CLUSTERS AND INNOVATION: A CASE OF THE COLCHAGUA WINE CLUSTER

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Abstract

ICT-enabled clusters are increasingly being employed to gain competitive advantage. Through the formation of relationships, participants of clusters share knowledge and expertise to collectively seek new markets and opportunities that would be otherwise unattainable on their own. This paper presents a research in the field of innovation clusters applied to the Chilean wine industry. The Innovation Value Chain is used as the basis for analysing processes of a wine cluster in Chile. Preliminary results from published data show that relationships formed by the structure of the cluster have enhanced the overall performance of the cluster. The Innovation Value Chain can be a useful strategic tool for management decision-making as organisations can identify areas for improvement through the three-phase process of innovation. The paper also concludes that a geographic based wine cluster fosters the surge, development and implementation of innovation activities to some degree. Future work involves conducting in-depth interviews with participating wineries to further verify the framework.

Keywords: Innovation, ICT-enabled clusters, Chilean wine industry, Innovation Value Chain.
1 INTRODUCTION

ICT enabled clusters have been receiving increasing attention as a possible business strategy for a range of different industries seeking to build competitive firms in their markets. Potential synergy can be achieved by firms either by collaborating with other firms or with external agents such as public institutions, business organizations and research institutions. This leads to the formation of relationships, networks and links where both formal and informal knowledge flows either intentionally or unintentionally (or spillovers) enabled by ICT such as connections through Internet based platforms. This knowledge can act as the source for the development of innovative activities which can lead to competitive advantage for firms. Innovation as defined by the OECD refers to the “implementation of a new or significantly improved product (good or service), a new process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations” (OECD 2005).

In the Chilean wine industry, the lack of resources, as well as the lack of highly developed knowledge source (from research programs and institutions), and professional workers have impeded it from reaching a higher position amongst the leaders of wine producing countries. Experts suggest clustering based on geographic wine zones as the business scheme to compete. Clusters can be defined as “geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate” (Porter 2000). Through the brand image of a cluster, wineries could develop activities that would not be possible on their own. Similarly, actions pursued within a cluster may foster an innovation prone atmosphere; therefore wineries may benefit from this innovative scheme, to reach new markets or increase their market share, and finally, to develop competitive advantage.

This paper presents a research in progress using the Chilean wine industry organized as clusters to ascertain whether the cluster environment fosters the surge, development and implementation of innovative activities. Processes, activities and relationships forged within the cluster environment will be analysed based upon an adapted framework namely, the Innovation Value Chain developed by Hansen and Birkinshaw (2007). This model examines the whole process of innovation development from idea generation through to diffusion of innovation. It was selected as it allows the analysis of the aggregation of individual innovations goals (from persons and individual firms within a cluster) at a cluster level, and how these are developed into commercialized actions. This paper is structured as follows: Section 2 analyses the literature on innovation clusters and the Chilean wine industry; Section 3 describes the research methodology; Section 4 analyses the data; finally Section 5 concludes the paper with recommendations for further work.

2 LITERATURE REVIEW

2.1 Innovation and Clusters

A definition of innovation clusters is found in Hamdouch (2007) as “an innovation cluster comprises an ensemble of various organizations and institutions that are: (a) defined by respective geographic localizations occurring at variable spatial scales and within specific institutional environments, (b) interacting formally and/or informally through inter-organizational and/or interpersonal regular or more occasional relationships and networks and (c) contributing collectively to the achievement of all kind of innovations within a given industry or domain of activity, i.e. within a domain defined by specific fields of knowledge, competences and technologies”.

From the literature, there are different approaches to innovation studied from the spatial boundaries and location of business clusters. One approach analyses economic growth as a positive effect of the
innovation developed within clusters. Many efforts have emerged towards the analysis of clustering as a business model which fosters worldwide competitiveness from a regional perspective. To this aim, Mejía Trejo et al. (2011) examined empirically which are the variables found within a cluster context supporting innovation for developing competitiveness in the Guadalajara information and communication technology cluster in Mexico. These variables are: strategy, policies towards the development of value added product and services, creativity, and national government policies. They found that strategy and government policies are the most and least important variables respectively. Moreover, according to Chang et al. (2012) innovation and cluster represents the most important dimension for measuring regional innovation and entrepreneurship, which in turn boost regional development and growth amongst clusters within the Taiwan Science Parks. Similarly, Bröcker et al. (2003) argued that geographic based clusters are the source of regional growth, in terms of regional competitiveness and employment. Also, Cooke (2003) points out that the development of innovation is crucial to increase competitiveness through the upgrading of firms which finally will stimulate economic development. The study by Rodríguez-Pose and Comptour (2012) found that the importance given to regional innovation systems for economic growth explains the increasing application of clustering programs.

