The impact of inter-firm networks on regional development: the case of Mendoza's wine cluster

Verónica Alderete y Miguel Bacic

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Abstract: *Cooperation among firms can be analyzed from different theoretical perspectives. The objective of this paper is to frame the analysis of firms' networks according to the local economic development approach. Since fostering cooperation between firms is one of the main elements of local economic development, the objective of this study is to identify the activities and strategies of Mendoza's Wine Cluster that drive the dynamics and development of this regional territory. We provide a theoretical and descriptive analysis to characterize some elements of local development and inter-firm cooperation, so as to identify the possible impacts of winery activity at a regional level.*

Keywords: *wine industry, networks, cluster, local development, Mendoza-Argentine. JEL Classification: L14, L66, R11, R19, Q13.*

El impacto de las redes inter-empresariales sobre el desarrollo regional: El caso del cluster vitivinícola de Mendoza

Resumen: *La cooperación entre empresas puede ser analizada desde diferentes perspectivas teóricas. El objetivo de este artículo consiste en enmarcar el análisis de las redes de empresas de acuerdo con la visión del desarrollo económico local. Dado que el impulso a la cooperación entre empresas es uno de los elementos más importantes de las políticas tendientes al desarrollo económico local, este estudio identifica algunas de las estrategias y actividades del cluster vitivinícola mendocino que estimulan la dinámica y el desarrollo de su territorio de influencia. El artículo presenta un análisis teórico y descriptivo que permite caracterizar algunos de los elementos del desarrollo local y de la cooperación inter-empresarial para identificar los posibles impactos de la actividad vitivinícola a nivel regional.*

Palabras clave: *industria del vino, redes, aglomeraciones, desarrollo local, Mendoza-Argentina. Clasificación JEL: L14, L66, R11, R19, Q13.*

L'impact du réseau d'entreprises sur le développement régional: le cas du cluster du vin dans la ville de Mendoza

Résumé: *La coopération entre les entreprises peut être analysée depuis différentes approches théoriques. L'objectif de cet article est d'analyse les réseaux d'entreprises dans le cadre du développement économique local. Etant donné le fait que la coopération entre les entreprises est l'une des politiques les plus importantes pour le développement économique local, cette étude identifie certaines stratégies et activités qui stimulent la dynamique du cluster du vin à Mendoza, lesquelles contribuent également au développement de sa propre zone d'influence économique. Cet article présente une analyse théorique et présente certains éléments du développement local et de la coopération entre les entreprises, dont l'objectif est celui d'identifier les impacts potentiels de l'industrie du vin au niveau régional.*

Mots-clés: *l'industrie du vin, réseaux d'entreprises, clusters, développement local, Mendoza, Argentine. Classification JEL: L14, L66, R11, R19, Q13.*

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–**Introduction. –I. Theoretical Background. –II. Measuring Inter-Firm Impact on Local Development. –III. Descriptive Analysis of Mendoza´s Wine Cluster. –IV. Factorial Analysis. –V. Correlation between Indicators. –Contributions. –References.**

Introduction

Inter-firm cooperation is an important tool to foster small- and medium-sized enterprises' (SME) competitiveness (Wittmann et al., 2008; Bacic and Souza, 2008; Fuller-Love and Thomas, 2004; Kosacoff and López, 2000; Oughton and Whittam, 1997). For more than twenty years, inter-firm cooperation has been considered a corporative strategy, but only recently has this strategy become important. We can find many types of cooperation and different concepts, for instance alliances, networks, industrial districts, and clusters. Broadly speaking, the network concept refers to a grouping of firms. Building networks presumes that a set of interrelated firms is more efficient than a stand-alone firm or isolated firm due to the networking effects among each other. In general terms, the construction, running and the failure

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phases of the network depend on three basic aspects: trust, competency, Information and Communication Technologies, and inter-organizational integration (Casarotto Filho and Pires, 2001).

The concept of *Arranjos Produtivos Locais* (APLs) or Local Productive Arrangements was spread by researchers associated to the Research Network on Local Productive and Innovative Systems (RedeSist). Lastres (2007) distinguished *Sistemas Locais de Produção e Inovação* (SPILs) or Local Productive and Innovative Systems from APLs. SPILs refer to arrangements of economic, political and social actors that are linked or interrelated to the production of specific goods and services (industrial, agricultural, services, cultural, among others). Among SPILs, we observe ties between agents, cooperation and interaction that promote innovation. In APLs, there are not significant links or cooperation between agents, although territorial concentration prevails. Therefore, APLs can be subject of public policies to develop ties and cooperation among agents.

An important topic in the recent regional development literature has emphasized the role of cooperation among firms, especially in relation to SMEs, in the realization of local competitive advantage (Storper, 1997; Patchell, 1996). Regional clusters create regional employment and wealth and are thus promoters of economic and social development (Corral et al., 2006). Government policies for the clusters should recognize this potential, which is often overlooked. After analyzing state policies for the APLs in Brazil, Garcez et al. (2010) endorse the need for a new generation of support policies. These policies surpass random acts based on the supply of traditional products, and are underpinned in the acquisition of knowledge and in the development of local productive and innovative capacities concerning the economic, social, cultural and environmental scales of the territory.

Many theoretical interpretations have been made about the socioeconomic dynamism of some areas whose competitiveness is based on inter-firm cooperation and knowledge assimilation, and that are successfully integrated into a more globalized economic system (Caravaca et al., 2005).

The new focus of local development promotes endogenous growth, local knowledge, links between firms, the productive system and the scientific-technological system, and the participation of local actors.

