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Public-Private Institutions, Upgrading, and Accessing
Knowledge Resources in Emerging Market Societies

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**Public-Private Institutions, Upgrading,
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Abstract

This article argues that the ability of a firm to access a variety of knowledge resources, and in turn upgrade its products, depends on being tied not simply to any or many organizations and institutions but rather to those that act as social and knowledge bridges across previously isolated producer communities. Through a multi-method analysis of the recent transformation of the Argentine wine industry, we highlight how distinct governance rules for new government support institutions can anchor their multiplex, cross-cutting network qualities, which underpin their ability to provide improved collective resources and reshape the ties between firms.

Since the late 1990s, scholars of international management and economic development have increasingly argued that sustained growth and competitiveness in emerging market countries depend on the ability of their firms and industries to upgrade – combining existing resources in new ways to create new products for potentially higher value. (Giuliani, Pietrobelli, & Rabellotti, 2005, Hitt, Li & Worthington 2005; Song 2002) In drawing on evolutionary theories of the firm, this research emphasizes that product upgrading and the attendant creation of “combinatorial capacities” emerges in large part from a firm’s access to a variety of knowledge resources. (Fleming 2001, Ghoshal & Moran, 1999, Kogut & Zander 1992) But it is less clear what type of institutional infrastructure and processes facilitate such access.

A growing current in the management literature argues that access to knowledge depends often on whether firms are embedded in rich inter-firm networks, which enable them to build collaborative relationships, gain resources, learn, and coordinate experiments. (McEvily & Marcus 2005, Powell et al. 1995) However, scholars also how the stickiness of past firm practices, social structures, and institutions are slow to change and can constrain one’s access to new knowledge resources. (Granovetter 2002; Spencer, Murtha & Lenway 2005; Uzzi 1996)

This enabling and constraining nature of embeddedness resonates strongly in emerging market countries (Spicer, McDermott & Kogut 2000), and especially Latin America, where societies are often noted for their weak institutions and social capital. (Henisz and Zelner 2005; Haber 2002) But researchers tend to argue that firms fail to learn and adapt because they are trapped in societies with long histories of weak associationalism and low densities of economic and social organizations. (Putnam et al 1993, Schmitz 2004)

In contrast, an often overlooked intersection between research on networks, organizational fields, and historical institutionalism understands the dual nature of embeddedness in terms of the structure and composition of organizational networks. (Granovetter 2002, Knoke 2001) Policy scholars have noted that although a society may contain a plethora of associations and dense inter-

firm networks, this diversity can thwart broad-based upgrading and concerted action. The social ties and norms that promote cohesion within certain communities can also lead to fragmentation and isolation between them. (Locke 1995, Ostrom 1999, Safford 2004) Network scholars have argued that the very inter-organizational network that may facilitate collaboration among particular firms can equally restrict their access to a variety of new resources and information beyond the network. (Lin 2001, Uzzi 1996)

Conversely, researchers have illustrated how certain institutional characteristics of an industry or region can relieve such constraints. For instance, Safford (2004) and Zuckerman & Sgourev (2006) show how certain voluntary civic and industry associations facilitate learning because of their ability to create horizontal or cross-cutting ties between firms from different social and geographic communities. McEvily and Zaheer (1999) and Owen-Smith and Powell (2004) show how government support institutions (GSIs), such as public research institutes and training centers, can shape the content of information firms receive.¹ Because of their public mandate to provide collective resources and broadly disseminate their findings, GSIs, be they fully or only partially funded by the government, can improve a firm's access to knowledge from a variety of producer communities and its ability to innovate.

This article contributes to this stream of research by arguing that product upgrading depends on a firm being tied not simply to any or many organizations and GSIs, but rather to those that act as social and knowledge bridges across distinct producer communities and in turn offer firms access to a variety of knowledge resources. In particular, we highlight the ways in which governments can alter the trajectory of product upgrading not simply through largess or market

¹ This article will focus on the heterogeneity of organizations and institutions in a region. For the sake of simplicity, we refer to a GSI as any institution that receives at least partial government funding, has government actors participating in its governance and program evaluation, and provides firms with specific services. Such a definition follows research on government support of industries from organizational fields and historical institutionalism. (Campbell 2004, Knoke 2001, Thelen 2003) Below we distinguish further between different types of GSIs, schools, and associations.

liberalization but by constructing a new set of GSIs with a variety of previously isolated, even antagonistic, stakeholder groups. To the extent that GSIs are constituted with rules of inclusion and participatory governance, they can anchor new multiplex, cross-cutting ties between producer communities that underpin their ability to provide firms with a new scale and scope of services and facilitate new problem solving relationships between them. In making this argument, we draw on a rich body of research across disciplines that emphasizes how governments can reshape the structure and composition of organizational fields, and in turn, knowledge flows, by instigating the creation of new institutions that seek to combine existing public and private sector resources in new ways and at different levels of society.² (Campbell 2004, Scott et al. 2000, Stark & Bruszt 1998, Thelen 2003)

We advance this argument by analyzing the transformation of the Argentine wine sector in the two neighboring, dominant winemaking provinces of Mendoza and San Juan. On the one hand, Argentina is a country better known for its dysfunctional social capital and institutions, while its wine industry has a long history of backwardness and virtually no international presence. On the other hand, the Argentine wine sector witnessed a dramatic turnaround in the 1990s and now accounts for almost 3 percent of the over \$14 billion global wine market. Mendoza has led this change, pioneering a new constellation of institutions and inter-firm networks that appears to have facilitated wide spread product upgrading. San Juan, in contrast, remained a laggard, despite its numerous firms, high density of associations, and its policies that ushered in large amounts of new investment. In turn, this setting allows us to investigate in detail the broader theoretical concern of the types of institutional mechanisms that help firms access a variety of knowledge resources and learn.

² We embrace here a historical institutionalist understanding of institutions as having a fundamental public and political character and setting the foundations for the provision of collective goods beyond simply property rights and regulations and including supply side resources for firms. See Locke (1995), Piore & Sabel (1984), Spencer et al. (2005), and Thelen (2003).

We attack this puzzle employing both qualitative and quantitative methods. Section I gives a qualitative, theory driven comparison of the evolution of policies and industry restructuring in San Juan and Mendoza during the 1990s. It draws on existing research and our own fieldwork from 2003-04, including over 50 interviews with managers, industry activists, and policymakers. We find that the barriers to upgrading appear rooted less in a society's inherited stock of economic and social resources per se and more in the ways that fragmentation among producer communities undermined concerted action and access to new knowledge for firms. Employing the method of difference, the comparison also allows us to focus on the configuration of factors that appear different (Ragin 1987) – namely the divergent institutional policies between the provinces in the 1990s. We highlight how Mendoza's construction of a new set of GSIs with distinct governance principles helped improve firms' access to a variety of resources by acting as social and knowledge bridges between the communities.

In Section II, we build on our qualitative analysis to present testable hypotheses about the impact of the structure and composition of a focal firm's network on its level of product upgrading. Section III describes our methods and unique cross-sectional data set based on our 2004-05 field survey of wineries from different sub-regions (zones) in the two provinces. With few exceptions, most research on upgrading in emerging markets has been case based, failed to capture firm-level upgrading, or focused only on inter-personal relationships.³ In contrast, the survey was specifically designed to measure each firm's level of product upgrading, demographics, and the structure and strength of its ties to other firms as well as non-firm entities, such as trade associations, schools, and GSIs. In turn, although we do not claim to present definitive, linear causality, our research design combines the strengths of comparative qualitative and statistical analysis to capture configurative causation – the plausibility of certain policies

³ See Giuliani et al (2005) and Schmitz (2004) for reviews of this research. Some interesting exceptions are Giuliani & Bell (2005) and Song (2002).

reshaping the organizational and institutional factors that significantly impact firm level product upgrading . (Bennett & Elman 2006; Ferraro & O’Mahony 2007; Uzzi 1996) The statistical evidence discussed in Section IV is consistent with our qualitative findings. Firms which have more numerous ties to other firms and particularly Mendoza’s new GSIs will have higher levels of product upgrading than those that tied to other types of organizations. These mediating firms and GSIs have particular value because of their centrality and bridging qualities, in turn offering focal firms access to a variety of knowledge resources.

I. NETWORKS, INSTITUTIONS, AND THE CHALLENGE OF UPGRADING⁴

“[Argentina] is one of the biggest wine success stories in the past decade.” *Wine Spectator*, October 31, 2007.

Argentina is historically one of the largest volume producers of wine in the world, and for decades through the 1980s production focused on low-quality wine and grapes for the domestic market. By the end of the 1990s, the industry had undergone a profound transformation, with wine exports growing from a few million dollars in 1990 to over \$480 million in 2004 (or over 3% of the world market). (Azpizu & Basualdo 2003) These gains came especially from consistent advancements in product quality and innovation. Argentine vineyards significantly increased the varieties of high enological value grapes from 20% of vine surface area in 1990 to about 43% by 2001. (Cetrangolo et al., 2002). Wine quality improved, with 85% of wine exports coming from fine wines sold in sophisticated, competitive markets like the US, EU, and Japan. Moreover, Argentine wineries were increasingly ranked among the world’s elite, particularly for their ability to produce a great variety of new products, such as previously undervalued varietals, “redesigned” varietals from other specialized regions of the world, and distinctive blends.⁵

⁴ Much of the background information on the Argentine wine industry and related policies comes from McDermott (2007), which focused on the politics of institution building. In contrast, this article uses unpublished, primary firm-level and network data to focus on the statistical impact of the institutional policies on firm level upgrading and the influence of ties to different types of organizations and institutions.

⁵ Details on the prominence of Argentine wines in world markets and their unique product innovations can be found in Cetrangulo et. al. (2002); McDermott (2007); “La amezana a las vinas chilenas,” *El Mercurio*, Nov. 2, 2005; and the

Relative to San Juan, however, Mendoza became the leader of this transformation (Centrangolo et al. 2002; Ruiz & Vila 2003). Although Mendoza accounts for roughly 60% of the country's wine production and San Juan accounts for about 30%, its share of wine exports is disproportionate at over 90% and San Juan's only 6%. Analyses showed that improvements in product quality and vineyard conversion were both more widespread and advanced among firms in Mendoza than those in San Juan by the late 1990s. Indeed, even a number of firms from zones (sub-regions of Mendoza, like the *Zona Este* and *Zona Sur*) historically viewed as backward and with substandard climates were becoming industry leaders.⁶

But just how Mendoza firms came to achieve such a leadership role in product upgrading is less clear. Following Schumpeter (1934) and evolutionary theories of the firm, product upgrading is a particular form of innovation, in which firms focus on the creation of new products for higher value by incrementally and iteratively experimenting with new combinations of existing material and natural inputs. (Giuliani et al., 2005, Hitt et al. 2005; Schmitz 2004, Moran & Ghoshal 1999) As Fleming (2001) has argued, this process of recombination is fraught with technological and market uncertainties, demanding that firms gain knowledge and expertise to convert different types of inputs into specific products, to assess the reliability of suppliers, and to learn which types of products can gain traction in different market niches in the short and long run. While firms gain experience from their own in-house activities and human capital, they access a variety of raw and applied knowledge through their peers and suppliers as well as via non-market actors, such as trade associations and government support institutions (GSIs) that provide training or R&D services. (Owen-Smith & Powell 2004, McEvily & Zaheer 1999) This

lengthy annual reviews of Argentine wines in *Wine Spectator* (November 15, 1995; December 15, 1997; March 24, 2003; November 30, 2004; November 30, 2005).

⁶ The most comprehensive analyses within and between the provinces are found in Cetrangulo et. al (2002) , Bocco (2003), Ruiz & Vila (2003), and "Cosecha 1999-2002," *La revista de la Bolsa*, N° 441, October 2002. According to the 2003 industrial survey of 400 wineries by the Ministry of Economy, wineries in the *Zona Este* had dramatically improved their capabilities. They now accounted for a third of the province's wine exports, and over 55% possessed modern quality control systems. Author's calculations.

work further emphasizes that although firm rivalry can induce firm motivation and discipline (Porter 1990), durable social relationships between firms underpin their ability of firms to undertake iterative, joint-experiments and participate in the sustained provision of collective resources. (McEvily & Marcus 2002, Saxenian 1994)

Such a view of product upgrading is widely embraced in studies of developing countries in general and wine in particular. (Aylward 2003; Giuliani & Bell 2005; Henderson, Pagani, & Cool, 2004; Perez-Aleman 2005; Roberts & Ingram, 2002; Walters, 1999) Upgrading in wine takes several years, beginning with transforming the middle segments of the value chain: state-of-the-art quality control and product development running from vine planting to careful vineyard maintenance to flawless harvests to fermentation and blending. Enologists work closely with agronomists and growers to introduce, evaluate, and document experiments with new methods of growing and fermentation for different types of varieties and clones. Because of the variation in climates and soils, experimentation is contextualized and knowledge is often tacit, posing barriers to dissemination and application elsewhere. In turn, to accelerate product upgrading, wineries gain a variety of market and applied technical knowledge from other firms as well as collective resources housed in industry associations, schools, and GSIs.