Another approach examines how firms become innovative as a result of their participation in a cluster. Following this line, Baptista and Swann (1998) pursued an analysis to elucidate whether firms within a strong cluster (i.e. high employment density), are likely to innovate more than others outside it. The results demonstrated that firms belonging to a strong cluster in the same industry have a higher probability to innovate. This supports the argument that concentration of knowledge spillovers in a certain location would boost innovative developments. Besides, there is a significant relation between market share and innovation as firms with bigger market share are more innovative. Nonetheless, this relationship also implies a negative impact of market concentration. The explanation is that despite the positive correlation between market share and innovation, a higher likelihood to innovate is found in firms of industries with more intense competition. Thus, two assumptions arise from this work: innovation is boosted by competition; and innovation is inhibited by market concentration. Similarly, Aharonson et al. (2013) pursued an study of the biotechnology industry in Canada to ascertain that firms belonging a cluster in this industry innovate more that external firms. The results reaffirmed that clustered firms achieve greater outcomes from innovative activities. Furthermore, clustered firms demonstrated innovative levels eight times higher than dissociated firms. Nevertheless, Beaudry and Breschi (2003) applied the same methodology as Baptista and Swann (1998) but their findings differ. According to them, the beneficial outcomes emerge as an effect dependent on the presence of innovative companies. In this sense, the probability to innovate for a clustered firm depends on an accentuated existence in the same region and industry of the cluster of innovative firms, and spillovers possessing important knowledge concentration as well. Furthermore, existence of non-innovative firms in the same region and industry appears to negatively affect the innovation process.

2.2 ICT enabled Clusters

Despite the extensive research done in the field of business clusters and the many benefits clusters bring to participating firms, especially for innovation development, there is a lack of research in the role ICTs play for their competitiveness (Steinfield et al 2012; Steinfield & Scupola 2008). This leads to further studies on clusters’ advantages derive from collaboration and learning processes among clustered firms, which are developed basically through communication (Steinfield & Scupola 2008). Moreover, the studies performed within this field reinforce the argument that ICTs could strengthen clusters competitiveness based in the given use. It was thought that when firms within a cluster, interacts with firms outside their cluster, it would reduce the cluster vitality. However this was found to be untrue. Instead, companies find markets outside, meanwhile ICTs use may provide sources for technology and innovative knowledge to be applied within the cluster through the geographic based clusters interactions. Furthermore, SMEs could gain greater benefits since they could get access to ICT infrastructure that they would not attain on their own (Steinfield & Scupola 2008). Investigations
regarding these issues have focused in varied industries. Steinfield et al (2012) studied SMEs in rural business clusters in the metalworking, auto and wood product industries. Steinfield and Scupola (2008) investigated SMEs from a knowledge-intensive industry, concluding that ICTs reinforce cluster vitality. Konstadakopulos (2005) researched SMEs clusters from a region in a developing country, i.e. the handicraft industry in the Red River region of northern Vietnam. In this case, the extent of ICT and mechanisms used such as e-commerce depends upon the ICT infrastructure and Internet connectivity in those areas. Similarly, Opiyo and K’Akumu (2006) studied informal MSE – Micro and Small Enterprises- clusters in Nairobi. The findings pointed out the need to enhance the understanding of the drivers and pressures to ICT adoption. Braun (2003) investigated the influence of the process of developing an e-marketing and e-commerce platform on cluster vitality and innovation for the regional tourism network in Victoria, Australia. Nonetheless, the outcomes showed that decision makers targeted the potential platform for market purposes and not for cluster strengthening. Specifically for the wine industry, Notia and Vlachvei (2013) analysed a web site utilization in SMEs for the Greek wine industry. Even though this study was not focused on any particular wine cluster, the findings provide insights about the aims of wineries websites. Thus, wineries can be classified in four categories according to their websites functionalities, i.e. e-commerce experts, social media users, simple informative features, and wine tourism oriented. Novoa (2010) examined a Web 2.0 project to promote the Portuguese wine industry, i.e. the INFOVINI project. The results demonstrated the efficacy of this portal to promote Portuguese wines based upon improving the user experience through offering mobile applications, and enhancing collaborative processes among wineries. Sellitto and Burguess (2005) examined a government funded portal aimed to promote cluster vitality and relationships in the Gippsland wine cluster in Australia. The findings illustrated beneficial outcomes for the wineries since the portal boosted resource sharing, informal knowledge exchanges, and innovative practices which led to new product development. Moreover, Adebanjo and Michaelides (2010) showed the analysis of a Web 2.0 enabled e-cluster which connected firms of the UK food industry geographically dispersed. Research to date has shown that firms could reap many benefits of geographic clusters that are facilitated as an ICT enabled cluster. Thus, studied firms in various industries mentioned above are slowly adopting digital clusters. The following section presents the case of ICT enabled clusters in the Chilean wine industry

