and demand dynamics in a market economy. The interaction of producers (supply) and buyers (demand) determines the market equilibrium for price and quantity and their respective influence on innovation (innovation-push by producers and demand-pull by buyers) can contribute to market disequilibrium and profit-opportunity. The profit opportunity in this study is not viewed from a neoclassical economics perspective, which operates on the assumption that market interactions results in equilibrium outcomes, rather the market processes leads to entrepreneurial discovery. (Kirzner, 1997). Therefore, the interaction of both supply and demand in the market are seen as an entrepreneurially driven process. Innovation-push can fail to account for market conditions, while demand-pull may ignore innovation capabilities, so it is not simply that both contribute but they also interact (Arthur, 2007). The debate around such interaction has reached a consensus that a combination of innovation-push and demand-pull is necessary (Mowery and Rosenberg, 1979; Howells, 1997). This argument was further advanced by Crespi and Pianta (2008) who found in their study of certain manufacturing and service industries in Europe that innovation studies should not focus only on supply-side market dynamics; that the innovation-push and demand-pull effects can complement each other resulting in productivity growth.

An innovation-push occurs when an innovative product convinces that market that the product is needed while the demand-pull for an innovation results when the market

convinces the innovator that an innovative product is required to satisfy a market need (Herstatt and Lettle, 2004). Said another way, demand-pull drives innovation to seek to solve a market problem that cannot be solved with existing products or services whereas innovation-push results in the adoption of an innovation because the product or service capabilities of that innovation establishes a demand in the market, regardless of whether or not an initial demand existed (Brem and Voigt, 2009).

Taken together, (innovation-push, demand pull), the market dynamic approach considers the supply of innovative products or services and the demand for them. In terms of supply, an underlying factor in this approach is an extensive need for a change of customer behavior toward the innovation (Brem and Voigt, 2009). This behavior is influenced by the sociopolitical and cognitive legitimacy associated with a firm's capabilities to innovate (Sheperd and Zacharakis, 2003). This line of reasoning extends to the level to which a society has developed sophistication or knowledge around the innovation that can impact its diffusion in the market. Said another way, the greater the level of societal or market sophistication the greater the likelihood of the adoption of that innovation (Eng and Quaia, 2009). Demand steers firms to work on certain problems (Rosenberg, 1969) with other factors such as cost and the perceived ease of utility of that product (Wang et al., 2008); shifts in relative factor prices (Hicks, 1932); geographic variation in demand (Griliches, 1957); the identification of “latent demand” (Schmookler, 1962, 1966); potential new markets (Vernon, 1966) and government policy (Nemet, 2009), all affecting the size of the payoff to successful investment in innovation.

### 4. Commercialization and innovation in the global wine industry

The new economic order of globalization has emerged with two systems to describe the wine industry; old world wines and new world wines (Lukacs, 2012). The old world wines (largely Western and Southern Europe), are characterized by long-established and relatively unchanging methods and locations of wine production. Centuries of trial and error have perfected viticulture and winemaking techniques that are suited to particular places. Certain varieties have been selected and refined over many years that seem to “belong” to certain regions and not others. Likewise, the methods of growing grapes and making wine has developed slowly and been perfected by generations of small-scale, locally based artisan producers. The qualities of different wines are explained — and marketed — with reference to their terroir: their place of origin (Charters, 2006). Tight government regulation created a long multilevel value chain, with service providers in many of the links lacking either the scale or the expertise to operate efficiently (Bartlett, 2009). As a result of the fragmented approach of wine production and classification systems in various regions of the old world, countries were unable to support a branding strategy (Bartlett, 2009; Markham, 1997).

In contrast, new world wines are places where experimentation and development are encouraged. Innovation is the

watchword, not conservatism. Varieties are not limited to certain places and winemakers are free to trial modern oenological techniques. Differentiation of wines is based on explicit declaration of grape variety rather than disguised by deliberate obfuscation through inordinately complex “place of origin” labeling (Banks and Overton, 2010). The large new world wines controlled the full value chain, extracting margins at every level and retaining bargaining power with increasingly concentrated retailers (Bartlett, 2009).

Growing competitiveness among wineries and the globalization of the wine market has given rise to strategies that encompass the broad spectrum of value contribution from the production and marketing of high quality, high priced premium wine to low cost, low quality wines. However, that value contribution can be influenced through the application of innovation differentiation. Broadly, value is created through the application of innovation to the functionality, design, performance and consumption experience of a product or service so as to ensure its uniqueness and superiority (Menguc et al., 2007). Specifically to the wine industry, this innovation strategy involves initially focusing on niche markets producing premium priced goods for global markets, and continuously improving productivity (Luczkiw et al., 1999). This shift in quality wines was corroborated by (Bartlett, 2009). With the shift to quality, a greater fashion element began to influence demand. The decline in importance of working families’ daily consumption of locally produced table wine was offset by upscale urban consumers who chose bottles on the basis of grape variety, vintage, source – and increasingly fashion. (Cholette, 2008; Rachman, 1999).