Such coordination and relational-based upgrading is not necessarily forthcoming, however, especially for firms with limited resources and backward routines in a highly volatile environment. On the one hand, developing countries, such as Argentina, are widely known for their lack of collective knowledge resources, weak markets, and limited state capacities. (Doner et al. 2005, Schmitz 2004, Sutz 2000) On the other hand, the continued diversity and decentralized structure of the wine industry in San Juan and Mendoza can exacerbate the problems of concerted action and block the wide-spread diffusion of new practices instead of serving as sources of rejuvenation. (Jacobs 1984; Romanelli & Khessina 1993) For instance, in both provinces there are over 100 micro-climates supporting a wide variety of high value grapes and thousands small producers,

which typically supply 30-50% of a winery's needs. Mendoza and San Juan still have over 680 and 170 wineries, respectively, which range from many small and medium family firms and partnerships to some cooperatives to a few large diversified corporations.⁷ As of 2004, there were about 300 firms that exported wine, with the top five firms accounting for about 40% of total wine export sales and the top 20 for about 70%. By industry standards, such figures indicate a rather low concentration of exporters.⁸

In turn, despite their apparent common, rather unproductive histories, the wine industries in Mendoza and San Juan diverged, with the former charting a path of innovation in the 1990s that looked remarkably different from both its past and its neighbor. Such different transformations elicit two related questions that link the mechanisms of upgrading with broader policy problems of development. How were a broad set of firms able to upgrade their products and exploit variety rather than being paralyzed by it? What types of new institutional mechanisms were created to help firms access a variety of knowledge resources and learn?

Ia. Comparing Mendoza and San Juan -- The Limits of Endowments

We first compare the two provinces through the lenses of two common views of innovation and development that often rely on the determinate power of different inherited economic and social endowments. We then consider the ways in which the structural embeddedness of economic activity can hinder access to new knowledge resources and how public policy might overcome it.

⁷ On the variety and decentralized structure of wine and grape production, see Cetrangolo et al. (2002) and Ruiz & Vila (2003). According to the data from the Instituto Nacional Vitivinícola (INV), although there was some consolidation, there were still over 16,000 vineyards in Mendoza and 6,000 in San Juan; vineyards in both provinces with less than 25 has. still accounted for about 92% of the total number and 60% of surface area. According to the 2003 agricultural survey of vineyards in Mendoza, the largest 18 vineyard owners control only 5% of vineyard surface area, and about 1100 owners control 50%. (Authors' calculations for both sets of figures.)

⁸ As detailed by McDermott (2007), Argentina wine exporting has low concentration figures and is broadbased, particularly in Mendoza. For instance, within the first decade of the transformation of the wine sectors in Chile and Australia, 6 firms and 3 firms accounted for 95% of wine export value. Between 1990 and 2004, the number of wine exporting firms grew from 8 to 275 in Mendoza and 1 to 19 in San Juan. (INV 2004) About 45% of the wineries in our own data base, discussed below, have at least 10% of sales coming from exports. Nonetheless, as we discuss below, one should not equate export sales with product upgrading, since the former is biased by firm size and volume; the latter is a more fine tuned indicator of innovation ability, regardless of size and volume.

The first view argues that innovative capacities emerge once an insulated, powerful government imposes on society a new set of rules based on high powered economic incentives, be they based on market liberalization or state interventionist schemes. (Haggard & Kaufman 1995) Given the market liberalization policies during the Menem administration (1989-99), variation in upgrading between firms and their regions are largely manifestations of different pre-existing stocks of economic and natural resources or property rights and regulations. However, there is good reason to be cautious about such determinism. For instance, in his historical comparison of the wine industry and restructuring politics, McDermott (2007) shows that although Mendoza is about twice the size of San Juan in terms of population and GDP, both provinces had similar soils and climates, industry structures, densities of wineries and vineyards, stocks of knowledgeable elites, and access to foreign investors and consultants. They were also subject to the same national systems of property rights and sectoral regulations.⁹

The second view argues that upgrading is likely to occur in societies historically rich in networks and associations, which provide the social ties, norms, and resources that enable individuals to cooperate in the provision of collective goods and the diffusion of knowledge. These social forces are enduring and manifested in the relative density of associations and cooperatives as well as pre-existing coherent public policies. (Grabher & Stark 1997, Putnam et al. 1993, Chavez 2007) But again, there is good reason to be cautious about such determinism.

First, both provinces had about the same number of civic associations per 1000 inhabitants and San Juan indeed had more agricultural cooperatives.¹⁰ They also had similar structures and histories of business and sectoral associations that battled for access to their respective provincial

⁹ Moreover, according to the aforementioned survey of Mendoza wineries, only 4% have foreign investment and about 6% are associated with or controlled by a diversified Argentine business group or corporation. Foreign investors control less than half of the 30 top exporters, and FDI accounts for about half of the \$1-1.5 billion invested in the wine industry in Argentina between 1991 and 2003, with most coming after 1996.

¹⁰ In the 1990s, Mendoza had about 2.3 NGOs per 1000 inhabitants and San Juan had about 2.2. As 1989, Mendoza had 64 cooperatives in agro-related industries and San Juan had 79. Authors' calculations based on UNDP data available at: <http://www.undp.org.ar/sociedad-civil/>.

governments to play a zero-sum game over price supports and subsidies. (Paladino & Jauregui, 2001; Rofman, 1999) Second, the governments of both provinces were better known for their lack of coherent policies and continued regulations and production quotas to subsidize wine products and thousands of weak grape growers. The common example was both provinces' respective state-owned, perennial loss-making wineries, Covic in San Juan and Giol in Mendoza, whose purchasing contracts and inflated prices effectively promoted the production of large volumes of low-quality wine. (Azpiazu & Basualdo 2003) The few training and R&D programs in agro related industries typically ossified under bureaucratic ministry offices that were unresponsive to firm needs. (Casaburi 1999)

Ib. The Embeddedness Trap as a Barrier to Upgrading

An alternative view begins with Mark Granovetter's (2002) insight that the development of and differences between regions or clusters depends more on the relational structure of socio-economic life than on its density. Recent research in management and development appreciates how embeddedness can both facilitate inter-firm coordination and constrain firms from accessing new knowledge resources.

The work on strategy and innovation increasingly emphasizes that a firm's ability to access different types of resources and information is greatly shaped by the structure and composition of its network. (Ahuja 2000, Fleming 2001, Owen-Smith & Powell 2004) As Lin (2001) and Uzzi (1996) have shown, however, one's ego-network can easily restrict access to different resources and blind it from new information because of the strength of immediate ties and the limited variety of valuable information and resources that its alters (other organizations, firms etc) can pass on. That is, although a region on aggregate may have a wide variety of resources and experiences that, when combined, could create value, a firm is often embedded in a rather restricted network, be it composed of firm's, associations or public agencies. (Knoke 2001) The close relationships among all the relevant actors may indeed breed a sense of community and shared norms of reciprocity,

but they can also cause the group to grow ever more insular while shielding it from an external flow of information and opportunities.

At a more macro-level of analysis, recent work public policy has sought to show that although a society may contain a plethora of, e.g., professional associations, the attendant social ties and norms that can promote collaboration and collective learning can also be self limiting and exclusionary. To the extent that these groups and localities have different needs and resources, are relatively isolated, and are not incorporated into more encompassing institutions, a diverse socio-economic environment can easily produce a balkanized society that thwarts broad-based innovation, knowledge diffusion, and concerted action. (Locke 1995, Ostrom 1999, Safford 2004, Schneider 2004, Tandler 1997) The basic observation from contexts as varied as sub-Saharan Africa to Northern Brazil to the rust belt of US Midwest, is that the lack of collective goods and coherent policies is rooted not in the absence of social ties but their insulating qualities and the lack of cross cutting between ties producer communities and their respective associations.

These micro and macro views imply that the problems faced by San Juan and Mendoza were a history of fragmented socio-economic life between producer communities. Our interviews with managers, enologists, and agronomists appeared to confirm both the facilitating and exclusionary natures of social structure. On the one hand, our interlocutors continually emphasized that their ability to learn about new techniques in vineyard management and developing new varietals and blends of wine was closely linked with their relationships with other firms that facilitated collective problem solving and coordinating multiple experiments. Such close ties were particularly important because of the need to learn how different “imported” techniques and advice were applied to particular microclimates and local varietals of grapes. Our fieldwork also revealed that past social and professional ties could be the basis of new forms of concerted, collective action. For instance, many of the first initiatives to upgrade products and processes in the broader region came from firms in Mendoza’s *Primera Zona* that were led by

Argentines with foreign education and contacts. In 1990-91, these elite firms began organizing two main forms of collective learning based on past professional and local ties – voluntary learning groups and wine evaluation competitions, in which the participating firms benchmarked their products and processes, shared practices to resolve common problems in grape growing and winemaking, and brought in respected consultants. (Paladino et al., 2001; Walters, 1999)

On the other hand, these prior relationships demonstrated their insulating qualities and limitations in bridging the existing social and economic gaps between sub-regions or zones of Mendoza, and thus in creating and diffusing new knowledge. The learning groups and competitions included a few firms – only the most elite wineries of the *Primera Zona* that viewed those in the other zones of Mendoza and San Juan as incapable of producing fine wines because of their apparent substandard economic, educational, and climate conditions. At the same time, as our interviews revealed, winemakers of these “lesser” *Zonas* saw little to gain from those who always criticized their products and from discussions not focused on improving the kind of intermediate and low enological quality grapes that composed their wine supply chains. In his detailed account of winemaking in Mendoza in the early 1990s, Walters (1999: 120-123) argues that enologists and agronomists in different zones rarely learned from one another’s ongoing field and wine experiments because of historical animosities and pre-conceptions of one another’s skills and capacities. This socio-economic fragmentation was amplified by the aforementioned zero-sum game of industry policy, as it fostered weak horizontal ties between sectoral and zonal associations and ad hoc vertical ties between just a few associations and the government. (Paladino & Jauregui, 2001; Rofman, 1999)

The need for more specific applied knowledge and skills, coupled with regional prejudices and resource inequalities, can create barriers to the processes of aggregation and joint action vital for a sustainable base of innovation. We now combine the insights of Fleming, Granovetter, and Lin with recent work on organizational fields and institutions to redirect the lens of comparative

analysis toward institution-building processes that can accelerate the recombination of social ties and knowledge resources at different levels of society.

Ic. Revisiting the Comparison – Public-Private Institutions as Conduits to New Resources

To the extent that upgrading depends on access to a variety of knowledge and resources, the isolating effects of a firm's immediate inter-organizational network can be relieved by introducing new alters or nodes into the network that can facilitate such access. The research on networks and innovation has shown that the presence of cross-cutting ties between firms from distinct producer networks or geographical locations can help them overcome these barriers and access new knowledge resources. (Uzzi 1996, Zuckerman & Sgourev 2006) This work often relies on individuals, firms, or voluntary associations to act as the conduits for such ties. Policy scholars such as Locke (1995) and Ostrom (1999) suggest that when more encompassing, bridging structures are not historically or organically given, then government can find a role to provide them to improve coordination and knowledge diffusion. Network scholars have recently supported such views in showing how some GSIs, in providing new training and R&D programs, can bridge socially and geographically isolated groups of firms, legitimize new standards, and promote new forms of joint action. (Knocke 2001, McEvily & Zaheer 2004, Owen-Smith & Powell 2004)

This intersection of research has gained increasing traction in policy research on societies noted for their weak state capacities and fragmented, rent-seeking industry groups. First, when confronted with crises, governments can change existing policy by creating new GSIs in partnership with a broader variety of stakeholder groups than in the past. (Campbell 2004, Schneider 2004; McDermott 2002) In acting less as a direct provider and more as a coordinator and empowerer, the government can instigate a process of recombining the resources and information of better placed actors with its own to facilitate the creation of more effective services and programs. (Audretsch et al. 2002; Furman et al. 2006; Rodrik 2004)

Second, to the extent that these new GSIs are governed by a variety of public and private actors, they have the potential of also reshaping the social and knowledge ties among the government and previously isolated, even antagonistic, producer communities. (Safford 2004, Ostrom 1999) The new GSIs are constituted with rules of empowered inclusion and multiparty governance, whereby participants representing the government and a variety of relevant non-government stakeholder groups, such as trade associations, have sets of rights and responsibilities in defining and evaluating the development of certain upgrading programs. As such, they offer participants new structures to engage in collective problem solving, improve mutual monitoring, and build broader strategic considerations on top of their past rent-seeking, mutual hold-up instincts. (Sabel 1994; Schneider 2004; Stark & Bruszt 1998; Tandler 1997)

We refer to this sub-group of GSIs as public-private institutions or PPIs. (Ostrom 1999, Sabel 2007, Tandler 1997) Our main interest is not their hybrid ownership form per se, but particularly the way their governance principles foster multiplex, cross-cutting ties among previously isolated public and private actors and improve the access firms have to a variety of knowledge resources.