Territorial development is conditioned by three different factors: innovation, cooperation among firms, and rational use of the existing resources. Osorio et al. (2006) focus on the influence of these conditioning factors upon the construction of intelligent territories; that is, those capable of improving the local society inhabitants' quality of life and their personal development. These authors link the concept of territorial development to the notion of innovative and productive local systems.

Innovations in economic governance constitute one of the radical changes of our times. Many innovations have emerged in inter-firm and extra-firm organization. In comparison to clusters and districts, there are very few studies on localized learning and innovation in lower- and middle-income countries, so it may be too early to judge the degree to which this perspective can be of help in understanding local economic development (Helmsing, 2001).

Different types of territories may arise whether local inter-firm networks exist or not, and are dependent on the innovative capacity of firms, institutions and the society as a whole. Those territories with established networks are usually considered as emergent territories (Caravaca et al., 2005) and behave more dynamically and competitively.

Lotero et al. (2009) examines regional competitiveness of Colombian departments by obtaining measures of competitiveness using principal components analysis and hierarchical cluster techniques. These simple measures are the product of the combination of a small number of variables, and are consistent with the conceptual framework of economic geography. Regional competitiveness must be understood as a matter closely linked to the spatial strategies of the firms.

Even though there is a strong interaction between the development of networks, clusters and territorial systems (among firms and local institutions without a sectorial focus), these are not necessarily sequential. At the network level, some difficulties are the complexity of public administrations and bureaucracies to legalize collective enterprises, flaws in business management and in connections with local institutions, and the reluctance of owners to share knowledge. Furthermore, geographic proximity is not a sufficient condition

for building networks. Souza and Bacic (2002) examine the agglomeration of firms from the third-generation petro-chemical chain in the Grande ABC Paulista region. The presence of a large number of proximate firms involved in the same economic activity and, to some extent, sharing the same history and tradition is not a decisive factor for cooperation.

Buarque (1999) argues that although local development is a trend with a strong internal content, it is inserted into a wider and more complex reality that interacts and influences it. Barreiro (2000) defines local development as an oriented process and the result of the actors' actions in the development of a particular territory. These decisions are not only taken at a local level, but there exist decisions from a national or international level that influence the development of a specific territory. The goal of this research is to explore Mendoza's Wine Cluster from a local development perspective, with special emphasis on economic and social dimensions, omitting the institutional framework analysis. We have chosen Mendoza's wine cluster due to its recent dynamism. In Argentina, the national government settled the Winery Strategic Plan with the goal of selling around 2 billion dollars in 2020. The province of Mendoza accounts for 70% of the planted surface of wines and 66% of wine production in the nation.

A substantial part of research on socioeconomic and territorial changes includes the idea of a space integrated by flows and networks. Many disciplines have studied this phenomenon: sociology (social interaction, dynamic and socio-institutional networks), economics (inter-firm networks) and geography (territorial networks). For the purpose of this article, we revised contributions from economics and geography, building links between them. The analytical starting point consists of using the theoretical framework for a better understanding of local development and the role of inter-firm networks in promoting it.

The purpose of this study is to identify the presence of correlation between the wine cluster's economic indicators and Mendoza´s economic and social indicators. From a factorial analysis, we build some economics and socio-demographic indicators. We show that there are some relationships between them, meaning that the winery activity in Mendoza promotes a virtuous circle

towards local development in the economic and socio-demographic fields.

The paper is organized as follows. In section 1, we provide a theoretical analysis that allows us to characterize some elements of local development and inter-firm cooperation. In section 2, we offer through a descriptive analysis some possible indicators to measure the impacts of Mendoza's wine cluster at a regional level. Then, we build some indicators by means of a Components Principal Analysis. Afterwards, we apply a correlation analysis between indicators. Finally, we mention some contributions of the paper.

I. Theoretical Background

Although there are different types of networks (strategic alliances, joint ventures, manufacturer networks, clusters, industrial districts, among others), the concept of cluster seems to dominate among the categories related to regional and local development.

The network structure facilitates the common use of resources. The adoption of common standards, exchange of information and shared use of common facilities are all examples of cooperation in which firms may increase their profits.

Productive agglomerations refer basically to input-output relations in a territorial agglomeration. Clusters, also known as industrial districts, consist of a sectorial and geographical agglomeration. Firms benefit from the local economy resources (infrastructure, specialized labor, natural resources) and the productive chains' institutions. However, geographical proximity is not a sufficient condition for networking. In particular, Souza and Bacic (2002) analyzes the concentration of firms of the third-generation petrochemical chain from the ABC Paulista region, where the presence of a large number of firms localized in a proximate space and partly linked by the same history is not a decisive factor for cooperation.

In Latin America, international organisms such as the Inter-American Development Bank or the World Bank foster the consolidation of clusters through the promotion of regional competitiveness programs. The United

Nations Industrial Development Organization (UNIDO, 2003) differentiates between Clusters and Networks. Clusters are geographic concentrations of firms producing and selling a set of complementary products, and therefore facing common challenges and opportunities. Moreover, UNIDO clusters' projects have stimulated innovation of products, processes and productive functions, facilitated the access to new markets and contributed to the creation or strengthening of institutions (by building collective norms and organizations).

The concept of productive agglomerations has evolved because of the importance of local actors to achieve local development goals. This conceptual evolution has impacted on defining development policies, including those promoting innovation (Table 1).

