

8-28-2012

High Road Development in a Low Tech Industry: Policymakers, Producer Networks, and the Co- Production of Innovation in the Mexican Ceramics Sector

Steven Samford

Follow this and additional works at: https://digitalrepository.unm.edu/pols_etds

Recommended Citation

Samford, Steven. "High Road Development in a Low Tech Industry: Policymakers, Producer Networks, and the Co-Production of Innovation in the Mexican Ceramics Sector." (2012). https://digitalrepository.unm.edu/pols_etds/7

This Dissertation is brought to you for free and open access by the Electronic Theses and Dissertations at UNM Digital Repository. It has been accepted for inclusion in Political Science ETDs by an authorized administrator of UNM Digital Repository. For more information, please contact disc@unm.edu.

Steven Samford

Candidate

Political Science

Department

This dissertation is approved, and it is acceptable in quality and form for publication:

Approved by the Dissertation Committee:

Andrew Schrank, Chairperson

William Stanley, Chairperson

Mark Peceny

Kathryn Hochstetler

**HIGH ROAD DEVELOPMENT IN A LOW TECH INDUSTRY:
POLICYMAKERS, PRODUCER NETWORKS, AND
THE CO-PRODUCTION OF INNOVATION
IN THE MEXICAN CERAMICS SECTOR**

by

STEVEN SAMFORD

B.A., English, Reed College, 1997
M.A., Latin American Studies, University of New Mexico, 2006

DISSERTATION

Submitted in Partial Fulfillment of the
Requirements for the Degree of

**Doctor of Philosophy
Political Science**

The University of New Mexico
Albuquerque, New Mexico

July, 2012

**HIGH ROAD DEVELOPMENT IN A LOW TECH INDUSTRY:
POLICYMAKERS, PRODUCER NETWORKS, AND
THE CO-PRODUCTION OF INNOVATION
IN THE MEXICAN CERAMICS SECTOR**

by

Steven Samford

B.A., English, Reed College, 1997

M.A., Latin American Studies, University of New Mexico, 2006

Ph.D., Political Science, University of New Mexico, 2012

ABSTRACT

When faced with the integration of international markets, some small producers in the developing world respond with “low road” strategies that undermine wages and working conditions while others take the “high road” to become globally competitive. Existing explanations – macroeconomic policy, human capital development, geography – are unable to account for this variation both across and within sectors. I address this variation by examining workshop-level responses to a government effort to develop and disseminate a lead-free glaze in the Mexican ceramics sector. Many producers have failed to adopt the glaze despite the fact that it promises to improve both their health and their export prospects. I draw on a variety of data to understand which workshops adopt the improved glaze technology: social network and statistical analysis of an original survey; interviews with state and federal officials and workshops in several villages; observation of training programs and meetings of producer groups. I find that upgrading is most likely where state agents work through existing networks of producers, using these social ties as conduits for the flow of information about technology and markets. However,

networks of producers at the cluster level are highly uneven, which complicates the task of disseminating information through clusters. Moreover, the weakness of the Mexican state relative to civil society – especially in remote rural areas and highly indigenous areas – has made the formation of public-private ties much more difficult for the state to accomplish.

Table of Contents

Chapter 1	
Introduction: High Road Development for Low-Tech Industry?	1
Why Innovate?	3
Production of Ideas	5
Dissemination of Ideas	9
Co-Production of Public Goods	13
Selection of Cases: Country, Sector, Cluster	15
Research Design & Methods	19
Interviews	20
Survey	21
Overview of the Chapters	22
Chapter 2	
Information, Organization, and the Pathology of Non-Innovation	28
Historical Foundations of Ceramics Production	30
Distribution of Production	34
Hazards of Lead-Oxide	38
Health Implications	38
Economic Implications	43
Informational Pathologies	47
Learning in the Workshop	47
Market Information	52
Chapter 3	
State-Led Research and Development?:	
Bureaucrats Catalyzing Innovation	57
Collaboration and Innovation	60
Mandating Innovation	65
Catalyzing Innovation	67
Catalytic Intervention in Perspective	77
Conclusions	83
Chapter 4	
Networks, Embeddedness, and Innovation Diffusion	88
Embedded Autonomy and Brokerage	90
Bureaucratic Autonomy in Fonart	96
Embeddedness and Diffusion	98
NGO and International Support	112
Conclusions	114
Chapter 5	
Friends, Family, Colleagues, Competitors:	