A fruitful comparative analysis, in turn, would focus on how the contrasting policies toward resolving a common crisis in the late 1980s in Mendoza and San Juan led to the formation of different organizational and institutional arrangements in the 1990s. San Juan's government sought to insulate itself and rapidly impose high-powered, arm's-length economic incentives on society to induce change. It first chose to rapidly privatize the collapsing Cavic to local interests, brushing off the protests of dependent small grape growers and wineries. The firm soon failed again, causing the government to intervene and liquidate it. Then through the 1990s, the government focused on attracting new investment through a federally subsidized tax incentive. By most accounts this policy did bring in record levels of investment to the wine industry but failed to encourage broad based upgrading. The economic benefits remained concentrated among a few

large firms that had little interest in incorporating and diffusing new practices along the value chain. The top down approach also exacerbated the fragmentation and animosities among relevant sectoral associations and the state, and perpetuated the old strategies of divide and rule cum rent-seeking.¹¹ For instance, on several occasions during the 1990s, different sectoral associations proposed new institutions to support training and export promotion. Each attempt failed, with the state and the associations accusing each other of free-riding and attempting to gain control of state resources. Suspicion became so endemic that as late as 1997 San Juan's largest grape-producer association declared that the incorporation of new technologies and vineyard management techniques proposed by some of larger wineries were simply attempts to cut labor costs and undermine the stability of smaller producers. (Rofman 1999, Ch. 4)

In contrast, Mendoza gradually built a new set of GSIs to provide a variety of new support services and resources in agriculture and especially the winemaking value chain (e.g., hazard insurance, training, R&D, export promotion, etc.). The first experiment came in 1987-88, when the newly elected provincial administration chose to transform Giol into Fecovita, a federation of cooperatives, which were created from the previously dependent thousands of small grape growers and wineries. This experience not only revitalized the cooperative sector, but also initiated a broader effort by the Mendoza government to create PPIs de novo and then later reform existing GSIs with socio-economic partners over ten years. (McDermott 2007)

Table 1 gives an abridged description of the most prominent PPIs, their different support activities, and shared governance traits. They are public-private in their legal form, governance structures, resources, and membership, which includes representatives from the government and associations of a variety of zones and sub-sectors. As a sub-group of GSIs, they too received at

¹¹ See Gago & De La Torre (1996) and Rofman (1999) for detailed analyses of San Juan policy. They also show that between 1990 and 1998, 424 firms invested over \$1 billion in San Juan agriculture. Approximately 193 of these firms were committed to investing into wine and grape production, including upgrading over 14,000 hectares, most of which have been for the development of fine grapes. Some estimate that the San Juan policy cost Mendoza \$100-200 million per year in production output from diverted investments.

least partial public funding, had state representatives on their boards, and had a public mandate. But the aforementioned characteristics made the PPIs distinct from the pre-existing GSIs, since the latter were state/bureaucratic centered in their governance and had only ad hoc contact with a few elite groups instead of governance and resource ties to a variety of associations. They were also distinct from the pre-existing sectoral and zonal associations, since the latter were voluntary organizations with no government representation or resources, were narrow in membership and mission, and had few services other than lobby the government as mentioned above.

[Insert Table 1 about here.]

Our particular is how the distinct governance rules of PPIs anchored their ability to act as multiplex bridges (Ansell and Padgett 1993, Burt 1992) between the public and private domains as well as between the relevant producer communities, and in turn create mechanisms to improve firm access to a variety of knowledge resources. At the meso-level, the rules of inclusion allowed each PPI to become more embedded with one another, the pre-existing GSIs (such as the regulator of the wine industry, the center for small business support, and the agency for phytosanitary control), and the associations of Mendoza. The bridging quality of PPIs, such as those in Table 1, was institutionalized in their statutes, which explicitly mention as voting founders and members of governing and advisory boards certain government agencies and relevant sectoral and zonal associations. (McDermott 2007: 123-124). Deliberations about the formation and performance of the PPIs opened up new cross-cutting lines of communication between these associations. To illustrate this structural trait further, we collected membership and board data of the PPIs, associations, schools, and GSIs relevant to the wine industry. Figure 1 shows the resulting network via a UCINET analysis. (Borgatti *et al.*, 2002) Notice that PPIs are neither domineering nor isolated, but appear almost as brokers between different constituencies. This point is reinforced by the “betweenness” scores of the leading entities, which indicate that the PPIs were key hubs of diverse membership and potentially diverse information. (Borgatti, 1995) Although

not conclusive, the data suggest that by 2001, the PPIs (as well as some of the reformed GSIs) tied the different associations and communities together.

[Insert Figure 1 and Table 2 about here.]

The multiplex quality of the ties between the PPIs and different producer communities emerged from the rules that gave participants both joint decision making rights and resource responsibilities for programs and services. As a participant in regular performance evaluations, the representative of each association was transmitting the interests of his or her constituents. In meeting their material responsibilities to the PPIs and in trying to ensure that the relevant programs attend to the needs of their constituents, the participants also opened up two-way channels for the transmission of knowledge and resources. For instance, although the government often provided the bulk of initial financing, participating associations provided personnel, facilities and financing as well as the experience and information from their constituent firms. As the associations incrementally and jointly helped develop services, they increased their confidence in the PPIs and encouraged firms to utilize the new resources.

The combination of these governance rules and network qualities in PPIs fostered three mechanisms to transmit a new variety of applied knowledge to firms.¹² First, in combining the material and informational contributions of the public and private participants, the PPIs gradually built up knowledge resources at a scale, scope and accessible cost that the government and the associations could not have provided individually and did not exist before or in other provinces. For instance, INTA Mendoza, IDR, and ProMendoza pioneered new detailed mappings of the micro-climates for grapes and other agricultural products; data bases on best practices (internationally and sub-regionally), harvests, and product markets; benchmarking and training programs for different sectors and zones; and teams of experienced consultants. The staff

¹² See McDermott (2007: 121-126) for a more detailed account of these mechanisms and related services.

acquired such contextualized knowledge from the input of the associations themselves, their own research, and the various service contracts with constituent firms, and then incorporated it into their databases and training programs. Similar to the technology centers described by McEvily and Zaheer (2004), these PPIs became public repositories of diverse practices and standards and also of repackaged knowledge to be adapted to particular settings.

Second, PPIs produced services that integrated the needs of their different constituencies and high standards for firms to participate in more sophisticated programs. The leverage of each participant came from its ability to provide or withhold resources as well as its ability to voice proposals and grievances through the board. Even if consensus could not be reached in one moment, the iterative nature of joint evaluations and the government's interest in maintaining a broad coalition allowed the minority to look to further rounds of deliberation and other GSIs to attend to their needs. For instance, our interviews revealed that the few generic extension programs in INTA and IDR were initially heavily criticized by firms and the representatives of their associations that sat on the governing councils. Such pressure gradually forced these PPIs to build programs that tailored vineyard maintenance practices and grape fermenting techniques to the distinct climates and firm capabilities that characterized the different zones. It also led them and the FTC to establish satellite offices in the different zones. Similarly, soon after its creation, the export promotion programs of ProMendoza were criticized by firms and associations from both elite and backward zones for favoring one group over the other. ProMendoza altered its practices to support the different sets of firms. It created a system of benchmarks to allow the capable firms to participate in its sponsored trips to international trade fairs. But it also began requiring inferior firms to undergo training in international distribution and market segments in its own programs and those of sister institutions. At the same time, Pro Mendoza expanded its program of annual tours for foreign trade journalists to visit wineries from a variety of zones, not

just the better-known firms. In both cases, firms from more backward zones learned about different international standards as well as how they could meet them.

Third, the PPIs built programs to help firms learn from one another and create new relationships. Both firm managers and directors of these institutions repeatedly told us that one of the most valued qualities of services was the way they helped to diffuse standards, practices, and experiences from one zone or sector to another. A typical example of an indirect method was the use of INTA Mendoza's testing labs and viticulture consultants by a variety of firms, from the most elite to the fragile cooperatives. With this diverse experience, INTA Mendoza began documenting, benchmarking, and teaching practices from the most advanced form of computer monitored drip-watering to new applications of the more traditional orthogonal vine training systems. The most common examples of a more direct method of knowledge transmission and relationship building was the use by INTA, IDR, and ProMendoza of multi-firm training and research programs based on collective problem-solving techniques. A key component of all these programs was having managers, enologists, or agronomists from different zones jointly resolve particular fermentation, blending and viticulture problems on site in the different firms. As several participating firms told us, an important by-product of these programs was creating new professional relationships with firms about which they had little prior knowledge. INTA and the Fondo Vitivinicola also collaborated with associations to establish annual wine evaluation competitions in the late 1990s in the more backward zones, *Zona Sur* and *Zona Este*, as well as in San Juan, where both institutions had satellite offices. By including oenologists from different zones on the evaluation committees, firms with little previous contact were directly learning from one another about their product development methods. In turn, the PPIs were becoming "network facilitators," a vital role McEvily & Zaheer (2004) identified in public-private technology centers in the US, which used support programs to help firm share practices and tighten relationships between loosely linked networks.

By the end of the 1990s, the overlapping ties and demonstration effects of the new institutions channeled spillovers across policy domains and provinces. Within Mendoza, the older, more archaic institutions, such as the regional university, the province's phytosanitary regulator, and the national regulating agency for wine, began to change their programs, standards, and governance structures largely due to their participation in new advisory councils and industry support programs. The Mendoza government and associations also spearheaded the replication of the institutional model at a national level that was signed into law in late 2004. Beginning in 2002, the San Juan government openly criticized the old approach of tax incentives and advocated the creation of new public-private institutional resources for training, R&D, and export promotion. Indeed, the government explicitly mentions INTA San Juan, INTA Mendoza's satellite center created in 1996, as an exemplary model. (Gobierno de San Juan, 2004)

In sum, Mendoza's approach to building new GSIs appears to have helped induce upgrading by improving the access firms had to a variety of knowledge resources and functioning akin to the "network facilitator" role discussed by McEvily and Zaheer (2004). The rules of inclusion and multi-party governance helped representatives of previously isolated producer communities gradually forge common strategies and a coherent, dynamic set of support policies with the state. Consequently, the programs and services of the relevant institutions helped firms learn how to apply new knowledge with existing natural inputs and build new relationships with one another. With statistical techniques, we now explore the degree to which this new constellation of organizational and institutional ties, once it had taken root, shaped a firm's advance in product upgrading.

II. NETWORK COMPOSITION AND PRODUCT UPGRADING

The cross-sectional nature of our quantitative data impedes us from statistically tracking the changes in a firm's network and product upgrading. It does however allow us to evaluate how the composition and structure of a firm's ego-network impact its product upgrading, and the

plausibility of our key claim that Mendoza's policy approach facilitated firm access to a new variety of knowledge resources by creating new institutions with multiplex bridging qualities that fostered cross-cutting ties between producer communities.

The baseline view in the network literature is that a firm's access to a variety of knowledge resources depends on being highly embedded in an inter-organizational network, as indicated by the out-degree centrality of one's ego-network. (Coleman 1990, Uzzi 1996, Gulati, Nohria & Zaheer 2000, Wasserman and Faust 1994) That is, the more ties a firm has to all types of organizations, the more likely it is able to access a greater volume, and potentially variety, of information. The main benefit from Mendoza's approach, in turn, would be to expand the number of ties a firm has to a broader set of organizations and institutions.

Although this claim may in general be valid, it can blur the way Mendoza's approach created new actors and mechanisms for transferring knowledge. That is, it assumes a certain level of homogeneity about the members of an organizational field and the types of information and resources they can afford one another. The recent work on networks and innovation has increasingly sought to differentiate a firm's network composition, emphasizing that only certain types of alters lend valuable information and resources for the task at hand. (Ahuja 2000, Borgatti 2005, Fleming & Waguespack 2007, Gulati & Higgins 2003, Lin 2001) As noted above, the recent work on organizational fields has broadened this perspective in showing how not only firms but also schools, banks, cooperatives, associations, and GSIs afford actors with distinct types of services, data bases, and professional contacts.¹³

Our previous theoretical and empirical discussions argued that the alters, which appeared most valuable to firms were those offering a new variety of applied knowledge resources and cross-cutting channels of information and professional contacts between different producer

¹³ Given the enormity of this literature and our previous discussions, the best reference points are Knoke (2001), Locke (1995), McEvily & Zaheer (2004), Powell et al. (2005), Safford (2004), and Zuckerman & Sgourev (2006).

communities, especially the different zones. Mendoza's approach appeared to improve access for firms to a variety of knowledge resources by creating a new set of GSIs, the PPIs, and then reforming the old GSIs to offer new services directly to firms and fostered new types of relationships between them. Our qualitative analysis further suggested that wineries benefited most from their interactions with other firms and the GSIs, because these alters, as opposed to the other types, offered the combination of new knowledge resources and inter-active relationships for solving ongoing problems of product development. In contrast, pre-existing organizations, such as schools, banks, associations, and cooperatives were not the repeated recipients of policies to new knowledge resources directly for the firm or remained focused in their membership, clientele, and social orientation toward their locality or zone.¹⁴

H1a: The greater number of ties the focal firm has to other firms the higher will be its level of product upgrading.