Table 1. *Comparative table*

	Productive Agglomeration	**Cluster (industrial district, APL)**	**SPIL**
Research unit	Firms	Local actors	Local actors
Type of concentration	Sectorial	Sectorial/Local	Local
Importance of territory	Yes	Yes	Yes
Type of Relationships	Economic	Economic Institutional	Economic Institutional Political Social

Source: The authors.

If we made a literature review of the phenomenon, we observe a diversity of views. Some studies start from the perspective of the firms (neo-Schumpeterian vision). Others emphasize on territorial or geographical proximity in national and local innovation systems (Becattini, 1989; Garofoli, 1995; Storper, 1997). Others use the notion of innovative milieu, or the notion of learning region, to study several territorial dynamics.

In spite of the different views, they share a common characteristic: the importance of the territorial context for learning processes, building knowledge and exchanging tacit knowledge (Leite, 2004).

In Brazil, the emphasis on local factors brought about the development of the widely spread term *arranjos produtivos locais* (APL)[1] or, in English, local productive arrangements. APLs are production systems deeply rooted in the local because of the competitive advantages coming from the geographical territory. Competitive advantages come from cooperation and the possibility of improving knowledge.

The APL concept was extended to the *arranjos produtivos e innovativos locais* term that links the issues of competitiveness, innovation and economic sustainability to social inclusion, employment, land distribution and local development concerns (Cassiolato et al., 2008).

From a political perspective, productive and innovative local arrangements are part of a successful process in Brazil and its implementation is under study in the rest of the world.

The notion of local productive and innovative arrangements developed by RedeSist in Brazil does not pretend to determine general rules of application, since this perspective stresses the singularities of regional development. However, it could set a theoretical and normative starting point for the promotion of local development in many other countries.

The territorial perspective prevails to offer more effectiveness to productive and innovative policies. It places them in a real locus of implementation and promotes synergies and complementarities.

From the perspective of local development, networking is a key factor for innovation and territories' dynamism. It affects, directly or indirectly, the functioning of productive systems. The recognition of the transcendental importance of networks in the territories' competitiveness is observed in

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1   RedeSist is a research network focusing on productive and innovative local systems in Brazil. It has developed the concept of local productive arrangements and a local productive and innovative system, so as to study the relationship between groups of firms as well as their links with other agents (economic, political and social) within a given territory (Cassiolato and Lastres, 2003).

socioeconomic studies: inter-firm cooperation enables the construction of business systems that seek competitive and innovative neighborhoods. This process takes place by taking advantage of certain territorial externalities derived from agglomeration, and also by taking advantage of territorial business tradition (Narváez et al., 2008; Caravaca et al., 2005).

Inter-firm networks are a necessary but insufficient condition for local development. Therefore, the effect of inter-firm cooperation on territorial development depends on the relationship with other social agents.

According to Boscherini and Poma (2000), the global economy requires the presence of a larger capacity of design and joint decision making at the territory level. Thus, we need to make the industrial atmosphere visible and concrete under a project structure.

Porter (1990) shows how industrial agglomerations constitute an effective mechanism for regional development and how sustainable competitive advantages become progressively dependent on local factors.

Vázquez (1998) refers to development carried out in the economy by the endogenous growth perspective. Some of the conclusions that this perspective entails have been incorporated into relatively more recent theories of endogenous development. The growth perspective and the perspective of endogenous development share the vision that productive systems consist of a group of material and non-material factors that allow local and regional economies to adopt differentiated paths towards growth for development, and thus suggest there is room for regional and industrial policies. Vázquez (1998) argues that building a local productive system of many firms (most of them SME) specialized in one single product in a territory fosters exchanges in multiple markets. This causes the emergence of external scale economies, but internal to the local productive system, and the reduction of transaction costs. These externalities cause increasing returns and, therefore, promote territorial economic growth. The local development perspective assumes the importance of local productive systems for processes of growth and structural change in territories (Narváez et al., 2008).

Albuquerque (1997) states that local development can be understood as a transformation process taking place in the economy and the local society to overcome obstacles and challenges. It improves inhabitants' quality of life by means of local socioeconomic agents (public and private), whose activity seeks a more efficient and sustainable use of resources. Albuquerque (2004) argues the importance of considering development as a process rather than a result.

When referring to local development or territorial development, we must stress the importance of four main dimensions (Gallicchio, 2004): *a*) Economic: related to creation, accumulation and distribution of wealth; *b*) Social and cultural: meaning quality of life, equity and social integration; *c*) Environmental: refers to natural resources and sustainability of models in the medium and long term; and *d*) Political: territorial governance, a specific, independent and sustainable collective project.

Madoery (2005) analyzes three types of policies: first generation (to improve the local attractiveness: improve infrastructure, capture investment, industrial parks building); second generation (to improve entrepreneurship and allocate exogenous and endogenous resources) and third generation (associative processes and cooperation for development). In this respect, networks can encourage policies of second and third generation, and therefore territorial competitiveness (Varisco, 2007).

Mendez (2001) identifies the presence of pioneers in successful local development experiences. Local agents' presence and cooperation networks are strategic resources for local development. Romis (2008) suggests that the experience of the industrial cluster and supply chain projects underlines the importance of three hfactors –project governance, territorial assets,[2] and public-private collaboration– that are overlooked in the cluster approach. These factors need to be included in a more comprehensive territorial approach in order to achieve broad local development objectives.

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2   These factors, also identified as territorial assets, include the raw material and natural re-source base of a region, the local pool of skilled and specialized labor, the region's pool of R&D institutions, and the provision of public goods in the region (Romis, 2008).