The new world wine-producing countries (e.g. Australia, Canada, Chile and the USA), which typically use modern production techniques, up-to-date marketing and a premium wine product strategy, have challenged the old world countries, France, Italy, Portugal and Spain and strengthened their efforts to compete in the international market. Although, wine consumption patterns have changed in recent years, consumption has continued to fall in traditional wine-producing countries, and consumers there and in other high-income countries are moving gradually to higher-quality wines (See Fig. 1). In general, new world wine producers have an increased emphasis on market orientation, increased export assistance and manages trade barriers effectively, overall it is clear that the New World Countries are better positioned to capitalize on the opportunities created through industry globalization and its driving forces (Cholette, 2008).

Wine products could be generally categorized as a discontinuous innovation (Gersick, 1988; Cooke and Lazzaretti, 2007). This is further corroborated by (Cusmano et al., 2010) who declared that technologies and production methods have been based on discontinuous innovation rather than breakthrough innovation. Wine is a mature product in the marketplace and is generally distinct from other alcoholic beverages. In this regard, wine firms do not seek to destroy the value of an existing wine product but instead pursue the shifting of an existing technological learning curve in order to enhance the value of the product (Tushman and Anderson,

1986; Van de Van et al., 1999). Accordingly they face lower levels of technological and market uncertainty thus limiting the risk of market non-acceptance.

## 5. Methodology

Borrowing from Walsh’s (2012) market dynamic perspective and the identified dimensions of innovation push market dimensions of wine supply (innovation-push) and wine demand (market-pull), a commercialization environment framework for innovation in wine has been developed as shown in Fig. 2 with the related innovation types, commercial risk, and commercialization strategies listed in Table 1. This framework identifies four distinct commercialization environments:

### *Innovation wasteland*

An environment characterized by relatively little to no demand growth for wine products and a market unsophisticated in terms of specific knowledge about wine products or the manner in which they are produced is identified as an Innovation Wasteland. This lack of vino-sophistication increases the risk of non-acceptance on the part of the market and discourages wine innovation and product development. Consequently, innovation efforts by wine entrepreneurs face limited institutional support for funding and they are left to their own devices to invent products that might appeal to the market. Within this commercialization environment, product innovation would need to be disruptive in order to displace existing alternative beverage products while facing a higher risk of market non-acceptance. Such an environment would require collaborative strategies with government (through incentives) or large wine companies seeking to collaborate (through research and development) on potentially disruptive product development.

### *Innovation pull*

When the commercialization environment is exemplified by continued growth in demand for wine products without the existence of related institutional support, it is generally due to the characteristics of the market that make wine products acceptable. These characteristics may include the geographical capability to produce wine at low cost and of reasonable quality, the historical wine consumption habits of the market and the ease of access to the products. However, the market remains relatively unsophisticated about wine products i.e. limited wine industry education, less institutional investment as compared to other industries, lack of productivity gains. This inconsistency arises because the market is driven by its existing subjective needs or wants (Brem and Voigt, 2009) and not by the market or institutional ability to understand the product. Therefore, the demand growth is responsible for “pulling” innovative wine products into the market. This increases product exposure and customer knowledge and promotes greater local market vino-sophistication and

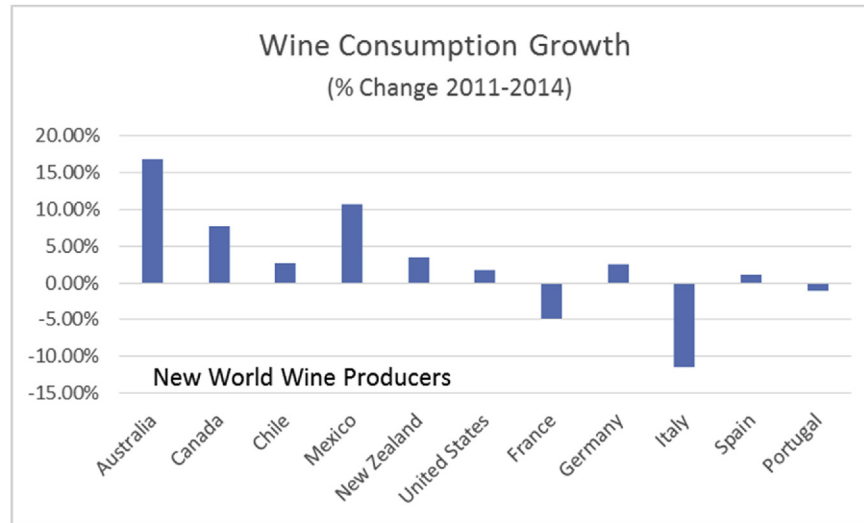


Fig. 1. Wine consumption growth (2011–2014).