H1b: The greater number of ties the focal firm has to GSIs the higher will be its level of product upgrading.

H2: The greater number ties a focal firm has to associations, banks, cooperatives, and schools, the lower will be its level of product upgrading.

Following our discussion about the distinct histories and governance of GSIs, we can further distinguish their different impacts on product upgrading. Although our qualitative analysis suggested that the overlapping ties between the PPIs and the old GSIs facilitated recent changes in the mission and programs of the latter, one would likely expect that firms would find greater relative value in the former. First, the PPIs were created with distinct governance rules and network qualities, while the old GSIs were not. Our qualitative analysis emphasized that the rules

¹⁴ Following our discussion in Section I, GSIs are those institutions that receive government funding (completely or partially), have at least one government representative on the board, and provide support services to firms, such as training, R&D, sales promotion, etc. PPIs are a sub-group of GSIs with the governance principles discussed above. Schools are a separate category because although some may receive public funds, the government is not represented on the board and the schools do not provide services (training or R&D) to firms. Rather, they traditionally provide basic or advanced education in the classroom. Associations are voluntary trade or civic organizations with no government funding and created and governed purely by their non-government members. Following the literature on development and governance, we also classify banks and cooperatives as distinct from private, commercial firms engaged in the industry. (Spencer et al 2005, Tendler 1997)

of inclusion and participatory governance fostered multiplex, bridging qualities in the PPIs, which in turn anchored their ability to deliver a new variety of applied knowledge resources to firms in different zones and facilitate the development of new inter-firm relationships. As noted above, recent research has shown in other contexts that the institutionalization of cross-cutting ties between previously isolated groups of firms can greatly improve support services, the diffusion of standards, and the access to diverse sources of information. (McEvily & Zaheer 2004, Zuckerman & Sgourev 2006) Second, research in economic sociology and historical institutionalism notes that older institutions and their attendant stakeholders are often slower to change than newer ones, especially if they have longer histories of being unresponsive or were built for particular aims in one period but of lesser value in subsequent periods. (DiMaggio & Powell 1983, Knoke 2001, Scott et al. 2000, Thelen 2003) The policy of Mendoza emphasized first the construction of new institutions, not reforming the existing ones, and then spinning off new operations as demands from a greater variety of programs grew. For instance, IDR and ProMendoza grew out of initiatives within INTA Mendoza and the Fondo Vitivinicola. An alternative could have been placing new extension and R&D programs in the regional university or placing export promotion within the Ministry of Economy, but they did not.

H3: The greater number of ties the focal firm has to the PPIs, the higher will be its level of product upgrading.

The foregoing makes indirect inferences about the mechanisms for knowledge transfer from the Mendoza policies and the governance histories of GSIs. Given our previous claims about the importance ties to other firms and GSIs being positively associated with higher levels of product upgrading, we focus here directly on cross-cutting qualities of these alters in facilitating access to a variety of knowledge resources. Our qualitative analysis noted that the ability of the new GSIs to give firms access to a variety of new resources grew out of the network structures that underpinned them. A key aspect of Mendoza's approach was to infuse GSIs with governance

principles that helped overcome prior problems of socio-economic fragmentation by being *both* more encompassing than existing associations *and* gradually functioning as social bridges between producer communities. Moreover, one could infer that certain firms developed these network qualities because of their participation in training, R&D, and export programs that fostered new professional relationships between firms from different zones. According to recent research on networks, those mediators with diverse knowledge resources are particularly those that are the most central or those that act as the most important bridges. (Burt 2001, Fleming & Waguespack 2007) The two traits are not necessarily exclusive, and both serve as key tests about one's access to diversity. But they reveal distinct mechanisms.

Firms might learn more rapidly when they are linked with organizations and institutions that are the most central or encompassing in the region, because they would have access to a great number of other associated firms and in turn variety of information and resources. (Borgatti 2005; Safford 2004) Being linked to a highly central organization or institution can also convey on the firm a particular level of legitimacy, which can act as a positive signal for its products and practices to other potential collaborators. (Benjamin & Podolny 1999; Knoke 2001; Provan and Milward 1995) In contrast, being linked to less central mediators would not provide access to a variety of knowledge resources.

H4a: The greater number of ties a focal firm has to firms with high levels of network centrality, the higher will be its level of product upgrading.

H4b: The greater number of ties a focal firm has to GSIs with high levels of network centrality, the higher will be its level of product upgrading.

One can also emphasize the ability of Mendoza's GSIs to act as social and knowledge bridges among the distinct, previously isolated communities, particularly those bounded by the aforementioned zones. Centrality may reflect simply the most dominant organizations and offer redundant knowledge. (Burt 1992, Romanelli Khessina 2005) That is, to the extent that variety is key for developing new product upgrading capabilities, then the relative importance in

intermediating organizations and institutions is the geographical diversity, not the quantity, of actors associated with them. The importance of bridging roles has been noted in research on entrepreneurship (Burt 1992, 2001) and on regional development. (Safford 2004) Obstfeld's (2005) theory of "tertius iungens" and Zuckerman and Sgourev's (2006) notion of "peer capitalism" highlight the importance of structures bringing previously unconnected actors together. McEvily and Zaheer (1999) also find that participation in government created regional technology centers improved the competitive capabilities of traditional manufacturing firms, largely because of the way the institutions gave firms access to a variety of information from different locations. In contrast, having numerous ties to mediators that have relatively few bridging qualities would not give a firm access to a variety of knowledge resources. Given the limitations of our data, we can not estimate which firms and institutions bridge structural holes in the conventional manner. However, given the literature on localities creating search costs for the pursuit of variety (Romanelli & Khessina 2005) and our previous discussion about the ways in which social fragmentation occurred in the provinces according to sub-regional zones, a reasonable proxy for an intermediating organization's bridging role is the geographic diversity of the firms associated with it.

H5a: The greater number of ties a focal firm has to firms with high geographic diversity, the higher will be its level of product upgrading.

H5b: The greater number of ties a focal firm has to GSIs with high geographic diversity, the higher will be its level of product upgrading.

III. DATA AND METHODOLOGY

The design of the sample and survey was based largely on the aforementioned field interviews in Mendoza and San Juan. We developed and administered our survey instrument during 2004-05. Our survey captured a focal firm's level of product upgrading, demographics, location, as well as its ties to firms, publicly support institutions and other organizations.

A simple random sample (SRS) of 115 firms was selected from a roster of the wineries in Mendoza and San Juan. We undertook several measures to increase participation and response rates, including gaining the enthusiastic approval of the project by the relevant sectoral associations, inviting firm owners/directors by mail and telephone to participate in the survey (Buse 1973; Hansen & Robinson 1980), and replacing 15 firms that declined to participate with 15 similar firms randomly selected. 112 firms completed our surveys (97% response rate).¹⁵ We compared with data of wineries from relevant government source and found no significant differences between them in geographic distribution, age, size, and FDI. For instance, about 60% of the firms are less than 20 years old, about 70% have less than 25 employees, and 50% have less than \$330,000 in sales. Roughly 10% have foreign investment.

We divided the questionnaires in two parts. The owner or general manager filled out the part covering firm demographics and general strategies. The chief enologist filled out the part covering production, product development and ego-networks. We designed and implemented the survey in collaboration with a leading agro-extension center in the region, whose field consultants interviewed each informant in person for about one hour, using the questionnaire.

IIIa. Dependent Variable

As discussed above, our dependent variable, *Product Upgrading*, is a particular form of innovation, in which firms focus on the creation of new products for higher value by incrementally experimenting with new combinations of knowledge, materials, and natural resources. (Fleming 2001, Ghoshal & Moran 1999, Giuliani et al. 2005) Following a well established research stream in the strategy and organizations literatures, we measured it by asking respondents to assess the extent to which the firm implemented the relevant practices associated with product upgrading in this particular context using a 5-point Likert scale. (Kostova & Roth 2002; MacDuffie 1995, 1997;

¹⁵ Of the 112 wineries, Twenty-two are from San Juan and 90 are from Mendoza, of which 26 are from Gran Mendoza, 32 from the East Zone, 15 from Valle de Uco, and 17 from the South Zone. Due to missing variables, our models include data from 97 firms (an effective response rate of 84%).

Zollo & Winter 2002). The list of these practices come from our interviews with winemakers and then confirmed by a team of experts from our collaborating center and five well-known wine consultants in Argentina. Such practices are the regular introduction of new and higher value wines, emphasis of quality over cost, experimentation with new blends, varieties and clones, and monitoring domestic and overseas markets.

In order to assess the validity of our instrument we conducted an exploratory factor analysis with oblimin rotation (PROC FACTOR, SAS v.9) on 22 questions that extracted five factors. Questions that loaded in more than one factor were dropped. Two of the five factors are associated with distinct aspects of product upgrading and contain four items each. (See Appendix 1 for questions and loading scores.) The items in each of these two factors, respectively, address directly the extent to which the firm overcomes technological and market uncertainties, which, as discussed earlier, are present in product upgrading for the wine industry. Our dependent variable is created by adding the responses to the eight questions loading in the factors associated to product upgrading. This index has a Cronbach's alpha of 0.78, which are above the cutoff value (0.70) for reliable scales (Nunnally, 1978).¹⁶ A third factor is associated with Upgrading Intent, which we use as a control variable for the underlying motivation of the focal firm to engage in product upgrading (see below and Appendix 1).

IIIb. Explanatory variables

To collect network data, our survey asked enologists to identify firms (up to seven) and non-firm entities (up to five) with which they regularly interact, collaborate, or exchange information regarding specific strategic areas, such as product development, production methods, technology acquisition, training, marketing, and exports.¹⁷ Following our terminology in Section

¹⁶ The two factors have Cronbach's alphas of 0.72 and 0.77. Given current debates in development, we note also that our dependent variable is highly correlated with exports. Based on both self reported and third party export data, the correlation is 0.24, significant at the 1% level.

¹⁷ Respondents were provided with a roster of non-firm entities developed with local experts but were also allowed to report entities not on the roster.

Ic and II, we validated and classified these firm and non-firm *alters* into six categories: associations (trade, peak level, etc.), banks, cooperatives, firms (wineries, independent grape growers, technology suppliers, etc.), GSIs (such as those discussed above), and schools (universities, technical schools etc.).¹⁸ As noted above, most GSIs are provincial and, hence, firms have access to them mainly within their own respective jurisdictions. Following the preceding discussions, we also decomposed GSIs into two sub-categories – PPIs and Old GSIs.¹⁹

We constructed a two-mode network consisting, on the one hand, of focal firms, and, on the other hand, of *alters* (firm and non-firm). Ties were defined as any relationship between the focal firm and the alter. All the measures based on ties are generated from the total count of mentions to the alter, which include repeated counts of the same alter if they were identified by the focal firm as providing useful information or services in multiple operational areas of firm management and winemaking. By doing so, we are generating variables that combine the structural aspects of the network with the strength of the relationship in a manner consistent with Cross, Borgatti and Parker's (2001) view about the importance of studying the role of multiplex network ties. A firm that interacts with the same alter in several areas engages in a stronger relationship than one that participates in a relationship limited to a few areas (Burt, 1983). In particular, when the underlying mechanism is access to diverse, tacit knowledge in order to generate innovations, multiplex relationships provide the repeated interactions that generate mutual understanding and facilitate the transfer of knowledge (Hansen, 1999; Nonaka, 1991). As opposed to equating single and multiple mentions of an alter, this relatively high threshold to identify alters eliminates irrelevant ties in the context of information flow, and the multidimensionality of the relationship provides a window into the value of the strength of the tie.

¹⁸ See Sections I and II, including supranote 14, for the logic behind these classifications.

¹⁹ PPIs include: Fondo de Vitivincola, Fondo para la Transformacion y Crecimiento, IDR, Promendoza, INTA Mendoza, INTA San Juan, and ITU. Old GSIs include all other GSIs. Old GSIs pre-date PPIs, and the two classifications are different in terms of the governance rules discussed above.