Overlapping Networks in Ceramics Clusters	120
Constitution of Three Producers Organizations	121
Capula, Michoacán	122
Santa María Atzompa, Oaxaca	124
Zautla, Puebla	126
Incentives and Dynamics of Group Formation	128
Insider/Outsider Dynamics	129
Incentives for Organization	131
Constitution	134
Intra-Cluster Networks	141
Conclusions	145
 Chapter 6	
Seeing Like a Weak State: Rural Resistance to Regulation	149
Social Legibility and Regulation	150
Stronger Society, Weaker State	153
Building Ties in Zautla, Puebla	157
Failed Ties	163
Conclusions	171
 Chapter 7	
Conclusions.....	175
Social Network Methods	176
State as Innovator	179
Co-Production of Innovation	182
NGOs and the State	185
Vestigial Corporatism and New Organization	187
Benefits of Regulation	189
Industrial Policy for Laggard Firms?	191
 Bibliography	194
 Appendices	207
Appendix 1: Common Abbreviations	207
Appendix 2: Survey Instrument and Methodology	208
Appendix 3: Additional Information for Statistical Models	213
Appendix 4: Interviews Cited	219

Chapter 1

Introduction: High-Road Development for Low-Tech Industry?

Globalization and trade integration pose serious challenges to small producers in developing countries: not only are they exposed to heightened competition from more productive foreign enterprises in their home markets, they are simultaneously required to meet demanding standards for product quality and cleanliness overseas. Observers have differed over the consequences of these challenges. Some argue for a “race to the bottom” in which small producers are forced to compromise wages, working conditions, and environmental protections in order to compete on cost, if they are not driven out of business altogether. The consequence is the exacerbation of poverty and underdevelopment. Others hold that in striving to reach the demanding standards and lucrative markets of wealthy countries, producers in poor countries may actually innovate and upgrade their productive capacities, and thereby improve their products and their working conditions simultaneously. Defenders of both of these perspectives can find empirical support for their claims, suggesting that neither view tells the whole story. In fact, variation in the effects of market integration occurs not only between but within countries, subnational regions, and even within particular industries.

In this context, a comparative study of a single productive sector in Mexico constitutes the basis of this dissertation. In this case, artisanal producers of ceramics have found themselves struggling to protect their domestic market from less expensive competing imports and yet unable to export because of their traditional reliance on toxic lead-oxide glaze. Since the late 1990s, a government-initiated effort to develop and diffuse an inexpensive lead-free glaze technology – which not only reduces the risk of

lead poisoning but qualifies products for US and other export markets – has provided an opportunity to mitigate downward pressures on earnings and continued lead poisoning. In spite of the congruence of improved working conditions and improved market access, upgrading has been inconsistent, exhibiting variation between and within productive clusters.

Intra-industry variation is particularly curious, given that existing explanations seem unable to account for the ability of some producers in the sector to adopt new technologies in the face of globally integrated markets and the failure of other producers. Macroeconomic policy has necessarily affected all producers in much the same way. Improvements in human and physical capital are less important to artisanal and labor-intensive industries than to their capital-intensive counterparts (see Estrada and Heijs 2006). Variations in the structural characteristics of the firms (e.g. diversification) apparently offer little explanatory power given their near homogeneity. Explanations rooted solely in geography and culture are unlikely to account for variation within the clusters in which the producers are grouped. Given the grave social and welfare consequences of the integration-induced race to the bottom, the inability of these kinds of variables to explain this variation highlights salient questions: Why do some industries in the developing world end up on the high road of upgraded production while others are forced down the low road? Why are some more successful at generating and diffusing productive ideas and technologies than others? Can governments affect which direction they take? And, if so, how?

Though linked to economic theory, the sources of inter-industry and cross-sectoral variation include political and sociological variables such as the nature of social

networks, strength of producer organizations, and contact with government agencies in the different communities. By focusing on a specific innovation in a single industry, this dissertation offers a look at the role of public agencies, private workshops, and their congruence in the process of adapting to global markets and norms through the generation and diffusion of new technology.

Why Innovate?

The most frequently proffered answer to this question is that innovation drives economic growth. Perhaps appropriately in a world of increasing rapid technological change, the importance of innovation has become major concern for economists in the last two decades. Economic output can be boiled down to two fundamental elements: the inputs to productive process and the nature of the process (Rosenberg 2004). Neoclassical economics has focused on inputs, but findings by Solow (1956) that suggested that perhaps as much as 85 percent of economic output was driven not by inputs but the means by which they were processed opened the door to the notion innovation was perhaps of greater importance. The so-called New Growth Theory (among others Romer 1990, 1993; Lucas 1988; Helpman 2004) developed models that tie a country's rate of productivity growth to its industries' capacities to develop or adopt innovations. Romer therefore, holds that if we are to account for cross-national inequality "we need to understand not only how big ideas, such as high-temperature superconductors, are discovered and put to use, but also how millions of little ideas, such as better ways to assemble shirts, are discovered and put to use" (Romer 1993, 69). In fact, much economic theory makes the simplifying assumption that access to information is homogenous and, therefore, has little to say about the social and political conditions under which these new

ideas are disseminated and developed. The study of innovation is therefore necessarily interdisciplinary, and literature in political sociology, political economy, and development offer greater insight into the means by which innovations are developed or diffused through firms and clusters of producers (Frickel and Moore 2005; Oliveira 2008).