2.3 The Chilean wine industry

The Chilean wine industry performed remarkably well since the 1980s’, shifting from a domestic market focus towards an international one. The production zone within the national territory, according to Felzensztein and Deans (2013) concentrates in three main regions: Maule, Casablanca and Colchagua valleys. Particularly, the Colchagua cluster consists of new worldwide level modern wineries developed during the last decade (Giuliani and Bell 2008). Besides employing a technological upgrading process to improve wine quality within the wineries, it also focussed on the development of technology and professional skills of its employees. All these made the Colchagua cluster a leading wine region in Chile (Giuliani 2007).

The history of the Chilean wine industry may be characterized upon the following issues: diversification of the target markets, due to the small size of its domestic market; introduction of technological innovation; political issues; the entry of foreign investors; and the influence of the globalized wine industry. Hopefully, through its evolution, Chilean wines could be recognized as very good quality with acceptable prices (Cusmano et al. 2008); (Van Tienhoven 2008); (Felzenszteïn 2011); (Gwynne 2004); (Kunc and Bas 2009); (Visser and De Langen 2006).

Since then, the Chilean wine industry has increased its levels of production, export and value of exports (Felzenszteïn 2011); (Van Tienhoven 2008); (Visser and De Langen 2006). Subsequently the Chilean wine industry reached the seventh position of the wine producing countries and the fourth largest exporter in the world between 2000 and 2012 (OIV 2013). Despite its outstanding performance, many authors have also mentioned the weaknesses and challenges for the Chilean wine industry. These are summarised in Table 1.
<table>
<thead>
<tr>
<th>Issue</th>
<th>Problems</th>
</tr>
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<tbody>
<tr>
<td>Market share</td>
<td>Focus in the production of bulk wine for the lowest segment of foreign markets at cheaper prices (Kunc 2007) Wineries should focus in the export of better quality wines to higher segments (Zamora and Bravo 2005) Necessity of rise of quality and variety of wines produced (Visser and De Langen 2006) Despite the increase of production levels, the growth of the export levels has been lower (Van Tienhoven 2008) Domestic consumption of wine has decreased since the 1960s (Van Tienhoven 2008)</td>
</tr>
<tr>
<td>Marketing</td>
<td>Concentration in wine as a product instead of marketing strategy (Foster et al. 2002) (Kunc 2007) Lack of a marketing strategy to promote and to position the industry worldwide (Foster et al. 2002) Lack of a “Chilean brand” to promote knowledge and attraction about Chile of target markets (Felzensztein 2011) Development of a brand strategy is required (Visser and De Langen 2006) Lack of well-known reputation difficult accessing proper distribution channels (Van Tienhoven 2008) Marketing vision and market research not developed (Van Tienhoven 2008) Efforts should be towards the development of marketing studies, and strategic alliances (Kunc 2007)</td>
</tr>
<tr>
<td>Resources</td>
<td>Small and medium wineries do not possess enough skills and funds for management and innovation procedures (Van Tienhoven 2008) Increment of costs for production and storage, the levels of business rivalry, and the global wine prices stagnation impede the rise of wines prices in international markets (Kunc 2007)</td>
</tr>
<tr>
<td>Technology</td>
<td>Technology incorporated for production process is mostly from overseas and still needs more efforts in order to take complete advantage of its benefits (Van Tienhoven 2008)</td>
</tr>
<tr>
<td>Support</td>
<td>Not enough public body sustenance (Zamora and Bravo 2005)</td>
</tr>
<tr>
<td>Cooperation</td>
<td>Lack of coordination due to confidence absence among wineries (Van Tienhoven 2008)</td>
</tr>
</tbody>
</table>

Table 1. Problems in the Chilean wine industry.

As shown in Table 1, Chilean wineries are only competing on low prices which is not sustainable (Zamora and Bravo 2005); (Visser and De Langen 2006). Therefore, clustering may be a suitable business model for Chilean wineries. This leads to the research question being addressed in this paper: “Does the environment within a geographic based wine cluster foster the generation, conversion and diffusion of innovative activities?”