Ties to All Alters & Ties to Different Types of Alters. These variables measure the degree centrality (Freeman, 1979) that captures a focal firm's exposure to the knowledge and immediate influence of others (alters) (Borgatti, 2005) by counting the focal firm's total number of ties to other organizations and institutions. It is based on the ego network and lacks any dyadic characteristic. The variable, *Ties to All Alters*, is the total count of ties a focal firm has to all types organizations and institutions mentioned above, capturing the overall embeddedness of the firm assuming homogeneity across alter types in terms of their knowledge resources afforded to focal firms. We relax this assumption and emphasize heterogeneity by decomposing this variable, following standard methods (Ahuja 2000, Lin 2001, Owen-Smith & Powell 2004), into six variables that capture the composition and structure of the focal firm's ego-network. The variables, *Ties to Firms*, *Ties to Associations*, *Ties to Banks*, *Ties to Cooperatives*, *Ties to Schools*, and *Ties to GSIs*, are each constructed by counting the number of ties between the focal firm and the given type of alter, as classified above. We follow the same method, when decomposing Ties to GSIs and constructing *Ties to PPIs* and *Ties to Old GSIs*. We discuss our second method of decomposition and aggregation of network ties below in III.d.

Ties to TopCentralFirms & Ties to TopCentralGSIs These measures capture the benefits that a firm can obtain indirectly from being connected to alters with high centrality, and therefore, exposure to influence and resources of a large number of actors in the network (Burt, 1983). We first identified all the firm and GSI alters and ranked them separately by the total number of ties from the focal firms.(Frank, 2005) Firms and GSIs with in-degree centrality in the top decile were considered to be highly central alters.²⁰ Then, for each focal firm, we calculated the total number of ties to these high network centrality alters.

²⁰ An analysis of number of ties of each alter shows a skewed distribution with an inflection point at around 10%. For this reason, we selected those firms in the top decile as being the most central. In addition we run robustness checks by defining the most central alters as those in the top 5% and 20%. Models utilizing all three versions produced similar results.

Ties to Top Geo Div Firms & Ties to Top Geo Div GSIs. By considering geographic zones as proxies of different knowledge, this measure captures the diversity of knowledge accessed through network ties. High network heterogeneity is associated to increased opportunities to innovate (Burt, 1983). We calculated the geographic diversity of network ties by examining the alter's direct ties to firms in different zones of the region. Even lacking information about the complete network, our random sample of firms provides the information to generate unbiased estimations of such a measure. (Frank, 2005) First, we calculated the total number of ties for each alter and assigned the ties to zones based on the geographic location of the surveyed firms that identified the relationship. These zone counts were then used to derive a Herfindahl Index score for each alter based on the number of ties in each zone.²¹ Alters were ranked from highest to lowest based on their diversity score and the top decile was selected.²² Finally, we generated the variables by counting the number of ties the focal firm has to these most geographically diversified alter firms and alter GSIs.

IIIc. Control variables

The location variables are categorical, associated to different zones that experts identified (Grand Mendoza, East, Valle Uco, South, San Juan). In addition to the usual location fixed-effects (e.g., local resources or natural endowments), this variable absorbs systematic error in the measurement of our dependent variable (due to its perceptual nature). Since these zones are relatively isolated, respondents are likely to use the performance of their neighbors as anchors, which may result in systematic reporting differences across regions. For this reason, we cannot infer upgrading differences between regions by comparing the coefficients of different zones.

We control for superior resources with *Foreign Ownership*, a dummy variable taking the value of a 1 for firms with foreign investment greater than 10% of equity and a 0 otherwise. In

²¹ This score was then subtracted from one (1 – Herfindahl Index) so that a higher score represented greater geographic diversity in the ties of the organization.

²² In selecting the 10% threshold, we used a methodology described in Footnote 15.

addition, resources are also captured by *Total Sales*, an interval variable with five levels. This approach provides a measure of resources available for innovation and development that is consistent across technologies and scales. This variable is more appropriate in this context because the industry technological diversity leads to diverse degrees of labor intensity, thus rendering meaningless size measures based, for example, on the number of employees.²³ To control for differences in absorptive capacity (Cohen and Levinthal 1990) and learning capabilities, we introduced *Education* and *Enologist*.²⁴ The former reflects the fact that higher educated managers are more likely to learn about innovative practices and is measured as an index based on the education level of general managers and enologists. The later is a dummy variable that takes a value of one when the firm has at least one full-time enologist, a well-known first stage signal of commitment to learning and experimentation. (Giuliani & Bell 2005) Given the problems of collecting firm level data in developing countries, these types of firm level controls are commonly used. (Meyer 2004)

Finally, in order to control for the effects of a firm's demand structure and positioning choice, we introduce *Upgrading Intent*, a perceptual variable derived from the factor analysis that captures the firm's unobserved intention to upgrading by its commitment to activities and assets that support upgrading (i.e., technology agreements, wine research and development agreements, and investment in micro-fermentation). (See Appendix 1 for the specific questions and factor analysis results.) As Kaplan (2008) shows, firm actions are motivated by cognition, capabilities and incentives; and although we control for capabilities, the inclusion of *Upgrading Intent* adds an

²³ We also generate a firm age variable to control for firm inertia. Unreliable responses and missing answers reduced the number of observations to 80. We introduced the logged variable among the controls. Model estimations did not change significantly except for increased standard errors and lower significance levels. For this reason, and in order to improve the statistical power, we excluded age from the reported models.

²⁴ R&D intensity, the standard way of measuring absorptive capacity in the literature, is not a reliable measure in this setting. Because of size, technology and historical imprinting, wineries in Mendoza and San Juan do not have an R&D department or keep records for this type of expenses. This is a common problem for firm level data in developing countries. (Meyer 2004, Song 2000)

additional control for unobserved differences in cognition (e.g., managers ability to understand the benefits of upgrading) and incentives (e.g., market demand faced by the firm) by inferring them from the firm's actions. Given the small size of our wineries, the questions in this measure reveal the firm's allocation of limited resources consistent with acting on a perceived demand for upgrading. We further discuss the utilization of this variable below.

III.d. Methodological issues and statistical inference

In order to test our hypotheses, we estimated two sets of linear regression models that regressed product upgrading on control variables and three groups of explanatory network variables with the firm as the unit of analysis. To correct skewness of our network variables we applied the Box-Cox transformation (Box & Cox, 1964) to each one of our network measures.²⁵ To address the problem of outliers, we report the results from robust regression (proc robustreg, SAS v.9) with Least Trimmed Squared (LTS) estimation (Rousseeuw, 1984), which generates OLS estimates robust to the presence of outliers.²⁶

The first set of models explores the relative impact of being tied to distinct types of alters on the firm's level of product upgrading (see table 4a). Model 1 is the baseline, which include only the control variables. Model 2 introduces our overall measure of embeddedness, *Ties to All Alters*. Model 3 decomposes the overall measure of embeddedness into the degree centrality for each one of the six networks based on the type of alter (*Ties to Associations, Banks, Cooperative, Schools, Firms, and GSIs*, respectively). Model 4 decomposes *Ties to GSIs* into *Ties to PPIs* and *Ties to Old GSIs*.

The second set of models explores the relative impact on product upgrading of being tied to alters that are, respectively, the most central and most geographically diversified, in terms of

²⁵ Box-Cox transformation yields the transformed variable most proximate to a normal distribution. Log transformation is a particular case of BoxCox ($\lambda = 0$) (Greene, 2000).

²⁶ We also ran robust regressions with M-estimation (Huber, 1973), which provides resistant results in the presence of outliers. Results from robust M- and OLS estimations are similar to the ones reported and available from authors.

their own connections. (See Table 4b.) We limit this analysis to firms and GSIs – the only types of alters that show significant impact on *Product Upgrading* in the first series of models. To provide consistency between the two sets of models and to account for our limited degrees of freedom, we modify our method of decomposition and aggregation in two systematic ways. First, in Models 5-8, we continue to include the ties to associations, banks, cooperatives, and schools by collapsing them into the variable *Ties to All Alters Except Firms and GSIs*. Second, Model 7 explores Hypotheses 4a & 4b by decomposing *Ties to Firms* and *Ties to GSIs* into, respectively, *Ties to Most Central Firms* and *Ties to All Firms Except Most Central Firms*, and *Ties to Most Central GSIs* and *Ties to All GSIs Except Most Central GSIs*. Third, Model 8 explores Hypotheses 5a & 5b by decomposing *Ties to Firm* and *Ties to GSIs* into, respectively, *Ties to Most Geo Div Firms* and *Ties to All Firms Except Most Geo Div Firms*, and *Ties to Most Geo Div GSIs* and *Ties to All GSIs Except Most Geo Div GSIs*.

It should be noted the differences between models is not about adding new variables but about decomposing the variable *Ties to All Alters* in different ways. In every case the sum of the decomposing variables is equal to the decomposed variable. In this way, we are able to show the distinct impact of *alters* that possess the characteristic of interest and those that do not.

For the models reported, we did not find significant multicollinearity problems in collinearity tests (proc reg, option VIF, SAS v9) and independent variables correlation. However, our measures of ties to the most central and geographically diversified alters presented Variance Inflation Factors (VIF) between 3.2 and 4, and correlations ranging from 0.78 to 0.85 (see Table 3) which are symptoms of multicollinearity. For this reason, and for lack of better solutions (Wooldridge, 2002), we only report models introducing those variables one group at a time instead of combining them. Moreover, as noted above, to test our claims about accessing diverse knowledge sources, our main interest is comparing the relative effects of the most central and geographically diversified mediating firms and institutions with the others.

The cross-sectional nature of our data constrains our ability to address reverse causality issues. One issue of concern is that ties to institutions and upgrading may be associated through a third omitted variable. The decomposition of our GSI variable between PPIs and Old GSIs reduces this concern due to their respective timing of inception and governance characteristics, as revealed in our qualitative study. Self-selection into cultivating ties with firms and GSIs associated with upgrading does not appear as a serious issue, and the introduction of the *Upgrading Intent* control should help to reduce this concern.

Another issue is the probability that firms may not engage in upgrading because of cognition, capabilities, or incentives (Cockburn, Henderson, & Stern, 2000; Hill & Rothaermel, 2003; Tripsas & Gavetti, 2000). One could argue that firms estimate larger benefits by producing the same old products instead of engaging in product upgrading. While *Total Sales*, *Foreign Investment*, *Education* and *Enologist* control for different aspects of capabilities, *Upgrading Intent* controls for unobserved differences in cognition (e.g., a manager's ability to understand the benefits of upgrading, which may drive strategic positioning) and in incentives (e.g., the perceived market demand). (Kaplan 2008)

One could also argue that the variable *Upgrading Intent* is actually driven by an unobserved upgrading motivation, and as such, would be an endogenous variable in our models.²⁷ We believe that this is not the case. First, it is a basic assumption of factor analysis methodology that indices generated with responses to questions loading in a factor are measuring the unobserved construct driving those responses and, thus, in our case, an actual measure of *Upgrading Intent*. The questions from which the variable is derived focus on the firm's actions driven by its motivation to upgrade, hence measuring intent, and not necessarily the ability to execute the recombination of inputs or the experimental processes that underpin product

²⁷ We thank an anonymous reviewer for pointing us in this direction.

upgrading. Second, the interpretation of our Oblimin factor analysis is quite clear. Factors utilized to generate our *Product Upgrading* variable are clearly associated to different aspects of product innovation (i.e., technological and market uncertainty reduction), while the *Upgrading Intent* factor is generated from questions that are not associated to product innovation but more general aspects of upgrading such as investment in process improvements and efforts to acquire knowledge in general.

Third, in addition to the models described above and as a robustness check, we performed a 2SLS with an instrument that treats our *Upgrading Intent* as an endogenous variable. The best instrument we have is the answer to the question: “What percentage of your sales was utilized to adopt the latest technology for the fermentation process?” This question should be associated to *Upgrading Intent*, but not to *Product Upgrading*, since it refers mainly to the firm’s investment on state-of-the-art equipment to improve processes but it is not necessary to create new products with greater value. We estimate the models with PROC SYSLIN, SAS v.9. We do not find major differences between the analysis reported below and the 2SLS one. Results are available from the authors.

IV. RESULTS AND DISCUSSION

[Insert Tables 3 &4 about here.]

Tables 4a and 4b present the results. Regarding firm demographic control variables, the most consistently significant variable was *Upgrading Intent*, which was positive, followed by *Education*, which was also positive but less frequently significant and only at the 0.10 level. Given the limitations of our survey data and its relatively small size, the lack of significance of the other demographic control variables should not be construed that firm level factors do not influence upgrading. Indeed, the relative significance of both *Upgrading Intent* and *Education* supports the increasingly well-established work in strategy that knowledge stock and perceived demand impact the likelihood firms with upgrade products. (Cohen & Levinthal 1990, Kaplan 2008) Given the

strength of our results below, the significance of these variables support calls by Giuliani & Bell (2005) and Zuckerman & Sgourev (2006) for further research on their interaction with cross-cutting network ties. We discuss the implications of the location controls below.