II. Measuring inter-firm impact on local development

To determine the effects of inter-firm cooperation on local development, we need to know which (and how) are the determining characteristics or factors if we are in complex and dynamic territories oriented towards competitiveness and development, or whether there are simple productive agglomerations. Also, we need to know which are the specific local productive structures, and their internal changing socio-institutional structures of power that operate in a non-harmonized or inclusive manner (Mackinnon et al., 2002; Hudson, 1999).

To achieve the objective of determining the impact of inter-firm cooperation on territorial development, we must use the explanatory factors of local development as a basis. We need some measures or indicators of local development (Table 2).

Table 2. *Regional development indicators*

Factors	Indicators
Social	Population density, poverty index, …
Economical	Gross Domestic Product (GDP), Per capita Income, …
Educational	Educational attainment, literacy, …
Health	Children mortality
Cleaning up	Potable water, litter treatment, …
Environmental Sustainability	Air pollution, forest cover, …

Source: Factors and indicators of local-regional development (Setrem Journal, 2003).

Cassiolato et al. (2008) argue that the identification and mapping of local productive agreements (APL) have advantages but also limitations. Since these exercises are based on conventional economic indicators, they can only capture one part of the systems (cutting by cities and sectors). In spite of progressively considering the agriculture and services sectors, most of the concepts (indicators) are restricted to the manufacturing industry.

From the recent local development perspective (Caravaca, 2005), successful experiences also mean that: *a*) local networks are linked to external

networks, they are linked not just to local institutions but also to foreign institutions, and *b*) there is an institutional implication in performing mutual projects. The joint evaluation of regional development indicators needs to take into account many factors and to employ reliable indicators (Rambo and Ruppenthal, 2004).

A. Economic Indicators

Some economic indicators can specify the relative importance of a network activity such as the percentage of sales, exports, number of employees, and investment. According to Pereira (2006), the economic indicators include the relative participation of the different economic activities (services, agriculture, industry) of each territory in national GDP. Similarly, we could also measure the relative participation of the networks in territorial GDP. Moreover, it is possible to analyze their evolution.

We can also ask to what extent exclusive consideration of the kinds of economic activity that are concentrated and combined in certain regions under network projects constitute factors in explaining their development processes. Some authors such as Markusen and Schrock (2001) think that a focus on occupations has greater explanatory power than focusing exclusively on industries (Casanova, 2004). This is based on the idea that the education, location and migration of people with specific competencies connected to occupations or families of occupations are more important than the location and migration of installations, firms or industries. The conclusion is that insofar as it is a basis for stimulating local economic development strategies, regional economic analysis has to take into consideration not only the existence and structure of economic activities, but also the specific occupational configuration of the region. The latter includes not only the current sectorial orientation of the labor market, but also its composition by occupational levels (managers, middle managers, technicians, professionals, manual workers, service workers, entrepreneurs) and the levels of qualification in that market (from the highest levels of specialization and qualification to unskilled labor).

The best strategy would be to measure the network results against the rest of the sector over the period, to determine the relative importance of the network and examine its sectorial contribution. The years of functioning of the networks matter since most socio-economic effects are medium to long term.

We can examine whether networks have an important effect on wealth and employment in their geographical areas of influence. Besides, when analyzing the quantitative effects of networks, we must distinguish between direct and induced effects. Direct economic effects come from final demand increase as a result of productive activity in the network. Induced effects are those generated in the region as a result of the multiplicative effect over the regional economy income and employment.

B. Social indicators

Local development and the socio-economic effects of networks are beyond the scope of economic indicators. There is a need to include other kinds of measures. When stimulating local development, it is essential to bear in mind that any action must allow connections to markets, sustainability by means of a pattern of organization sustained over time, the promotion of areas that include micro and small businesses in a market with distribution of wealth, and the raising of social capital through promotion and cooperation among local agents. It is also essential to create access to public goods such as education and health, to preserve the environment, to value the local history and cultural heritage, to get local people involved, to form alliances with other actors, to mobilize public and private resources, and to attract public or private resources complementary to those provided by local actors.

Firms in networks can perform activities that contribute directly or indirectly to social goals in their areas of influence. Broadly speaking, people concerned with cluster development are usually concerned with things such as growth and competitiveness, collective efficiency, local institutions, social capital, global buyers and, more recently, the ties between local clusters and global value chains. On the other hand, people concerned with poverty reduction are generally concerned with income, employment, vulnerability,

risk, participation, empowerment, social protection and social provisioning. In other words, there is a theoretical dichotomy between these two sets of frameworks. In order to bridge the gap between them, there are some important questions that need to be answered, such as whether clustering raises employment for the poor, reduces vulnerability and risk for firms and labor, promotes compliance with labor, social, environmental standards and CSR, and whether cluster upgrading has positive outcomes for the poor (Romis, 2008).

Most firms at the individual level, irrespective of size and economic activity, already impact directly on the development and economic welfare of their cities. Besides, these firms can firmly contribute to the improvement of economic, social and environmental conditions of their regional areas. An example is the contribution of firms to the Millennium Objectives defined by the United Nations (UN). The World Bank (2009) explores the feasibility of restoring international competitiveness and growth in African agriculture through the identification of products and production systems that can support rapid development of competitive commercial agriculture and be a major source of inclusive growth in many parts of the continent. Moreno and Serra (2009) show the impact of social and environmental responsibility (CSR) in Valencia (Spain).