### 2.4 The Innovation Value Chain Framework

The Innovation Value Chain Framework, proposed by Hansen and Birkinshaw (2007), has three stages: Idea Generation, Conversion and Diffusion. This model examines innovation development as three phases, idea generation, idea conversion, and idea diffusion; and six crucial elements (i.e. In-house, Cross pollination, External, Selection, Development and Spread) through the phases. It promotes the identification of strengths and weaknesses in the process which affect the innovation outcomes. In addition, it is also useful for decision makers regarding resources allocation. Figure 1 depicts this framework adapted from Hansen and Birkinshaw (2007).

The Innovation Value Chain framework was selected in this research because it provides deeper insights into the development of innovative ideas within a cluster arrangement. As mentioned previously, the cluster structure fosters the formation of knowledge, learning and business collaborative linkages ((Visser 2004), Giuliani (2003), Giuliani (2008), Olavarria A. et al. (2008)) among firms and between firms and other actors such as universities, business and research institutions. Therefore, innovation may be better studied within the Innovation Value Chain framework.
Framework as it considers particular analysis of these linkages amongst wineries, and other actors particularly at the Idea Generation stage.

<table>
<thead>
<tr>
<th>Idea Generation</th>
<th>Conversion</th>
<th>Diffusion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-house</strong></td>
<td><strong>Selection</strong></td>
<td><strong>Spread</strong></td>
</tr>
<tr>
<td>Do people in our unit create good ideas of their own?</td>
<td>Do we source enough good ideas from outside the firm?</td>
<td>Are we good at diffusing developed ideas across the company?</td>
</tr>
<tr>
<td><strong>Cross-pollination</strong></td>
<td><strong>Conversion</strong></td>
<td><strong>Development</strong></td>
</tr>
<tr>
<td>Do we create good ideas by working across the company?</td>
<td>Are we good at screening and funding new ideas?</td>
<td>Are we good at turning ideas into viable products, business and best practices?</td>
</tr>
<tr>
<td><strong>External</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of high-quality ideas generated within the unit</td>
<td>Number of high-quality ideas generated across units</td>
<td>% of all ideas generated that end up being selected and funded</td>
</tr>
<tr>
<td></td>
<td>Number of high-quality ideas generated from outside the firm</td>
<td>% of funded ideas that lead to revenues, number of months to first sale</td>
</tr>
</tbody>
</table>

**Figure 1.** The Innovation Value Chain. Source: (Hansen and Birkinshaw 2007)+

### 3 RESEARCH METHODOLOGY

Initially, a review of the literature was conducted to obtain information about ICT enabled clusters in the wine industry in Chile as well as other wine producing regions of the world. At the same time, relevant theories such as Diffusion of Innovations were investigated for their applicability to this research. Finally, the Innovation Value Chain framework was adopted in this research for the reasons illustrated in previous section (see section 2.4).

To apply the Innovation Value Chain Framework (as shown in Figure 1) to the Colchagua wine cluster, the following constructs will be considered.

1. Phase of Idea Generation:
   - In-house: This considers all ideas from the firms of the wine cluster as a result of the awareness of the managers and workers to innovate.
   - Cross-pollination: This refers to ideas that can flow among the firms as a result of cluster dynamics such as formal or informal relationships, and intended or non-intended ways.
   - External: This refers to ideas from external agents to the clustered firms. This exchange can be between actors of the Chilean wine cluster and other wine companies either from the Chilean or international industries.

2. Phase of Conversion:
   - Selection: This considers all the innovative ideas supported by the managers and owners of the firms within the wine cluster, which have received economic funds either from the firms or other institutions.
   - Development: This considers all of the supported ideas that are pursued and can be commercialized.

3. Phase of Diffusion:
   - Spread: In terms of the Colchagua wine cluster, this involves new distribution channels, increased market share and new markets.

The following section presents a preliminary analysis of the data found from the literature. In addition to this data, primary data will be collected from the Colchagua wine cluster to further validate and possibly enhance the innovation value chain framework for ICT-enabled wine clusters.
4 PRELIMINARY DATA ANALYSIS

Taking the Innovation Value Chain as the framework to assess the Colchagua wine cluster, initially published data based on this region is used to test the proposed framework. This cluster was chosen as a case study based upon its strengths described in section 2.3. Preliminary data analysis of this cluster is shown in Tables 2, 3 and 4, which present the Idea Generation, Idea Conversion and Diffusion stages respectively.

5 CONCLUSIONS AND FURTHER WORK

Preliminary results of this research show that beneficial outcomes emerge as a result of a cluster environment. This enabled the enhancement of the knowledge base of wineries and capabilities of the workers. At the same time, participants of clusters need to build durable relationships amongst themselves including business rivals and other sources of knowledge from regulatory bodies or institutions. Likewise, in the case of the Colchagua wine cluster, public policies have played a crucial role. This support has enabled opportunities to increase knowledge linkages and concretize innovative ideas leading to profitable outcomes.