With regard to the network variables, Model 2 shows that there is a positive and significant effect from *Ties to All Alters* ($\beta = 0.20$). This serves as an additional baseline model in two ways. It supports the increasingly held argument in both the network and development literatures that a firm's overall embeddedness is strongly associated with product upgrading, as the multiplicity of inter-active relationships to organizations and institutions can increase its access to knowledge resources. It also serves as a point of comparison as we decompose the networks. Following Fleming (2001), Lin (2001), and Owen-Smith & Powell (2004), we have argued that Mendoza's approach helped improve product upgrading because it offered wineries access to new knowledge resources via specific types of organizations and institutions. This view gains support from the increase in the R^2 values for the subsequent models, and it is magnified when we consider the effects of the different network variables, to which we now turn.

As discussed in the previous section, we created two sets of models to allow for consistency in the way we decompose the network variables. We found support for our Hypotheses 1a and 1b in Model 3 (Table 4a) and Model 5 (Table 4b). Model 3 shows that higher levels of product upgrading are positively and very significantly associated with the number of strong ties a focal firm has to other firms ($\beta = 0.41$) and to GSIs ($\beta = 1.12$), both with significance at the 0.01 level. Model 5 shows similar results. We found support for Hypothesis 2 in Models 3 and 4 of Table 4a. In both models, the variables for the number of ties a focal firm has to associations, schools, banks, cooperatives, and schools were either negative or insignificant. The results do not suggest that these types of organizations are not beneficial for upgrading in general. As noted above, the research on development and innovation has often noted the opposite to the extent that these organizations provide access to a variety of knowledge resources, be they

through specific support services or social ties. (Safford 2004, Zuckerman & Sgourev 2006) Rather, it suggests that in this context wineries access new applied knowledge mainly through ties to other firms and to GSIs. Our qualitative analysis showed that Mendoza's policy approach helped firms gain such access because of the new scale and scope of resources and services available in GSI and the way that their programs helped firms learn from one another.²⁸

The effect of GSIs is further clarified from the supporting evidence for Hypothesis 3 found in Model 4 (Table 4a) and Model 6 (Table 4b), which decompose the GSI variable into two parts – *Ties to PPIs* and *Ties to Old GSIs*, while holding all other variables the same.²⁹ Both models show that higher levels of product upgrading are positively and significantly (at the 0.05 level) associated with the number of ties the focal firm has to PPIs, but not significantly associated with the ties to the old GSIs. These results support our qualitative analysis that wineries found value mostly in the PPIs, because they were the initiators of the new participatory governance mechanism that anchored their ability to create and deliver a new variety of knowledge resources to firms. In contrast, the old GSIs appeared less able to do so as they lacked institutionalized ties to sectoral and zonal associations in their governance and slow to adapt their roles.

Hypotheses 4-5 sought to explore further the different mechanisms through which mediating firms and GSIs provide access to a variety of knowledge resources. As discussed in the previous section, to test these hypotheses we decomposed *Ties to Firms* and *Ties to GSIs* by isolating the ties to the most central firms and GSIs, respectively, (Model 7) and the ties to the firms and GSIs, respectively, with the most geographically diverse networks (Model 8).

Model 7 (Table 4b) does not lend support to Hypothesis 4a, as the number of ties to the most central firms was not significant. It does support Hypothesis 4b, showing that higher levels of product upgrading are positively and significantly associated with the number of ties a focal

²⁸ Given the cross-sectional nature of our data, we can not exclude, however, the supposition that the inter-firm ties were formed prior to these policies or via unobserved third parties.

²⁹ Note that the results of these two models also show that the *Ties to Firms* has a positive and significant effect on product upgrading, further confirming Hypothesis 1.

firm has to the most central GSIs ($\beta = 3.59$, at the 0.05 level). We also found support for Hypotheses 5a and 5b in Model 8 (Table 4b). Higher levels of product upgrading are positively and significantly associated with the number of ties a focal firm has to other firms and GSIs with the most geographically diverse pattern of connections ($\beta = 1.53$ and 5.44 , respectively, both at the 0.05 level). Models 7&8 also reveal that the effects of the other network variables are negative or not significant, with the exception of *Ties to Firms Except Top Central Firms*, which was positive and marginally significant.

The motivation behind these hypotheses is two fold. If access to diverse knowledge is key, then higher levels of upgrading should be associated with ties to alters that have the highest centrality and bridging traits but not with ties to alters that lack these traits. The results appear to broadly confirm our claim, but more so for GSIs than firms. Although our data prevented us from testing which of these traits appeared more dominant, as noted above, combination of these quantitative results and our qualitative analysis suggest that a firm's access to diverse knowledge resources depends on its being tied not just to any or many organizations and institutions but particularly on its being tied to those that excel in centrality and bridging qualities.

Indeed, our qualitative analysis suggested that both mechanisms could be at work. For instance, the Mendoza's PPIs appeared to foster flows of information, resources and contacts across the distinct producer communities because of both their encompassing and bridging characteristic. Moreover, given the context, one would expect that there would be relatively few GSIs (e.g., compared to the number of different firms). To the extent that the Mendoza reforms are working and the institutions are providing validated benefits to firms, then ever more firms would be associated with them. That is, centrality and bridging are not necessarily mutually exclusive traits for an organization. (Borgatti 2005) One could also argue that unexpected benefit of Mendoza policy is that the complementarities of the traits allow GSIs to be a vital source of sustainable value creation for firms. (Burt 2001, Safford 2004) Their multiplex, bridging nature

limits the ability of GSIs to promote a single upgrading strategy or become any single interest group's capture gate keeper, risks often associated with central, powerful actor. (Romanelli & Khessina 2005) At the same time, their encompassing nature helps consolidate programs and services focused on collaboration and the pursuit of innovation.

IVa. Public-Private Institutions and Product Upgrading

As discussed in Section III, the statistical analysis alone can suffer from problems of endogeneity because of its cross-sectional nature. For instance, given the lack of longitudinal statistical evidence, one could still argue that upgrading is driven by old inter-firm relationships or that the institutions of Mendoza mainly work with firms with superior capabilities. Our research design and the combination of qualitative and quantitative the analyses have tried to overcome these limitations, revealing less a definitive theory of upgrading and more a plausible role for public policy in improving firm access to a variety of knowledge resources (Bennett and Elman 2006; Edmondson & McManus 2007, Ferraro & O'Mahony 2007, Uzzi 1997).

The qualitative analysis sought to illuminate the institutional mechanisms that could reshape network ties and knowledge diffusion between firms by examining how the policy divergences between San Juan and Mendoza could account for differences product upgrading. The evidence suggested that while pre-existing socio-economic relationships could impede broad based collective action and knowledge diffusion, Mendoza's approach to constructing PPIs helped firms improve their access to new knowledge resources by providing a new scale and scope of services and by facilitating new relationships between firms themselves. In particular, the resulting PPIs had governance rules that allowed them to develop multiplex, bridging relationships between different producer communities as well as facilitate collective problem-solving among their representatives that governed the PPIs. The combination of these rules and network qualities helped the PPIs, and later some GSIs, to solve two major barriers to product upgrading and

learning for firms in emerging markets – weak institutional resources and socio-economic fragmentation.

The statistical analysis then tested the relationship between product upgrading and a focal firm's ties to other firms, GSIs, and PPIs as well as explored more fully the mechanisms that facilitate one's access to a variety of knowledge resources via these intermediating firms and institutions. The statistical evidence appeared to support our claims about the role of Mendoza's approach improving access for firms to a variety of new applied knowledge resources, in turn their product upgrading, particularly given the positive and significant impact of such variables as the ones capturing ties to the PPIs and those capturing ties to the alters that have the highest centrality and bridging traits. This reinforces the view that access to a variety of knowledge resources depends not simply on whether the alters are public or private per se but whether the alters are constituted in ways that provide cross-cutting ties between producer communities. (Fleming & Waguespack 2007, Safford 2004, Zuckerman & Sgourev 2006) Indeed, if we limit analysis to only market and non-state actors, we might miss two key ways in which the institutional qualities of clusters and government policy can improve innovative capacities in general.

First, to the extent that access to a variety of knowledge resources is vital for firm upgrading, the qualitative and quantitative evidence reframes our notion about which types of alters may facilitate such access. Prior research on innovation has emphasized the importance of firms and associations providing cross-cutting relationships between previously isolated groups of firms (Fleming 2001, Safford 2004, Zuckerman & Sgourev 2006) and the role of GSIs helping diffuse knowledge in providing collective resources and having a public mission to share new knowledge (Breznitz 2007, Owen-Smith & Powell 2004). The evidence here supports a blending of the two views in that the effectiveness of GSIs, and not just market and non-market actors, are rooted in the institutionalization of their network qualities. The innovation in Mendoza's approach was constructing a new set of GSIs, the PPIs, whose governance rules anchored its

multiplex bridging qualities that underpinned their ability to provide a new scale and scope of knowledge resources to firms and mold new relationships between them. Hence, this research suggests that firms can improve their access to a variety of knowledge resources and their attendant “combinatory capacities” (Moran & Ghoshal 1999, p 409) if they participate in structures that are constituted with the aforementioned institutional and network qualities.

Second, the evidence in its entirety suggests that organizational fields can be reshaped in different ways, primarily because one component – GSIs – is highly responsive to government policy. This is consistent with growing work on issues ranging from technology diffusion to health care to emerging market corporate governance that shows the impact of government policy in structuring inter-organizational networks. (Knoke 1991, Owen-Smith & Powell 2004; Provan & Milward 1995; Stark & Vedres 2006) Hence, a long term consequence of Mendoza’s policy has been to reshape the organizational field in different ways, as compared to its neighbor and as compared to its past. For instance, Figure 2 offers a UCINET depiction of the ties between focal firms and the entities we coded as GSIs, comparing the two provinces. An immediate observation is that firms in Mendoza live in a much richer institutional environment than those in San Juan. Table 5 compares the two provinces as well as the different zones in terms of the average number of ties a focal firm has to the different organizations and GSIs. One can see that location is marked not simply by geography but especially the different organizational and institutional contexts in which the firms are embedded. Consistent with our findings, the most notable differences between San Juan and Mendoza are the ties a winery has to other firms and to GSIs. This evidence also supports the increasingly growing argument that locational variables, some of which were significant in our models, should be viewed not simply as proxies for geography and natural resources but as indicators of the different constellations of organizations and institutions, in which a firm is embedded. (Granovetter 2002, Knoke 2001, Locke 2005, Owen-Smith & Powell 2004, Saxenian 1994)

[Insert Figure 2 and Table 5 about here.]

CONCLUDING REMARKS

This article has sought to explain how firms upgrade products in a society seemingly trapped in a history of dysfunctional institutions and social capital. In building on research emphasizing how the composition of networks can impede and facilitate knowledge transfer, we have argued that a firm's access to a variety of knowledge resources depends on its ties not simply to any or many organizations or institutions but especially to those that excel in their centrality and bridging qualities. In particular, we have highlighted the distinct governance principles that can anchor multiplex bridging traits in government support institutions (GSIs) and, in turn, underpin their ability to provide to firms a new scale and scope of diverse services and foster new learning relationships between firms from previously isolated producer communities. Our interdisciplinary approach suggests two related directions for further research at the intersection of institutional and network theory.