However, the character and extent of their influence depends on some factors, such as whether firms belong to an inter-firm network. Corral et al. (2006) create a wide list of activities developed by member firms of some particular clusters that contribute directly to the achievement of the millennium objectives in their regional areas of influence. These clusters are concerned with poverty eradication, as well as access and quality of education. On a second level, they implement activities for health improvement. On a lower level of implementation, these clusters perform activities related to sustainability, the environment and gender equality. In general, firms show a low level of knowledge on social initiatives. From a qualitative perspective, the authors argue that the presence of an alliance between public sector, private sector and civil society organizations is a strong factor that fosters the success of social activities made by firms in networks. It is important

that most of the private actions developed by firms are involved with public programs on a regional or national level.

One of the problems is that the effectiveness of the networks' "socially responsible activities" depends on two factors that are not always present in the networks where SME prevail. Firstly, the presence of a large firm, acting as the engine of others (suppliers, contractors) with respect to social and environmental activities, fosters territorial social development. Secondly, the existence of a solid institutional structure to guarantee the effectiveness of social activities, to combine efforts in a coordinated manner and to avoid individual or isolated actions from firms.

For instance, a list of possible social activities is to eradicate poverty and hunger, to achieve universal primary education, to promote gender equality and empower women, to reduce child mortality, to improve maternal health, to combat diseases, to insure environmental sustainability, and to develop a global partnership for development.

In some cases, the activities can influence different fields of interest, for instance to improve education, nutrition and gender equality at the same time. Besides, the activities performed can improve the external conditions of the network (the community in general) as well as inside the network (their employees).

We can examine whether socio-economic indicators of the networks' areas of influence perform better compared to their national means. The hypothesis is that firms in networks can develop socio-economic activities that improve territorial development.
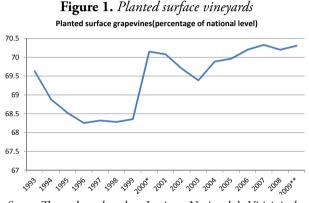
III. Descriptive analysis of Mendoza´s wine cluster

A. Economic indicators

Below we observe some economic indicators of the Wine Cluster in Mendoza.

1. Grape vines Planted surface evolution

Nowadays, Mendoza's share in Argentine total planted surface of vineyards is around 69.40%. Since 2000, we have observed an increase in its participation compared to the nineties (Figure 1).

Figure 1. *Planted surface vineyards*

Planted surface grapevines(percentage of national level)

Source: The authors, based on Instituto Nacional de Vitivinicultura (INV).

During the last twenty years, high-quality grapevines have won participation in the planted surface of vineyards, reaching a level near 63% in 2005 (see Table 3). Black grapevines prevail in the vineyard composition. The most planted vine grapes are Cabernet Sauvignon, Syrah and Malbec. In the period 2005-2010, the most planted grape vine was Bonarda (27%). However, the Malbec grape has won participation, reaching 25% in 2009 and 2010 (Figure 2).

Table 3. *Planted surface vineyard evolution by type of grapevine*

Type of Grapevine	1990		2000		2005	
	Ha	%	Ha	%	Ha	%
High quality	60608	41.97	80216	57.63	95247	63.09
Others	83800	58.03	58987	42.37	55733	36.91
Total grapevines	144408	100.00	139203	100	150980	

Source: The authors, based on Instituto Nacional de Vitivinicultura (INV) statistics.

Figure 2. *Evolution of High quality black grapevines participation*

Source: The authors, based on Wines of Argentina database.

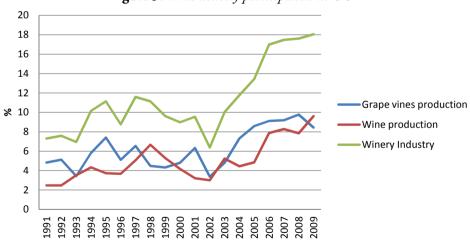## 2. Gross Geographic Product and the importance of the vinery activity

The Gross Geographical Product (GGP) is composed of different activities, as shown in Table 4. With respect to accountability, the vinery activity participates in the agricultural sector through the production of grape vines, as well as in the manufacturing sector by means of wine production, mosto and others. According to 2009 data, the two most representative branches of industrial economy are petrol extraction and processing, and the Food and Beverage industry. Together, they contribute 75% to Production Value. Inside the food sector, the wine industry and fruits and vegetables constitute their main branches.

At a disaggregated level, 22.59% of Mendoza's output comes from Commerce, Restaurants and Hotels. The second best industrial activity in terms of GGP contribution is Beverages (mostly wine industry). We can obtain the relative participation of wine and grape vines production to GGP from information about: *a*) the relative contributions of agriculture and manufacturing industry to GGP; and *b*) the relative participation of grape vines production in agriculture and of wine production in the manufacturing industry (Figure 3).

Table 4. *Gross Geographical Product. Mendoza province, 2009.*
(thousand million Argentine pesos, base year = 1993)

	Activity sector	Year 2009*	Activity participation (%)
	Total	**13,830,061**	
1	Agriculture	1,117,136	8.08
2	Mining	2,054,956	14.86
3	Manufacturing industries	2,188,020	15.82
4	Electricity, Gas y water	316,236	2.29
5	Construction	314,856	2.28
6	Commerce, Restaurants and Hotels	3,124,693	22.59
7	Transport and Communications	893,331	6.46
8	Financial Establishments	1,484,205	10.73
9	Community, Social and personal services	2,336,577	16.89

Source: Direction of Statistics and Economic Research (DEIE), Mendoza.

Figure 3. *Wine activity participation in GGP*

Source: The authors, based on DEIE; Fabre (2005); Institutos Multidisciplinarios Informe Preliminar (2010), FCE-UNCuyo, 2005; De la Torre (2007); www.frutosdellitoral.org.uy, Diario Uno de Mendoza, Blog Carlos Aguinaga.