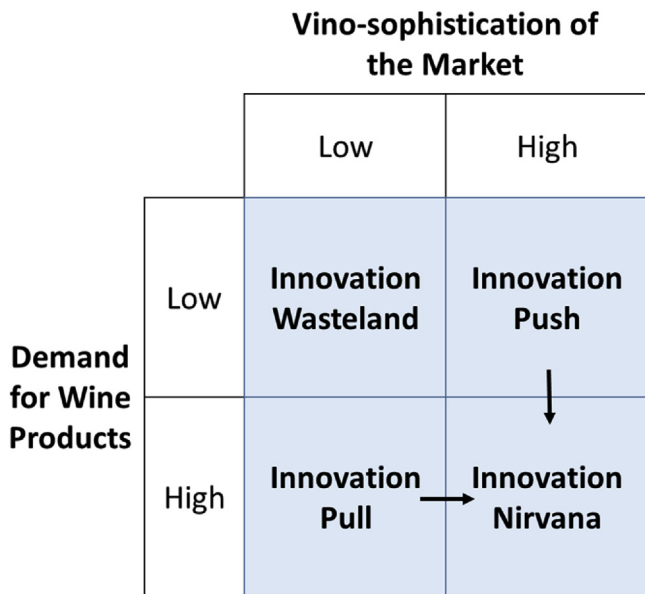


Fig. 2. Wine innovation commercialization environments.

institutional support for innovation development. Over time there is potential for transition to an Innovation Nirvana commercialization environment but before that occurs there will remain product uncertainty to some degree due to the lack of market vino-sophistication. This will discourage sequential innovation (Christensen et al., 2003) leaving wine innovation

in the domain of larger wine companies whose preference for lower risk and early profitability will encourage more discontinuous innovation in wine products. For smaller enterprises the interest shown by larger firms will provide opportunities for collaboration through outsourcing and licensing, consistent with this commercialization environment in that the inability of the market to recognize product superiority puts more of an emphasis on market drivers such as complementary distribution and sales assets that typically reside in the domain of the larger incumbent firms (Gans and Stern, 2003).

*Innovation push*

As opposed to Innovation Pull, an Innovation Push commercialization environment exists when demand growth is lacking for wine products but there exists a relatively high level of vino-sophistication and understanding about wine products and production. The lack of demand can be due to a number of factors such as a lack of historical consumption of wine and less-than-desirable production attributes i.e. lack of productive land or high costs of production. Market uncertainty exists not with the consumer acceptance of the product innovation but rather with the wine firms themselves who's concerns regarding the lower demand for wine products limits their willingness to invest in innovation. This particular uncertainty and the risks associated with it will encourage firms to pursue more discontinuous as opposed to sequential

Table 1  
Commercialization environments and related strategies.

Commercialization environment	Innovation type	Commercial risk <sup>a</sup>	Commercialization choice	Commercialization strategies
Innovation Wasteland	Disruptive	High	Dependent (Collaboration)	Government Incentives External R&D Contracts
Innovation Push	Discontinuous	Moderate		Outsourcing Licensing
Innovation Pull				Joint Venture Strategic Alliance
Innovation Nirvana	Sequential	Low	Independent	Venture Capital Equity Financing Acquisition

<sup>a</sup> Product risk, cost risk and market risk.

innovation processes (Rice et al., 2002). Within this environment, smaller firms with more sophisticated wine products can leverage their product superiority in collaborating with larger firms (Kasch and Dowling, 2008) and, as a result, the commercialization strategies will tend towards joint ventures and strategic alliances. These strategies will “push” innovation into lower-cost, higher quality, better value wine products that will encourage wider adoption and increased market demand and may ultimately transition this commercialization environment into a state of Innovation Nirvana.