First, the results suggest further research on the ways in which firms can access a variety of knowledge resources via intermediaries with different institutional and network qualities. While much of the research on knowledge transfer and innovation has focused on the types of relationships between firms and individuals (Sorenson et al. 2005, Bell & Zaheer 2007), students of public policy tend to focus on the stock of collective knowledge resources provided by non-market actors, such as GSIs and associations. (Breznitz 2007, Spencer et al. 2005) In contrast to both, this article supports an increasingly salient stream of research which emphasizes how public and private actors can construct new institutions that improve firm access to a variety of knowledge resources because of the underlying network properties of these non-market intermediaries. (McEvily & Zaheer 1999, Zuckerman & Sgourev 2006)

Second, our research calls for further analysis about the relationship between the governance principles of intermediating organizations, namely GSIs, and their ability to alter the

flow of knowledge in industries. While such scholars as Owen-Smith & Powell (2004) have studied how the institutional demography of networks shapes the content of information, they have stressed how GSIs and non-profit organizations are distinct because of their rules guiding the dissemination of proprietary information. We do not deny the importance of this institutional trait. But our research also emphasizes that the governance principles of GSIs can help institutionalize distinct network qualities, such as the multiplex bridging qualities of the PPIs in Mendoza. Such principles as empowered inclusion and participatory governance for a diverse set of relevant public and private actors can enable GSIs to provide more effective knowledge resources to firms as well as to reshape the relationships between firms themselves. (McEvily & Zaheer 2004, Safford 2004) Naturally, we have not exhausted the relevant governance principles or the types of institutions. Rather, this research is but one contribution to a growing effort in management and policy studies to identify how the construction of institutions in a variety of industries can recast or reify the diffusion of information and resources between firms. (Campbell 2004, Knoke 2001, Lounsbury 2001, Scott et al. 2000)

Table 1. Public-Private Support Institutions in Mendoza Created in the 1990s

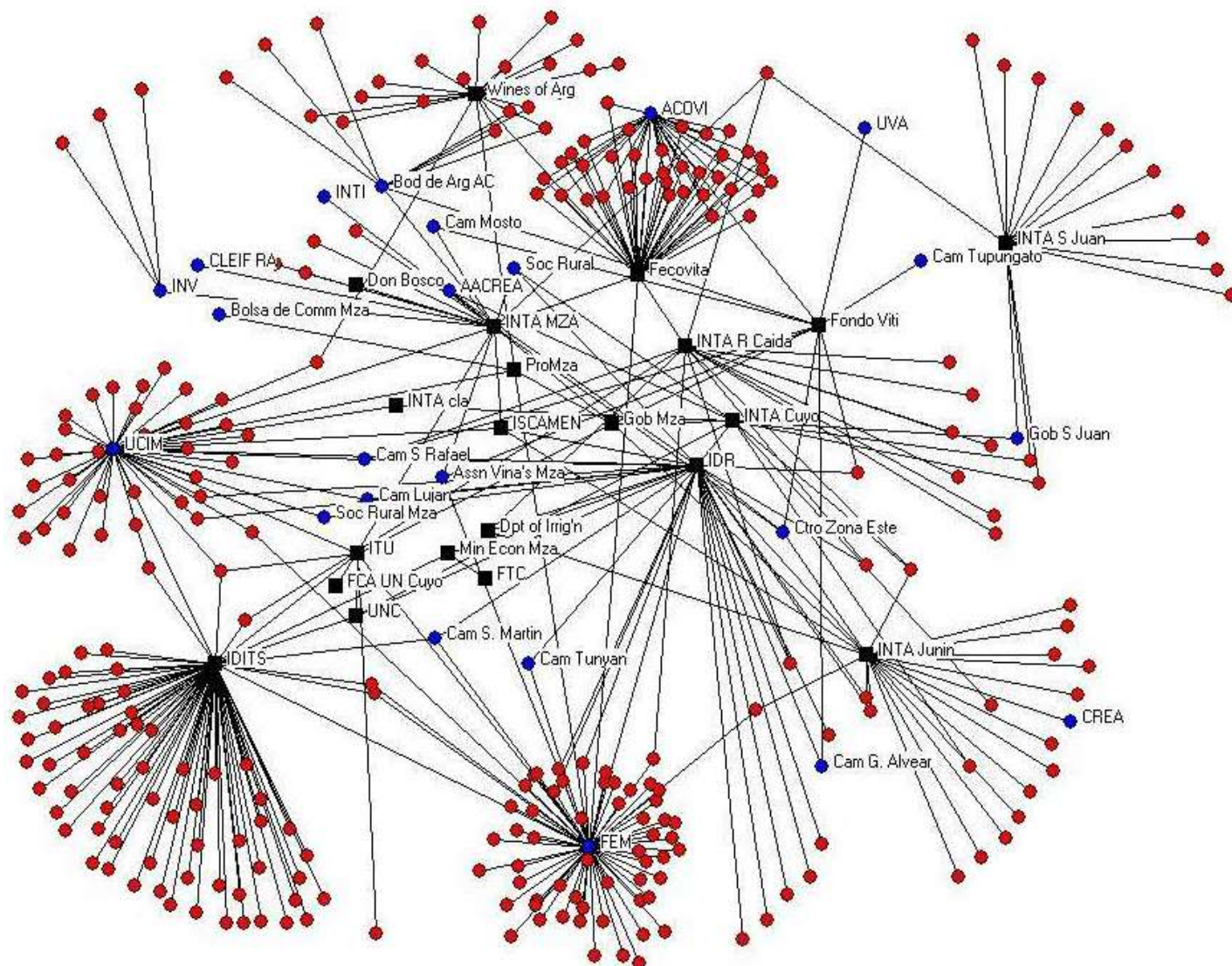
Institution	Year of creation or restructuring	Governing Members	Activities	Resources	Legal Form
INTA EEAs	1991; INTA San Juan reformed in 1996	Gov't of Mza, 15 Agro Ass'ns, Nat'l and Prov'l Institutes and Univ's	R&D (inputs, plants, tech), extension training, consulting	50% – Govt budget (salaries & overhead); 50% – services, alliances, cooperadoras	Part of INTA Cuyo; 4 in Mza, 1 in SJ; Public, Non-state, non-profit entity.
Fondo Vitivinicola	1993-94	Gov't Mza, 11 wine/grape Ass'ns	Oversees new wine regulations, promotes wine industry/marketing	Tax on firms from over produc'n of wine	Public, non-state, non-profit entity.
Fondo para la Transformacion y el Crecimiento (FTC)	1993-94	Gov't Mza, Regional advisory councils, ass'ns	Subsidized loans and credit guarantees to SMEs for tech. against extreme weather & for grape conversion	Self-financing; initial capital from gov't.	Independent legal entity under authority of governor
Instituto Desarrollo Rural (IDR)	1994-95	36 founders – INTA Cuyo, Govt Mza, ISCAMEN, 2 peak ass'ns, various agro sectoral ass'ns	Technical info collection & dissemination; Data base mgmt; R&D, training, consulting	Mza Gov't; services; gradual increase of fees from member ass'ns	Non-profit Foundation; with oversight by Min of Economy
Instituto Tecnológico Universitario (ITU)	1994	Founders -- Gov't Mza, Univ Nacional Cuyo, UTN, 2 peak ass'ns	Continuing education for managers and some R&D in mgmt and technology	Founders; fees for services	Non-profit Foundation
Pro Mendoza	1995-96	Gov't Mza, 3 peak business associations	Export promotion – organize fairs, delegations, strategic information, training	Gov't Mza; Peak ass'ns; services	Non-profit Foundation

Abbreviations: INTA – Instituto Nacional de Tecnología Agropecuaria; EEA – Estaciones Experimentales (Sub-regional centers); Mza – Mendoza; ISCAMEN – Instituto de Sanidad y Calidad Agropecuaria Mendoza; Cooperadoras – Non-profit NGOs.

Source: Adapted from McDermott (2007: 123)

Figure 1. Mendoza Policymaking Network in the Wine Industry, 2001

(NB Red circles are firms and associations; blue are prominent wine/grape associations; black squares are GSIs, including PPIs. Source: Publicly available membership and board data collected by authors.)

**Table 2. Largest Betweenness Scores, Mendoza 2001.**

	Betweenness	nBetweenness		Betweenness	nBetweenness
<i>FEM-peak ass'n</i>	20718	39.59	<i>INTA S. Juan</i>	3429	6.55
<i>IDITS</i>	18107	34.60	<i>ProMza</i>	2962	5.66
<i>UCIM-peak assn</i>	13556	25.91	<i>INTA Cuyo</i>	2805	5.36
<i>Fecovita</i>	12894	24.64	<i>Ctr Agro'ts - South Zone</i>	2498	4.78
<i>INTA Mza</i>	8431	16.11	<i>Fondo Viti</i>	1363	2.61
<i>IDR</i>	8041	15.37	<i>Bod. Arg (elites)</i>	1353	2.59
<i>Wines of Arg</i>	5469	10.45	<i>Univ Natl Cuyo</i>	1205	2.30
<i>INTA Junin (EEA)</i>	4148	7.93	<i>Govt Mza</i>	969	1.85
<i>INTA Rama Caida (EEA)</i>	3734	7.14	<i>Assn Vinas Mza</i>	943	1.80

NB. Highlighted entities are those created or renovated directly by Mendoza policy

Table 3. Descriptive statistics and correlation table.

Variable	OBS	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9
1 Product Upgrading	97	19.2	0.675	1	33	1.000								
2 Total Sales	97	3.06	0.19	1.00	6.00	0.124	1.000							
3 Foreign Ownership	97	0.09	0.03	0.00	1.00	0.239 *	0.228 *	1.000						
4 Education	97	4.14	0.25	0.00	14.00	0.243 *	0.166	0.337 *	1.000					
5 Enologist	97	0.71	0.04	0.00	1.00	0.180	0.167	0.033	0.090	1.000				
6 Upgrading Intent	97	4.76	0.32	0.17	12.00	0.388 *	0.116	0.254 *	0.384 *	0.052	1.000			
7 East	97	0.31	0.04	0.00	1.00	-0.057	0.008	-0.214 *	-0.180	0.153	-0.258 *	1.000		
8 South	97	0.15	0.03	0.00	1.00	-0.205 *	0.202 *	-0.054	-0.051	-0.027	-0.087	-0.309 *	1.000	
9 Valle Uco	97	0.13	0.03	0.00	1.00	0.048	-0.156	0.158	0.310 *	-0.256 *	0.485 *	-0.286 *	-0.197	1.000
10 San Juan	97	0.20	0.04	0.00	1.00	0.008	-0.149	-0.147	-0.073	0.095	-0.071	-0.309 *	-0.213 *	-0.197
11 Ties to All Alters	97	21.28	1.32	1.00	94.00	0.197	0.192	-0.077	0.209 *	-0.079	0.243 *	0.044	-0.098	0.517 *
12 Ties to All Alters Except Firms & GSIs	97	4.42	0.43	0.00	29.00	0.068	0.183	-0.007	0.305 *	-0.052	0.310 *	-0.230 *	0.083	0.408 *
13 Ties to Associations	97	1.39	0.19	0.00	20.00	0.256 *	0.227 *	0.282 *	0.570 *	0.123	0.429 *	-0.262 *	-0.026	0.371 *
14 Ties to Banks	97	1.08	0.12	0.00	8.00	-0.029	0.176	-0.090	0.187	-0.305 *	0.198	-0.293 *	0.249 *	0.412 *
15 Ties to Cooperatives	97	0.84	0.16	0.00	13.00	-0.054	0.105	-0.060	0.040	-0.072	0.195	0.003	-0.017	0.438 *
16 Ties to Firms	97	12.02	0.76	0.00	46.00	0.190 *	0.249 *	-0.112	-0.038	0.064	-0.041	0.372 *	-0.148	0.063
17 Ties to GSIs	97	4.84	0.51	0.00	38.00	0.193	0.027	0.057	0.315 *	-0.111	0.417 *	-0.293 *	0.009	0.596 *
18 Ties to Schools	97	1.11	0.15	0.00	12.00	0.296 *	0.205 *	-0.030	0.093	-0.031	0.253 *	-0.189	-0.097	0.154
19 Ties to Old GSIs	97	2.11	0.26	0.00	23.00	0.021	-0.084	-0.092	0.192	0.001	0.253 *	-0.185	-0.008	0.390 *
20 Ties to PPLs	97	2.72	0.31	0.00	23.00	0.202 *	0.102	0.112	0.241 *	-0.148	0.367 *	-0.208 *	0.082	0.555 *
21 Ties to All Firms Except Top Geo Div Firms	97	8.62	0.57	0.00	38.00	0.087	0.247 *	-0.191	-0.086	0.038	-0.143	0.377 *	-0.082	0.009
22 Ties to All GSIs Except Top Geo Div GSIs	97	3.29	0.39	0.00	25.00	0.146	-0.002	-0.085	0.223 *	-0.018	0.361 *	-0.170	-0.082	0.428 *
23 Ties to All Firms Except Top Central Firms	97	6.09	0.42	0.00	32.00	0.202 *	0.324 *	-0.115	-0.104	0.167	-0.137	0.211 *	0.041	-0.227 *
24 Ties to All GSIs Except Top Central GSIs	97	2.25	0.28	0.00	23.00	0.109	-0.067	0.027	0.211 *	-0.152	0.323 *	-0.342 *	-0.149	0.449 *
25 Ties to Top Central Firms	97	5.93	0.44	0.00	29.00	0.060	0.136	-0.068	-0.005	-0.029	-0.003	0.386 *	-0.239 *	0.251 *
26 Ties to Top Central GSIs	97	2.59	0.28	0.00	21.00	0.171	0.133	0.070	0.216 *	-0.048	0.317 *	-0.112	0.201 *	0.409 *
27 Ties to Top Geo Div Firms	97	3.40	0.28	0.00	16.00	0.259 *	0.144	0.053	0.019	0.096	0.090	0.218 *	-0.140	0.091
28 Ties to Top Geo Div GSIs	97	1.54	0.16	0.00	14.00	0.165	0.052	0.169	0.115	-0.128	0.282 *	-0.219 *	0.166	0.420 *