The tendency among scholars has been to concentrate on relatively high-tech innovations (von Tunzelman and Acha 2005), despite the importance of innovation and upgrading in low-tech industries. While it may be true that high-tech innovations are the more important drivers of overall economic growth, the adoption of new technology in smaller firms in less advanced industries is also an important developmental issue. For one thing, even though small industries may not be the primary drivers of national economies, they are key providers of employment in the developing world. And as such, they play a very important role in welfare by providing income to broad swaths of society. Donaldson (2011) points out that the kinds of development policies that may produce rapid economic growth do not necessarily alleviate poverty and improve the lives of small producers. In particular, studies of innovation in firms and public-private coordination have overwhelmingly focused on larger or more advanced firms in organized sectors to the exclusion of their smaller counterparts, leaving a gap in the literature. Second, as the least capable of upgrading, small low-tech businesses are highly likely to rely on inefficient, outdated, and often-dangerous technologies. The negative externalities and losses to the welfare of the workers associated with outdated technologies can be quite high; in the case of the ceramics sector, they include the loss of mental capacity (and future productive capacity), physical damage, and environmental

degradation (see Chapter 2 for greater detail). In the context of labor-intensive work, even simple improvements in technology can markedly lower the negative externalities that are typically absorbed by the laborers and the communities in which they work.

In the context of low-tech firms, innovation is much less likely to involve the development of a specific new technology; in fact, many productive ideas are public and available for repeated use (Romer 1990, 1993). An efficient design for the organization of a factory floor, for example, can allow the production of more and better goods with less labor and can be used repeatedly without added cost (Evans 2005). However, developing countries and their producers commonly fail to generate innovations or even to adopt existing ideas that would improve efficiency. Once a technology exists, for small firms the primary issues become the access to flows of information and the their absorptive capacity.

Production of Ideas

Distinct from the diffusion of productive ideas is the process by which they are generated. The market-based view of the generation of innovations is that it is driven by increased competition: facing relative inefficiency, knowledgeable workers in a firm invest a calculated portion of their future profits in the short term costs of developing improved productive technology. Helpman (2004; also Aghion et al. 2001) points out, however, that where increased competition cuts into profits it also undercuts the ability to pursue research and development. This critique is especially true for small producers in the developing world, where credit is scarce, profits are already slim, and information about markets is far from complete (Von Tunzelman and Acha 2005). Moreover, arguments that emphasize the importance of firm- or industry-driven innovation

implicitly assume high levels of human capital. Without sufficient levels of education and training, however, ideas are unlikely to be produced regardless of material incentives. In the industry in question in this study – and in a much broader range of small, labor-intensive industries in the developing world – low human capital and financial shortcomings tend to generate a low-equilibrium trap in which firms are unable to improve their own productive processes and competition has more nefarious consequences.

An alternative approach sees active government participation as a key source of assistance in the generation of innovations. Wade (1990, 17; also Amsden 2001; Kohli 2004) argues, for example, that government efforts to “build a national technology system” were a key to the success of East Asian countries like Taiwan and Korea. Sabel’s (1995, n.d.) notion of “bootstrapping,” or the capacity of government agencies to recognize and address industrial shortcomings, offers a related vision of how government participation might help fill sector- or firm-level gaps in idea generation and training. And Evans (2010) describes an updated version of the “developmental state” that links innovation with institutions. In this view, the state’s goal is to establish institutions – both political and social – that allow for rapid economic growth and the increase of human capabilities through the development of new ideas. Though provided assistance by state institutions to help overcome the barriers to innovation and development, these scholars ultimately see private industry as the source of innovation. States may carefully tailor policy to apply both pressure and some of the resources necessary to generate innovations, but the innovation themselves are generated in the private sector.

Small, low-tech firms are less likely to be able to generate new technologies on their own, regardless of the extent to which incentives are provided by the government. In this respect, perhaps the more accurate point of comparison for ceramics workshops are small agricultural producers, who are similarly affected by isolation, low levels of human capital, and incentives against experimentation. The US Agricultural Extension is the paradigmatic innovation system for agriculture: it established both institutions – land grant universities – that would generate innovations for agricultural production and “border agencies” to do field tests, work with producers to diffuse technologies and distribute material support, and provide feedback to the university researchers (Cash 2001; Anderson and Gershon 2004). The actual development of technologies occurred outside of the private sector by government-supported experts in what Lester and Piore call “public spaces” (see Chapter 3) with agricultural producers left only to implement them. The logic guiding the establishment and functioning of the Extension Service was that improvements in agricultural technology produced public goods, such as food security.