### *Innovation Nirvana*

The combination of high levels of market vinox sophistication and demand for wine products allows for lower levels of product and market uncertainty. When this is the case, the commercialization environment for innovation in wine products has reached Innovation Nirvana. Prompt adoption of wine product innovation and increased demand encourages sequential innovation processes (Rice et al., 2002) and allows for investment in continuously innovating on existing products. For smaller wine enterprises this lower risk environment increases the probability of returning value to investors and encourages solo activities in competition with larger incumbent firms. Commercialization strategies would include angel investors, venture capital, public equity investments, or the acquisition of their wine product by larger incumbent firms (Gans and Stern, 2003).

## 6. Application

In order to illustrate the commercialization framework, data was acquired for 22 OECD countries that produce wine annually. For the purpose of measuring the level of vinox sophistication the 22 countries were ranked on three measures; the total percentage growth from 2011 to 2014 of the value of wine production as a percentage of total GDP (as measured in \$US),<sup>1</sup> the total percentage growth in wine production per acre (measured in litres per acreage),<sup>2</sup> and the number of post-secondary education programs in vineology or oenology. The ranks were summed and countries were then re-ranked based on the aggregate ranking. The wine products demand metric was derived using rankings of countries based on the total percentage growth in wine consumption between 2011 and 2014. The country data is listed in Tables 2a and 2b.

Utilizing the commercialization framework discussed in Section 5 a k-means clustering methodology was applied to the data with a limitation of four clusters resulting in an iterative process of assigning cluster membership to each of the countries being analyzed. Cluster membership is assigned based on the distance of that country to the cluster mean and given the k-means cluster analysis is very sensitive to data outliers, the data was screened using a simple XY plot (Fig. 3).

SPSS was employed to determine the initial cluster centers (Table 3) and each country was assigned to the closest cluster depending on its distance from the cluster center. The iterative process then recalculates the cluster centers and re-assigns each country until the cluster centers remain unchanged. The iteration history (3 in total) is shown in Table 4. The final cluster centers and respective member countries are shown in Table 5.

## 7. Results and discussion

Cluster 1 is representative of an Innovation Wasteland commercialization environment characterized by low vinox sophistication and low wine demand growth. Countries falling into this cluster include Chile, Israel, New Zealand, Switzerland, Turkey and the United States. Technology push factors and demand pull drivers have not kept pace with other clusters. It is not surprising that Israel, Switzerland and Turkey are in this cluster as they are most likely constrained by land (soil), knowledge (expertise), and religious barriers (Islam). What is surprising is that this cluster includes the United States, Chile and New Zealand, since the literature is extensive in explaining the shift in demand to new world wines from old world wines (Aleixandre et al., 2016) and consumers have shown an increase in preference for new world wine with a perception that it offers uniqueness, value for money, quality and innovative blending (Insel, 2014; Aylward, 2003). However, there could be a number of possible explanations that place these countries in the innovation wasteland quadrant. Banks and Overton (2010) found that there appears to be a strong correlation between economic growth and growth in wine consumption. In the United States wine demand growth could have been impacted by the slow recovery in both economic growth and labour wage increases since the great recession of 2008 (Gordon, 2012; Das and Das, 2015). Furthermore, demand for domestic U.S. wines has been displaced by higher quality, imported wines (Banks and Overton, 2010). This may have led to less relative investment in the domestic wine industry that would negatively impact productivity improvements and industry-specific job creation, thus further limiting interest in promoting wine education.

In Chile's case, a failure to produce higher quality wine and instead specializing only in lower quality, bulk wine (Cusmano et al., 2010) may be limiting demand growth and investment. Chile also has a highly concentrated wine industry dominated by a few family-based wineries (Visser, 2004), and this has resulted in lower innovation and a focus on low quality, low cost products with a lack of a clear national image as a wine producer (Veseth, 2011). New Zealand is close to cluster 4 (innovation pull), where there exists higher wine demand growth, but that country still has a relatively lower vinox sophistication ranking, implying that there is relatively weaker institutional support and R & D infrastructure limiting innovative practices across the industry. This observation is supported by earlier work undertaken by Aylward (2003) where wine enterprises in New Zealand felt there was poor institutional support for research and development in their

<sup>1</sup> OECD and World Bank.

<sup>2</sup> [www.wineinstitute.org/resources/statistics](http://www.wineinstitute.org/resources/statistics).

Table 2a  
Calculation of country wine supply ranking.