3. Wine production

Mendoza produces more than 10 million hectoliters of wine per year, which turns this province into the largest winery producer center of South America. Mendoza is home to nearly 70% of fine Argentinean vineyards. This explains why Mendoza has a larger participation than the rest of the country (Figure 4).
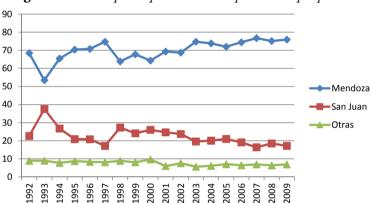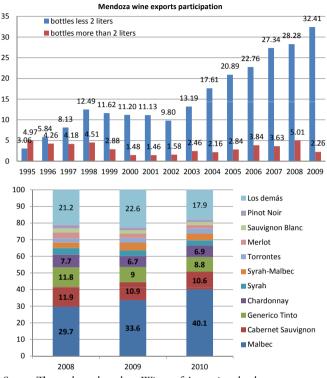
Figure 4. *Relative participation in Wine production per province*

Source: The authors, based on INV (Instituto Nacional de Vitivinicultura).

4. Export conduct

Throughout the world, Argentine is recognized for being a fine Malbec producer country, and those from Mendoza are considered the best. Mendoza exports products for 220 million dollars per year, approximately. Figure 5 shows the evolution of Mendoza's participation in export wines in FOB value, excluding sparkling wine and mosto and classified by type of bottle: bottles equal or less than 2 liters (higher quality wine) and bottles larger than 2 liters. Exports in small bottles have had a higher participation than the others. The export gap between types of bottles has increased during the period under analysis. Figure 5 evidences the Malbec's leadership in the total FOB value. Except for Syrah-Malbec and Torrontes, the rest of varieties descended.

Figure 5. *Mendoza wine exports*

Source: The authors, based on Wines of Argentina database.

5. Inter-firm cooperation

There are different kinds of actors in the wine agro-industrial chain. Some agents from the primary segment pursue cooperation strategies such as: *a*) integrated producers that are linked to the wine cooperatives; *b*) vineyard contractors that cooperate with land owners in taking care of the land labor in exchange for a percentage of the production.

In 2001, 40% of the existent 12,000 vineyard producers were associated to cooperatives (like FECOVITA-*Federación de Cooperativas Vitivinícolas*). Both integrated and non-integrated wineries join cooperatives of producers of integrated production (Goldfarb, 2007).

There exist other types of cooperation between first-level wineries and suppliers. Wineries acquire the producer's output at the market price for vintage and it offers him training in the selection of varieties, management of vineyards and time to harvest. Besides, many joint ventures between wineries prevail, such as Chandon and Terrazas de los Andes.

B. Socio-demographic indicators

1. Population and Economically Active Population

According to the last national census (Table 5), Mendoza's total population has increased in a decreasing tendency. Mendoza is characterized by a high geographical concentration: 97% of its population locates in 3% of the province surface. The Gran Mendoza district concentrates 62.5% of the total population in the province. In the Gran Mendoza area, an estimated population of 905,000 inhabitants (IV three-month-period) and an Economically Active Population (EAP) of 385,000 people live.

Table 5. *Mendoza Population*

Year	Mendoza Population	Variation
2010	1741610	3.83
2007	1674842	5.68
2001	1579651	10.58
1991	1412481	

Source: The authors, based on DEIE Statistics.

2. Demographic Growth

The vegetative growth rate shows a decreasing tendency during the period 1993-2002, when it started to increase due to the birth rate (Figure 6). Since 2001, this evolution has followed the national patterns, with birth rates of about 20% and death rates of 7%. Life expectancy in the female gender is higher than in the male one throughout the complete age strata.
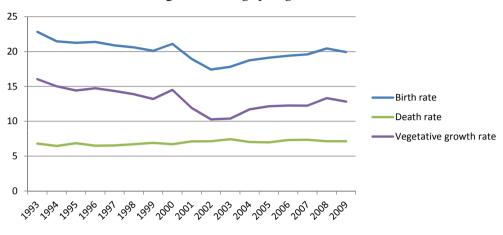
Figure 6. *Demographic growth rates*

3. Rates of employment, unemployment and activity in Gran Mendoza

The economic activity rate is the proportion of inhabitants that decides to offer their services on the labor market. Until 2003, we observe a stable evolution of the employment and economic activity rates, being 35% and 38% respectively (Figure 7). On the contrary, the unemployment rate ascended with a peak of 15% in 2003. Since 2003, the employment and activity rates grow in a decreasing manner, while the unemployment rate descends.

4. Human resources: Education

Based on the Home Permanent Survey (EPH) widened database publish by the INDEC, we analyze the evolution of some education indicators in Gran Mendoza (Figure 8).

The percentage of people with university level ascends progressively, while the percentage of inhabitants with primary school is descending.
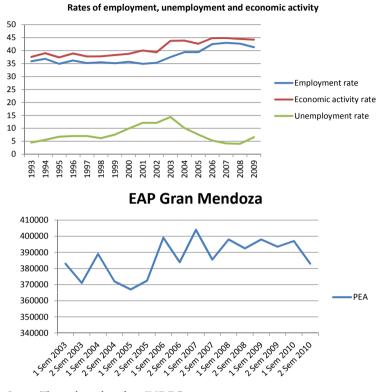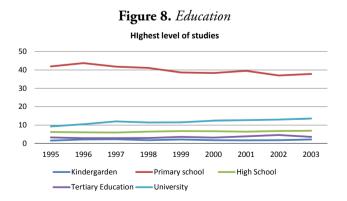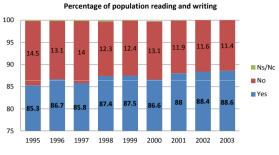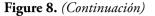
Figure 7. *Employment, unemployment and economic activity*

Rates of employment, unemployment and economic activity

EAP Gran Mendoza

Source: The authors, based on INDEC statistics.