Variable	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10	1.000																		
11	-0.352 *	1.000																	
12	-0.115	0.630 *	1.000																
13	-0.035	0.517 *	0.593 *	1.000															
14	-0.117	0.526 *	0.638 *	0.288 *	1.000														
15	-0.206	0.481 *	0.481 *	0.171	0.486 *	1.000													
16	-0.357	0.765 *	0.197	0.172	0.140	0.190	1.000												
17	-0.214	0.589 *	0.541 *	0.495 *	0.459 *	0.360 *	0.087	1.000											
18	0.026	0.463	0.555 *	0.322 *	0.369 *	0.249 *	0.189	0.353 *	1.000										
19	0.086	0.356	0.479 *	0.391 *	0.290 *	0.260 *	-0.066	0.722 *	0.207 *	1.000									
20	-0.514	0.623 *	0.426 *	0.383 *	0.424 *	0.340 *	0.249 *	0.848 *	0.311 *	0.376 *	1.000								
21	-0.291	0.683 *	0.142	0.067	0.132	0.198	0.931 *	-0.003	0.147	-0.093	0.165	1.000							
22	-0.003	0.453	0.481 *	0.397 *	0.305 *	0.235 *	0.054	0.818 *	0.299 *	0.867 *	0.539 *	-0.022	1.000						
23	-0.163	0.490	0.045	0.006	0.023	0.057	0.823 *	-0.116	0.128	-0.176	0.071	0.856 *	-0.100	1.000					
24	0.153	0.372	0.456 *	0.441 *	0.360 *	0.214 *	-0.089	0.718 *	0.373 *	0.722 *	0.449 *	-0.156	0.731 *	-0.208 *	1.000				
25	-0.420	0.720 *	0.236 *	0.224 *	0.154	0.223 *	0.797 *	0.254 *	0.155	0.081	0.349 *	0.663 *	0.192	0.395 *	0.051	1.000			
26	-0.566	0.574 *	0.390 *	0.325 *	0.336 *	0.307 *	0.283 *	0.782 *	0.216 *	0.394 *	0.892 *	0.214 *	0.545 *	0.105	0.245 *	0.376 *	1.000		
27	-0.315	0.584 *	0.275 *	0.280 *	0.097	0.159	0.677 *	0.182	0.191	0.039	0.239 *	0.419 *	0.139	0.410 *	0.059	0.708 *	0.256 *	1.000	
28	-0.533	0.511 *	0.347 *	0.287 *	0.348	0.289 *	0.218 *	0.740 *	0.243 *	0.311 *	0.883 *	0.141	0.387 *	0.075	0.405 *	0.294 *	0.805 *	0.227 *	1.000

* Fail to accept Ho: $\rho = 0$ at a p-value < 0.05

Note: Descriptive statistics are based on nominal values. Network variables are transformed in correlation table.

Table 4a. Regression Results with Product Upgrading as Dependent Variable

Parameter	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.
Intercept	14.303	2.152 ***	11.843	2.493 ***	9.252	2.434 ***	9.241	2.323 ***
Total Sales	0.328	0.356	-0.130	0.397	-0.044	0.368	-0.118	0.342
Foreign Ownership	1.800	2.323	4.259	2.568 †	4.199	2.276 †	2.260	2.229
Education	0.342	0.276	0.200	0.289	0.446	0.272	0.445	0.250 †
Enologist	1.925	1.460	1.088	1.501	-0.458	1.432	0.982	1.360
Upgrading Intent	0.735	0.227 **	0.834	0.233 ***	0.538	0.219 **	0.535	0.203 **
East	-2.742	1.857	-2.043	1.926	-0.763	1.855	-1.566	1.842
South	-7.049	2.091 **	-5.357	2.168 *	-3.705	2.135 †	-4.900	2.067 *
Valle Uco	-4.594	2.295 *	-8.420	2.711 **	-3.297	2.728	-2.113	2.513
San Juan	-1.793	2.050	-0.186	2.219	2.598	2.159	4.981	2.393 **
Ties to All Alters			0.200	0.073 **				
Ties to Associations					-9.675	5.163 †	1.316	5.117
Ties to Banks					-11.846	7.532	-19.326	6.995 **
Ties to Cooperatives					-64.251	32.857 †	-27.858	30.611
Ties to Schools					13.144	9.475	12.386	8.760
Ties to Firms					0.409	0.117 **	0.361	0.116 **
Ties to GSIs					1.109	0.402 **		
Ties to PPIs							-2.042	2.114
Ties to Old GSIs							3.025	1.283 *
N	97		97		97		97	
R-Squared	0.53		0.59		0.63		0.62	

NB: The Grand Mendoza Zone is the omitted location.

† p-value < 0.10; * p-value < 0.05; ** p-value < 0.01; *** p-value < 0.001

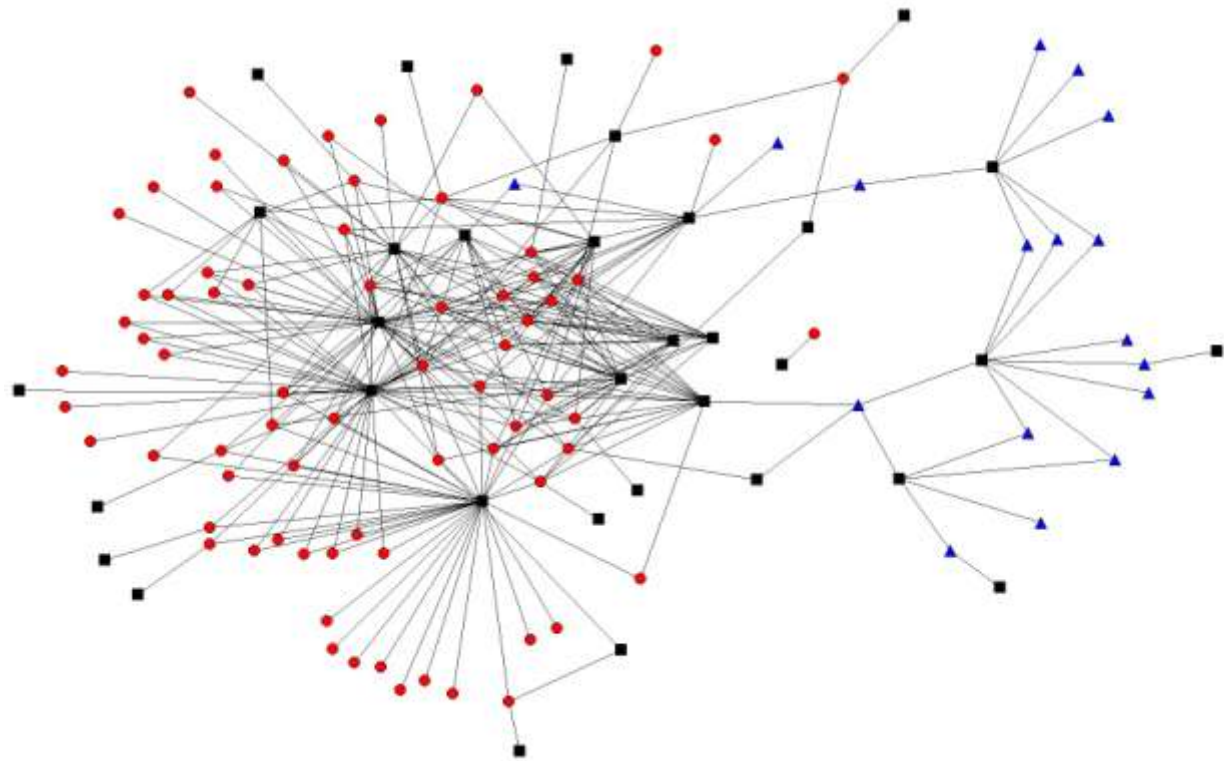
Table 4b. Regression Results with Product Upgrading as Dependent Variable

Parameter	MODEL 5		MODEL 6		MODEL 7		MODEL 8	
	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.	coeff.	std. err.
Intercept	11.117	2.484 ***	10.554	2.541 ***	12.451	2.499 ***	11.259	2.527 ***
Total Sales	-0.012	0.381	-0.063	0.384	-0.010	0.391	0.161	0.392
Foreign Ownership	3.865	2.426	3.897	2.438	3.825	2.466	2.555	2.519
Education	0.367	0.283	0.410	0.283	0.397	0.288	0.535	0.289 †
Enologist	0.596	1.437	0.714	1.449	0.286	1.480	0.387	1.455
Upgrading Intent	0.702	0.229 **	0.696	0.230 **	0.679	0.236 **	0.659	0.236 **
East	-1.979	1.905	-1.106	2.030	-1.242	2.020	-1.167	2.056
South	-5.729	2.132 **	-5.414	2.158 *	-6.538	2.211 **	-5.695	2.142 **
Valle Uco	-6.892	2.524 **	-6.592	2.532 **	-5.233	2.614 *	-5.315	2.505 *
San Juan	0.925	2.171	3.234	2.612	2.576	2.588	2.897	2.619
Ties to All Alters								
Ties to All Alters Except Firms & GSIs	-0.714	0.446	-0.525	0.458	-0.503	0.459	-0.767	0.461 †
Ties to Firms	0.339	0.123 **	0.290	0.127 *				
Ties to All Firms Except Top Central Firms					0.417	0.240 †		
Ties to All Firms Except Top Geo Div Firms							0.175	0.186
Ties to GSIs	0.972	0.405 *						
Ties to Old GSIs			-0.213	2.336				
Ties to PPIs			3.534	1.457 *				
Ties to All GSIs Except Top Central GSIs					0.551	2.452		
Ties to All GSIs Except Top Geo Div GSIs							0.723	1.215
Ties to Top Central Firms					0.224	0.429		
Ties to Top Central GSIs					3.592	1.594 *		
Ties to Top Geo Div Firms							1.526	0.735 *
Ties to Top Geo Div GSIs							5.438	2.747 *
N	97		97		97		97	
R-Squared	0.61		0.63		0.62		0.62	

NB: The Grand Mendoza Zone is the omitted location.

† p-value < 0.10; * p-value < 0.05; ** p-value < 0.01; *** p-value < 0.001

Figure 2. Ties Between Focal Firms and GSIs-Mendoza & San Juan



Note: The Red Circles denote wineries in Mendoza. The Blue Triangles denote wineries in San Juan. The Black Squares denote GSIs.
 Source: Authors' survey data, 2004-05.

Table 5: Average Out Degree Centrality per Winery for Given Alter, by Zone & Province

Alter/Location	East (E)	Grand Mza (GM)	South (S)	Valle Uco (V)	Mendoza (M)	San Juan (SJ)
All	28.52 (V)	23.33 (V)	25.17 (V)	53.47 (E GM S SJ)	31.77 (SJ)	17.35 (M) (V)
Associations	1.00 (V)	1.72 (V)	2.00 (E GM)	4.73 (E GM)	2.09	2.00
Banks	0.69 (S)	0.61 (S)	2.58 (SJ)	3.20 (E GM SJ)	1.49	0.80 (V S)
Cooperatives	1.21 (V)	0.11 (V)	1.00 (V)	3.80 (E GM S SJ)	1.43 (SJ)	0.00 (M) (V)
Firms	22.45 (S) (SJ)	14.50	12.83 (E)	16.47	17.74 (SJ)	10.30 (M) (E)
GSIs	2.24 (V)	4.61 (V)	5.58 (V)	22.93 (E GM S SJ)	7.55 (SJ)	2.50 (M) (V)
Schools	0.93	1.78	1.67	2.33	1.46	1.75

NB. The letters after each value indicate the zone or province from which the mean is different at the 5% level of significance.

Appendix 1. Factor analysis results for Product Upgrading (Factors 1 & 2) and Upgrading Intent (Factor 3)

<i>Question</i>	<i>Loadings</i>		
	<i>Factor 1</i>	<i>Factor 2</i>	<i>Factor 3</i>
	<i>(Market Uncertainty Reduction)</i>	<i>(Technological Uncertainty Reduction)</i>	<i>(Upgrading Intent)</i>
Our company incorporated new types of wines to offer more variety to our clients.	0.76		
Our company incorporated many types of wine with larger margins than the average margin of our wines.	0.85		
Our firm prioritized quality over cost of new wine.	0.37		
Our winery introduced many new varietals and blends.	0.74		
Our enologists visit overseas wineries regularly.		0.60	
Our enologists and agronomists work together actively to develop new varietals and clones.		0.71	
When we develop one type of wine, we already know the segment and/or retail price of the destination market.		0.78	
We know clearly who the competition in the overseas market is.		0.61	
Our winery has made important investments in micro-fermentation.			0.54
Our winery has made agreements for wine research and development with other organizations.			0.94
Our winery has made agreements for technological research and development with other organizations.			0.86

Factor Analysis with Oblimin rotation (Proc Factor, SAS v9)

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