	Wine Production Value as a % of Total GDP						Production per Wine Acreage (litres per acreage)						Wine Education Programs			
	2011	2012	2013	2014	Growth	Rank	2011	2012	2013	2014	Growth	Rank	(# of)	Rank	Total of Ranks	Sophistication Rank
	<b>Austria</b>	5.34%	8.23%	6.83%	7.74%	45.03%	3	1608	2426	1967	2113	31%	3	9	10	16
<b>Slovak Republic</b>	1.46%	2.61%	2.34%	2.64%	81.29%	1	828	1419	1300	1381	67%	2	5	13	16	1
<b>Germany</b>	1.23%	1.63%	1.59%	1.46%	18.52%	4	2835	3749	3700	3357	18%	6	12	7	17	3
<b>Portugal</b>	14.12%	16.35%	16.41%	16.49%	16.83%	5	1264	1421	1421	1405	11%	9	15	5	19	4
<b>Hungary</b>	6.14%	10.29%	8.43%	10.11%	64.61%	2	963	1509	1253	1722	79%	1	—	17	20	5
<b>Greece</b>	13.96%	15.14%	15.42%	16.20%	16.04%	7	1078	1271	1145	1229	14%	7	10	8	22	6
<b>Australia</b>	8.69%	8.78%	8.97%	9.12%	4.96%	17	2911	3316	3799	3519	21%	4	17	4	25	7
<b>Spain</b>	12.27%	0.13%	11.03%	13.46%	9.67%	12	1485	16	1336	1633	10%	11	24	3	26	8
<b>Czech Republic</b>	0.88%	1.48%	1.06%	1.02%	16.21%	6	963	1667	1154	1154	20%	5	—	17	28	9
<b>France</b>	17.26%	19.64%	15.96%	18.26%	5.83%	15	2348	2700	2186	2489	6%	15	66	1	31	10
<b>Italy</b>	11.92%	11.53%	15.56%	13.26%	11.25%	10	2636	2477	3114	2624	0%	19	60	2	31	10
<b>Canada</b>	0.51%	0.60%	0.60%	0.60%	15.78%	8	2154	2339	2393	2300	7%	13	9	11	32	12
<b>New Zealand</b>	20.03%	18.77%	16.25%	20.73%	3.49%	18	3390	3092	2855	3641	7%	12	13	6	36	13
<b>Mexico</b>	1.36%	1.37%	1.50%	1.50%	9.72%	11	1493	1522	1618	1652	11%	10	—	17	38	14
<b>Chile</b>	14.96%	20.17%	20.02%	16.26%	8.66%	13	1899	2464	2494	2015	6%	14	8	12	39	15
<b>United States</b>	1.74%	1.88%	1.95%	1.83%	5.10%	16	2759	2928	2992	2919	6%	16	10	9	41	16
<b>Israel</b>	1.81%	1.81%	2.00%	1.83%	1.27%	19	1368	1421	1882	1550	13%	8	1	15	42	17
<b>Turkey</b>	0.26%	0.28%	0.29%	0.29%	14.38%	9	11	11	11	11	1%	17	—	17	43	18
<b>Slovenia</b>	23.18%	12.01%	21.70%	25.16%	8.57%	14	1900	923	1600	1875	−1%	21	1	16	51	19
<b>Japan</b>	0.25%	0.24%	0.24%	0.26%	1.16%	20	1886	1860	1881	1907	1%	18	—	17	55	20
<b>Switzerland</b>	2.53%	2.52%	2.42%	2.18%	−13.99%	22	3030	2986	2973	2649	−13%	22	2	14	58	21
<b>Korea</b>	0.03%	0.03%	0.03%	0.03%	−2.50%	21	265	298	271	262	−1%	20	—	17	58	21

industry. More recent work by [Yu and Lindsay \(2016\)](#) suggests that perceived market uncertainty has reduced investment confidence in New Zealand's wine industry and, like that in the United States, has suffered from continued recessionary effects post-2008.

For the new-world wine producers the productivity constraints have factored into lower vino-sophistication measures and are a result of inefficient use of inputs that may not be meeting a surge in the market for higher priced premium wines. The expansion of the 1990s involving the production of

Table 2b  
Calculation of Country Wine Demand Ranking (000's litres).