Figure 8. *Education*

HIghest level of studies

Figure 8. *(Continuación)*

Percentage of population reading and writing

Source: The authors, based on INDEC statistics.

IV. Factorial analysis

The factorial analysis technique allows the identification of a relatively small number of factors to represent the existing relation between the set of interrelated variables. This analysis offers information to group the set of variables sharing the lowest number of feasible factors with a clear meaning and precise sense.

Principal Components Analysis (PCA) belongs to a group of multivariate statistics techniques that are mainly descriptive. The principal components method consist of linearly combining all the variables so that the first principal component is a combination that explains most of the sample variance, the second component explains the second largest proportion of the covariance while being uncorrelated with the first component, and so on.

The only requirements to apply the PCA technique are: a) continuity of variables; b) the number of individuals or elements observed must be larger than the number of original variables p. Apart from that, the PCA technique has the advantage of avoiding the assumptions of normality and homoscedasticity.

Based on a database built from secondary information and that joins information for the period 1993-2009, we proceed to search for indicators of the Mendoza's wine cluster.

We focus on economic and socio-demographic indicators at the local level, and take as given some endogenous factors for local development such as the local institutional framework or environmental aspects[3].

Taking into account that the variables are time series, and that there is heterogeneity among them, we disaggregated each of the variables by cycle and tendency by means of the Hodrick-Prescott filter. This filter extracts the variables' path tendency and smoothes the original variables. We took variables in cycles to obtain the indicators through the factorial analysis.

A. Wine cluster indicators

We study variables related to the winery activity: Surface planted with vines (SUPVID), number of vineyards (VIÑEDOS), Mendoza's share in national vine production (PARTMUVA), production of wine vines (UVASVINI), wine production (in hectoliters) (ELABVINO), Mendoza's share in national wine production (PARTMVIN), production of mosto (ELABMOST), production of wine for domestic consumption (CMOVINO), number of producer wineries (BODEGAELAB), wine/GGP (VINOPBG), vine/GGP (UVA/PBG), wine exports on bottles under 2 liters (XVINOM2LT) and exports on larger bottles (XVINO2LT), and income from winery activity (YVINICOLA).

We analyze the correlation matrix to show how each variable behaves against others. Since the determinant's value is too small, we argue that the level of inter-correlation between variables is high. By means of these variables, we build a factor or indicator through factorial analysis. When applying the

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3   To proceed with the correlation analysis including the institutions, we should have constructed a binary variable (if a particular institution performs in the corresponding year or no) for each institution to correlates with the others. However, the only presence of an institution in a particular year does not guarantee a frequent or satisfactory link with the productive system. And this information is rarely available. In the case of the environmental issue, there is no information regarding the presence of litter treatment per year, the level of air pollution and forest cover, among others.

PCA, we obtain the results in Table 6. This table contains eigenvalue values for each factor, the percentage of variance explained by each extracted factor as well as the percentages of cumulative variance explained by all factors extracted. For component 1, the eigenvalue is 7,046 and for component 2 is 2,634. Therefore, through the PCA technique we explain the 14 variables by means of 2 fictitious variables explaining 69.14% of total variance.

Table 6. *Variance explained*

Component	Initial eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of total variance	Cumulative %	Total	% of variance	Cumulative %
1	7.046	50.329	50.329	7.046	50.329	50.329
2	2.634	18.817	69.146	2.634	18.817	69.146
3	2.320	16.572	85.718	2.320	16.572	85.718
4	1.032	7.369	93.086	1.032	7.369	93.086
5	0.817	5.832	98.919			
6	0.151	1.081	100.000			
7	4.530E-16	3.236E-15	100.000			
8	2.096E-16	1.497E-15	100.000			
9	9.927E-17	7.091E-16	100.000			
10	1.912E-17	1.366E-16	100.000			
11	-1.012E-16	-7.231E-16	100.000			
12	-3.336E-16	-2.383E-15	100.000			
13	-5.831E-16	-4.165E-15	100.000			
14	-1.650E-15	-1.179E-14	100.000			

Source: The authors. Extraction Method: Principal Component Analysis.

Table 7 contains the component loadings of each variable over each of the components obtained through the CPA. The fourteen variables can be explained by means of two fictitious variables, IV and IPV, which are explained by the bold variables. We interpret these factors as: IV: Wine activity indicator, and IPV: Wine production indicator.

Table 7. *Components Matrix*

| | Component | |
	IV	IPV
SUPVID	**0.970**	-0.115
VIŃEDOS	**0.859**	-0.075
PARTMUVA	-0.383	**0.682**
UVASVINI	**0.671**	-0.043
ELABVINO	0.351	**-0.618**
PARTMVIN	-0.347	**0.767**
ELABMOST	0.258	**0.720**
CMOVINO	**-0.872**	-0.165
BODELAB	**-0.796**	0.043
VINOPBG	**0.788**	0.528
UVAPBG	**0.678**	-0.391
XVINOM2L	**0.909**	0.362
YVINIC	**-0.778**	-0.259
XVINO2LT	**0.745**	-0.039

Source: The Authors. Extraction method: principal component analysis.