The Innovation Value Chain is shown to be a useful strategic tool for management decision-making. When embarking on an innovation journey, organisations can address each phase of the Innovation Value Chain in detail and identify where further work needs to be done to reach the diffusion phase of innovation. In the case of the Colchagua wine cluster, evidence was found for all three phases of the Innovation Value Chain, which supported its leading position in the wine industry. However the findings in this paper were based mainly from published data of the Colchagua region.

Further work for this research involves collecting data from the region itself through an online questionnaire to be applied to participating wineries to verify the framework. There may be other industry-specific innovation factors that are not in the current framework. For instance, while some central firms in the cluster demonstrated low innovative performance, overall the cluster was reported to be more innovative than other leading clusters. Investigations via in-depth interviews will shed further light into the relationship between clusters and innovation theory.

In conclusion, the environment within a geographic based wine cluster fosters the surge, development and implementation of innovation activities to some degree. Last but not least, further work also involves studying other regions in Chile as well as other leading wine producing regions/clusters in the world. The results of future studies will enable benchmarking of wine industries in order to map their immediate strategic competitive directions. Nevertheless, despite wineries are reaching higher levels of innovation due to their participation in a cluster, this case study demonstrates the lack of ICT adoption within Chilean wine clusters.

The contributions of this work include the identification of the environmental factors to promote innovation in a wine cluster in Chile; the application of the Innovation Value Chain framework to the wine cluster setting; and ascertaining that ICT enabled clusters are underdeveloped in the Chilean wine industry. Furthermore, contributions of further work will also allow comparison between various wine clusters in Chile as well as other wine producing regions in the world.

ACKNOWLEDGEMENT

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Table 2. Idea Generation Stage

<table>
<thead>
<tr>
<th>Idea Generation</th>
<th>Cross-pollination</th>
<th>External</th>
</tr>
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<tbody>
<tr>
<td>In-house</td>
<td>Innovative ideas emerge from two kinds of relationships, i.e. general relationships, and knowledge sharing networks among wineries, measured in terms of density. Density of general relationships network measures the number of firms connected to each other to exchange resources such as machinery, grapes, wines and inputs. A density of 1 in means that all firms exchange resources with each other. The density of this network is 0.34. Density of knowledge share network measures the number of firms connected to each other to exchange specific industry related knowledge. A density of 1 in means that all firms exchange knowledge with each other. The density of this network is 0.12 (Olavarría A. et al. (2008)).</td>
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Table 3. Idea Conversion Stage

<table>
<thead>
<tr>
<th>Selection</th>
<th>Development</th>
<th>Diffusion</th>
</tr>
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<tr>
<td>Selection of ideas rest on the funds available from the government, public and private institutions, and the wineries. The percentage of the firms that have expended innovation is (Olavarría A. et al. (2008)): Acquisition of new or significantly enhanced winemaking machinery (73%), Buy of new or significantly enhanced inputs for vineyards (19%), Buy of new or significantly enhanced inputs for winemaking (4%), Buy of new or significantly enhanced inputs for the bottling process (4%), Implementation of new or enhanced innovation certification strategies (0.1%).</td>
<td>Innovations developed by firms are mostly in product and processes. The percentage of the firms that have developed the following innovative outcomes is (Olavarría A. et al. (2008)): Wineries infrastructure (24%), Improvements in bottling (10%), Vinification/oenology procedure (8%), Vinification machinery (8%), Development of new products (8%), Micro-oxygenation (7%), Oenology inputs (7%), Management (7%), Barrels use (7%), Chemic-microbiologic analysis (3%), Grapes selection (3%), Specialized advices (2%), Riles (2%), Enhanced personnel (2%), Energy management (2%).</td>
<td>Innovation is defined as the development of new wines rated as “quality wines” by experts Giuliani (2008). Here, a higher innovation output is related with the next firm characteristics, i.e. larger size, younger, foreign owned, higher knowledge base, joint closer networks, and higher external openness. Specifically, the benefits of product innovation for the wineries are: 95% of firms increased profitability, 59% of firms increased market share, a 52% of companies achieved new markets achieved (52%), and a 50% of them increased their product price (Olavarría A. et al. 2008).</td>
</tr>
</tbody>
</table>

Table 4. Diffusion Stage
References

Aharonson, B. S., et al. (2013). Industrial clustering and innovation output. DRUID. Copenhagen/Aalborg: DRUID.