	2011	2012	2013	2014	% Change 2014/2011	Wine Demand Rank
Japan	287,000	336,000	342,100	348,000	21.25%	1
Austria	210,900	262,000	253,000	252,000	19.49%	2
Korea	29,800	32,200	34,200	35,000	17.45%	3
Australia	462,000	458,000	453,000	540,000	16.88%	4
Greece	258,300	303,100	290,000	300,000	16.14%	5
Slovenia	77,000	86,400	87,800	88,000	14.29%	6
Mexico	144,600	149,900	152,500	160,000	10.65%	7
Canada	470,000	488,000	498,000	506,000	7.66%	8
Czech Republic	193,000	199,400	200,300	200,000	3.63%	9
New Zealand	89,900	91,300	91,500	93,000	3.45%	10
Chile	290,100	293,500	296,900	298,000	2.72%	11
Germany	1,970,700	2,000,000	2,030,000	2,020,000	2.50%	12
United States	3,163,300	3,159,500	3,117,600	3,217,500	1.71%	13
Spain	989,400	930,000	910,000	1,000,000	1.07%	14
Switzerland	310,700	309,600	310,900	310,000	−0.23%	15
Hungary	241,200	201,000	235,200	240,000	−0.50%	16
Portugal	455,000	460,000	455,100	450,000	−1.10%	17
France	2,932,200	3,026,900	2,818,100	2,790,000	−4.85%	18
Israel	8252	7463	7160	7838	−5.02%	19
Italy	2,305,200	2,263,300	2,179,500	2,040,000	−11.50%	20
Slovak Republic	97,600	84,200	85,000	85,000	−12.91%	21
Turkey	113,700	14,100	14,100	14,000	−87.69%	22



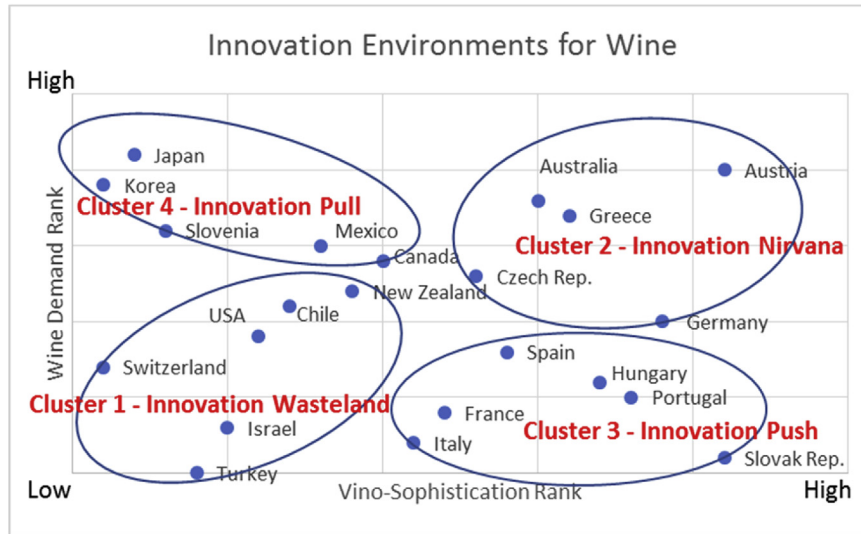


Fig. 3. Wine innovation commercialization clusters.

Table 3  
Initial cluster centers.

Cluster	1	2	3	4
21.00	1.00	11.00	21.00	
15.00	2.00	20.00	3.00	

Table 4  
Cluster iteration history.<sup>a</sup>

Iteration	Change in Cluster Centers			
	1	2	3	4
1	4.808	6.083	3.332	4.294
2	1.425	.000	1.756	.000
3	.000	.000	.000	.000

<sup>a</sup> Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 3. The minimum distance between initial centers is 11.180.

too much lower-end bulk wine products may have destined these countries to be in the innovation wasteland a decade later (Banks and Overton, 2010). The lack of new production processes or techniques has hindered advances in productivity and this ultimately leads to lower growth prospects in the wine industry for these countries. Perhaps this lower level of growth may signal to wine companies within these countries that they have reached their limit of innovation as a result of a lack of management focus and planning. Finally, the relative lack of investment in wine education programs leads to weak factor conditions related to human capital with these countries producing less skilled human capital and accordingly a greater likelihood for low knowledge creation to innovate.

Since the markets in this cluster generally lacks understanding of the nature and complexity of wine making and product knowledge, there are higher levels of uncertainty

Table 5  
Final cluster centers and cluster membership.

	Cluster			
	1	2	3	4
Vino-sophistication	16.67	5.20	6.50	17.20
Wine Demand	15.00	6.40	17.67	5.00
Commercialization Environments	Innovation Nirvana	Innovation Wasteland	Innovation Pull	Innovation Push

Cluster Membership

Case Number	Country	Cluster	Distance
1	Australia	2	3.000
2	Austria	2	6.083
3	Canada	4	6.003
4	Chile	1	4.333
5	Czech Rep	2	4.604
6	France	3	3.516
7	Germany	2	6.017
8	Greece	2	1.612
9	Hungary	3	2.242
10	Israel	1	4.014
11	Italy	3	5.069
12	Japan	4	4.883
13	Korea	4	4.294
14	Mexico	4	3.774
15	New Zealand	1	6.200
16	Portugal	3	2.587
17	Slovak Rep	3	6.431
18	Slovenia	4	2.059
19	Spain	3	3.962
20	Switzerland	1	4.333
21	Turkey	1	7.126
22	United States	1	2.108

about the product and when combined with the lack of economic incentives increases the risks associated with the cost of innovation and product development which can limit the participation of larger incumbents. This results in lower levels of risk capital and a greater reliance on government funding to stimulate innovation with such funding more likely to be available for disruptive innovation.