B. Socio demographic indicators

We build an indicator through factorial analysis from the following socio-demographic variables in Great Mendoza: Employment rate (empleoGM), rate of economic activity (activGM), unemployment rate (desocGM), birth rate (natalid), mortality rate (mortalid), percentage of population with primary education (edprim), percentage of population with secondary education (edsecun), percentage of population with higher education (edsup), percentage of population with university education (eduniv), and economically active population (peaGM).

The results show that the eigenvalue for factor 1 is 3,669. This factor explains 36.70% of item variance; factor 2 explains 27.56% with an eigenvalue of 2,765, and factor 3 explains 19.29 % of the variance with an eigenvalue of 1,929. The PCA reduces 10 observable variables into 3 fictitious variables, with which the model explains 83.54% of the total variance. The 10 variables can be explained through the following three factors:

ISD1 (Growth): this factor groups the variables pertaining to employment and birth rates, unemployment rate, mortality rate and the percentage of population with higher education. There is bipolarity, meaning that years where employment and birth rates correlate are years where the other variables do as well.

ISD2 (labor supply education): this factor groups the variables pertaining to the rate of economic activity rate and the percentage of inhabitants with primary or university education.

ISD3 (EAP): Economically active population.

C. Mendoza's economic indicators

We build the economic indicators from the following variables: drinkable water production, volume of sewage liquid waste, value added from construction sector, value added from transport sector, value added from communal, social and personal services, ratio outcome/income, and gross geographical product. The PCA obtained one factor (derived from 6 observable variables) that has an eigenvalue of 3,097 and explains 51.60% of total variance. This factor is mainly explained by the gross geographical product and the value added from the transport sector.

D. Commerce and tourism indicators

With the same methodology, we build an indicator taking into account the following variables: Value added from commerce, restaurants and tourism, sales in shopping centers, accommodation establishments, touristic hotels, number of incoming people, tourism annual incomes. The PCA obtained one factor (derived from six observable variables) that has an *eigenvalue* of 3,314 and explains 55.23% of total variance. This factor is mainly explained by value added from commerce and the number of touristic accommodation establishments.

V. Correlation between indicators

From correlation matrix (Table 8), we observe correlations between the following indicators:

Table 8. *Correlation*

		IPV	IEC	ICOMyT
ISD3	Pearson correlation	0.999(*)	.(a)	-0.224
	Sig. (bilateral)	0.028	.	0.776
	N	3	1	4
IV	Pearson correlation	0.000	0.903(*)	0.850(*)
	Sig. (bilateral)	1.000	0.036	0.015
	N	7	5	7
ICOMyT	Pearson correlation	-0.427	0.910(*)	1
	Sig. (bilateral)	0.339	0.012	.
	N	7	6	9

* Correlation is significant at 0,05 level (bilateral), a Cannot be calculated since at least one variable is constant
Source: The Authors.

- IPV and EAP: There is a positive strong correlation between the wine production indicator and the economically active population. The Food and Beverage industrial sector concentrates 39% of total employees of the province in 2003, according to DEIE statistics. This probably explains the influence of winery production on the employment rate.

- IV and IEC: There is a positive correlation between the wine activity indicator and the economic indicator of the province. This is explained by the fact that winery activity represents nearly 19% of GGP in 2009 (see Figure 3).

- IV and ICOMyT: There is a positive correlation between the wine activity indicator and the commerce and tourism indicator. Winery activity reaches a virtuous integration with the commerce and tourism

sectors in Mendoza. There are different touristic Ways of the Wine. The departments of Tupungato, Tunuyán and San Carlos are the main areas of enological tourism. The tourism sector contributes around 47 million dollars to the province and the commerce sector represents 2120 dollars.

Contributions

The purpose of this study is to identify the effects of the Mendoza Wine Cluster for local development from a theoretical and empirical perspective.

This paper contributes to the building blocks of the analysis of Mendoza's wine cluster for local development. Although there exist some papers about the wine industry in Mendoza, analyzing its contribution to local development is a novelty.

From an empirical view, the major challenge to identifying lessons learned from clusters is the lack of robust tools to measure whether or not such policies are successful at the local level.

The literature on cooperation or networks has historically tended to focus on issues relating to the competitiveness of firms based on the economic advantages that clustering could engender. However, researchers and policymakers often omit the fact that in many cases small firm networks are sources for overcoming some social problems such as unemployment, lack of education, among others.

Much research still needs to be done in this area. The strengthening of the local territory will depend on what are known as 'endogenous' factors; that is to say, the local economic network, the human resources of the place and the local institutional framework, which was taken as given in this analysis.

Mendoza's Wine Cluster has shown great performance in recent years. This performance is reflected in the export path and the increase in production and consumption of fine wine (varietal wines), parallel to the reduction of standard wines. From the indicators obtained through the PCA, we derive some correlations between these indicators. The correlations

seem to anticipate a virtuous tendency of the wine cluster activity with some economic and socio-demographic indicators. The virtuous economic path of the wine cluster is followed by an equally directed tendency in social aspects. The application of econometric techniques to deduce a causal relationship between indicators is a difficult challenge considering lack of data and the multivariate nature of the phenomenon.

This paper addresses the need faced by many local policy makers to determine, according to national and local data availability and information, some core indicators that can help link data to local development drivers and link policy to drivers. A better knowledge of inter-firm networks in promoting socio-economic development is not just a valuable tool for public policy, but also for networks themselves. There is still much research to do about the direct and indirect effects outside the network at the local level.

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