Table 6  
National commercialization environments and strategies for wine industry entrepreneurs.

Country	Commercialization Environment	Innovation Type	Commercial Risk <sup>a</sup>	Commercialization Choice	Commercialization Strategies
Chile	Innovation Wasteland	Disruptive	High	Dependent (Collaboration)	Government incentives, external R&D contracts
Israel					
New Zealand					
Switzerland					
Turkey					
United States	Innovation Push	Discontinuous	Moderate		Outsourcing, licencing
France					
Hungary					
Italy					
Portugal					
Slovak Republic	Innovation Pull				Joint ventures, strategic alliances
Spain					
Canada					
Japan					
Korea					
Mexico	Innovation Nirvana	Sequential	Low	Independent	Venture capital, equity financing, acquisition
Slovenia					
Australia					
Austria					
Czech Republic					
Germany					
Greece					

<sup>a</sup> Product risk, cost risk and market risk.

Cluster 2 contains high wine sophistication and high wine demand countries within the Innovation Nirvana commercialization environment. Countries identified in this cluster are Austria, Australia, Czech Republic, Germany and Greece. Wine sophistication among these countries are related to optimal use of factors of production in wine making such as better use of technology to increase productivity. Higher rates of technology push are related to investment in equipment, machinery and software, as well as process innovation, such as growing and production techniques. The literature identifies Australia and Greece as countries that are investing in varietal conversion, vineyard relocation, and improvement of vineyard management techniques in order to boost the competitiveness of both countries (Vlachos, 2017). These countries also have strong institutional linkages to research and development in their wine industries and have developed a strong collaboration with the science community that facilitates the flow of information among researchers and also allows for cost-sharing and improved efficiency in research (Katz and Martin, 1997; Newman, 2004). The interactions between wine regions in terms of investment, technology transfer, movement of wine makers and trade are also related factors that place these countries in the Innovation Nirvana cluster (Legendijk, 2004).

Another reason for higher wine-sophistication in these countries is the increased attention to standards by wine associations and government agencies (Anderson, 2001). Developing high quality wine standards from the technology push factor has a positive impact on demand pull. The market demands premium wines that command a premium price and therefore the wine sophistication and demand pull drivers in

this cluster has allowed wine entrepreneurs to continuously improve their product offerings. This situation leads to sequential innovation that encourages product acceptance and market demand.

An important factor contributing to the vino-sophistication of countries within this cluster is the investment in wine education programs. These types of investments, not only in the technical nature of wine production but the business side of wine leads to a specific skill set which in turn has greater opportunity for human capital to use the skills and knowledge to innovate in the wine sector. These programs are linked to introducing new grape varieties and on reducing the variability of output in order to produce wines of regular taste and quality despite the variability in climate conditions, and soil characteristics (Cusmano et al., 2010). For wine entrepreneurs in countries identified in this Innovation Nirvana cluster the limited product and market risk encourages continuous innovation and attracts venture capital, equity investment, or an acquisition of their innovation by larger incumbent firms.

Cluster 3 represents a wine product Innovation Push environment characterized by wine producing countries that rank highly in terms of their market's vino-sophistication but where their growth in wine demand rank is lower. Within this cluster are countries whose wine markets are very mature including Italy, France, Spain and Portugal therefore the higher levels of vino-sophistication is not surprising. However, growth in wine demand when compared to other regions is low. This finding is consistent with the work of Martínez-Carrión and Medina-Albaladejo (2010) who found that these traditional wine countries continued to see declines in wine consumption. Market decline is indicative of a mature industry where product

innovation declines and has been replaced by process innovation that seeks to improve efficiencies and lower costs (Grant et al., 2015). Research undertaken by Giuliani et al. (2010) in the Italian wine market supports that scenario. Introducing new product innovation into a declining market faces higher economic risk and is therefore likely to be more discontinuous than sequential. For wine entrepreneurs, the existence of large wine producers in these countries and the relative vino-sophisticated environments would support the use of joint ventures or strategic alliances with their larger competitors.

The fourth cluster of countries exist within the Innovation Pull commercialization environment. In this cluster the vino-sophistication of the market is relatively low but the growth in wine demand is quite high. Accordingly, countries that fall within this environment include emerging wine producers such as Japan and Korea. In their study of Japan's wine industry Bruwer and Buller (2012) describe how wine has become increasingly popular but that the domestic wine industry is still overshadowed by imported production from more established wine producing countries. Other countries such as Canada and Mexico were allocated to this cluster, albeit at the periphery of the cluster and leaning towards an environment of Innovation Nirvana. In Canada, innovation in wine products and production continues to move towards being sequential in nature with significant innovation being undertaken by most domestic wine producers (Doloreux et al., 2013). However, when compared to the larger global producers, Canadian firms and the local wine industry are tiny in comparison thus limiting the size and scope of institutional support in increasing market vino-sophistication. This would suggest that smaller Canadian wine producers face greater product uncertainty for innovative wine products and this risk promotes more discontinuous, rather than sequential innovation. The framework identifies commercialization strategies that involve collaboration through outsourcing and licencing with larger incumbent wine producers where the combination of the smaller firm's innovative wine products and the established complementary capabilities of the larger firms would enhance the commercial potential of the new products. A recent study of the organization of innovation in the Canadian wine industry supports Canada's environmental cluster location as it found that innovation is principally developed in a collaborative manner (Doloreux and Lord-Tarte, 2013). Mexico's wine industry, while growing, also is limited due to its industry size and lack of domestic innovation support so that innovation relies on collaborative approaches with larger non-domestic firms (Trejo-Pech et al., 2012) supporting this respective cluster analysis result.

## 8. Conclusion

The purpose of our study was to identify which wine producing countries provided a better environment for commercializing innovation in wine products and production. Relying on a commercialization framework derived from a market dynamics approach, two specific market dimensions; vino-sophistication and wine demand, are measured to identify four specific environments for commercialization potential

within the wine industry: Innovation Wasteland, Innovation Push, Innovation Pull, and Innovation Nirvana. Each of these environments has their own dominant innovation process and innovation strategies. As indicated by the name given it, the Innovation Wasteland environment suffers from both a lack of wine demand and vino-sophistication making it difficult for innovation in wine products and production to emerge. If innovation is to succeed it requires an innovation that is disruptive to the existing alcoholic beverage market and would benefit from institutional incentives to promote its adoption. Furthermore, collaboration with existing market players whose interest would be piqued by the disruptive potential of the innovation and who would have the necessary capital to invest in further research and development is a likely strategy for wine entrepreneurs to pursue.

With the Innovation Pull and Innovation Push environments the wine product and production innovation processes remain discontinuous and incremental as both product and market uncertainty arising from lower levels of demand or vino-sophistication increase the risk associated with investment in innovation. Employing collaborative commercialization strategies will encourage market demand and vino-sophistication and over time these commercialization environments may transition to an Innovation Nirvana where market risk is low and wine product and production innovation can be sequential in nature.

A k-means cluster analysis was undertaken on 22 OECD wine producing nations to illustrate the use of this framework in suggesting the choice of commercialization strategy to be employed for innovative wine products and production. Table 6 highlights the conclusions of the results of the analysis with identified commercialization environments for the various nations, the expected domination innovation type, level of commercial risk, and the commercialization choice and strategy that would best suit entrepreneurs within the wine industries of those nations.

The contribution made by this research includes the provision of a developed framework and tool for wine entrepreneurs and larger wine companies seeking to assess what form of commercialization strategy, from a market dynamics perspective, would best suit certain wine producing countries and regions. It also adds to the literature on innovation commercialization in the context of the global wine industry.

This research has its limitations in that we have focused on only two market dimensions and therefore have restricted the number of commercialization environments to four. The complexity of the global wine industry suggests that other market dimensions might influence innovation strategies for wine producers and that the reliance on demand and vino-sophistication only may be too generalized to rely on when making specific strategic choices. For example, the global wine industry is dominated by major international firms with production in many countries and intrinsic factors such as supply chain management (import/export strategies) practices could impact innovation decisions by the firm. Furthermore, the generalization of results from the k-means cluster analysis particularly for those nations that occupy the peripheries of the

clusters may not be appropriate. However, the cluster analysis results suggest that the application of the framework as an initial determination of the environment for commercialization, and related commercialization strategies, is reasonable and that further support can then be obtained through additional market analysis of specific countries.

### Conflict of interest

The authors declare no conflict of interest.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.wep.2019.10.001>.

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