The kinds of state institutions that are able to either create the incentives for firms to develop innovative technologies or assist more directly in the coordination of innovation are marked by a critical characteristic: the capacity to accurately assess the needs of the industry in question. This point is made by Evans’s earlier work on “state-society synergy” (1997) and “embedded autonomy” (1995): it is not only public agencies and policies that are important, but the manner in which they are able to draw information from and coordinate with the private sector. The nature of public-private interaction in the ceramics sector is suggestive of the kind of state-society information coordination

described by Evans (1997), Ostrom (1997), and Tendler (1997). Newly developing literatures on “tutorial” approaches to the enforcement of labor and environmental norms (Schrank and Piore 2007, 2008; Pires 2009; Coslovsky et al. 2011) and the promotion of “rewarding regulations” (Schrank n.d.) similarly identify, if implicitly, the critical importance of state agents’ capacities to assess and understand the barriers and bottlenecks faced by producers. Bureaucracies that are able to assess, understand, and help mitigate the informational needs of producers are often a critical part of moving them toward compliance with these kinds of regulations.

While the importance of knowledge production and technological innovation for development has been well established, studies of the dynamics of innovation have tended to ignore small producers in labor-intensive industries, for whom innovation is a lower-tech, but no less important affair. These kinds of producers are crucially important as generators of jobs in the developing world but are often portrayed as little more than mendicants by policymakers (Tendler 2002). Large firms and high tech industries are viewed by policymakers as the more important drivers of the economy, and agricultural production has traditionally been a politically weighty sector because of the importance of domestic food production for both subsistence and national food security. Small businesses have little organizational capacity and correspondingly little political clout to push for well-funded and effective state agencies to generate innovations for their industries (Shadlen 2002, 2004).

This literature leaves open questions about how direct a role public agencies might play in the development of new or adaptation of existing technologies. How can

poorly-funded and often inexpert public agencies be effective at producing technologies that will improve the prospects of low-tech industries?

Dissemination of Ideas

The diffusion of technologies is largely an issue of information provision and movement, especially in industries where technological changes are relatively small. In his classic work on the diffusion of innovations, Rogers (1983) identifies five key factors that determine the whether or not individuals or organizations adopt new technologies: 1) what the advantage of the innovation is, 2) how compatible with current practices and norms, 3) how complex the innovation is, 4) how easy it is to experiment with and test the new innovation, 5) observability of the outcome. What is notable about this list is the degree to which these factors are fundamentally informational. Firms deciding between immediate adoption of new technology and the potential to adopt later (Hall 2005) must understand how the new technology is adopted, be able to build know-how by testing, understand how it affects the market for their products, and have information about the outcome of the innovative process. Even the “complexity” of the innovative technology is something that is perceived by the producers themselves, and therefore shapeable by the provision of information. For example, untrained ceramics producers often believe that use of lead-free glaze is extremely difficult and requires a number of changes to the kiln (i.e. is complex) and therefore are dissuaded from considering upgrading in spite of the fact that simple steps to prevent sticking in the kiln are sufficient. This is not to deny that material barriers may be involved in these decision-making processes, only that the five points made by Rogers (1983) are often fundamentally information.

The earliest New Growth models envisioned a frictionless spillover of knowledge that “inadvertently contributes to the aggregate stock of public knowledge that raises everyone’s productivity” (Helpman 2004, 38; see also Marshall 1920). Empirical studies of knowledge diffusion focused on the import of information from abroad and therefore recommended policies that allowed multinational companies to operate freely in developing countries (see Romer 1993). Recent studies, however, have questioned the ease of passing down particular kinds of ideas (Dussel Peters et al. 2002; Gereffi et al. 2002) and the extent to which high value-added processes are exported to the developing world (Wade 2004). Such studies erode confidence in the notion that the key to the diffusion of ideas is as simple as creating conditions that allow and encourage foreign investment. This study follows in that vein by arguing that open market policies are an insufficient condition for the spread of ideas, especially for small producers who are inefficient, resource poor, and unlikely to attract foreign investment or tutelage. For them, open market policies introduce competitive pressures, which generate the need for innovation, but do little to foster knowledge production or absorption. Thus, open markets may be a necessary but insufficient basis for the flow of useful ideas, and small producers may be particularly ill-equipped to exploit globalization without the support and cooperation of government.

Social networks and inter-firm relations have been identified as important factors affecting information transfer. Heaney and McClurg (2009, 729) hold that network analysis is particularly germane when “the flow of information is at the heart of the problem,” which is certainly the case when productive practices and technologies are disseminated (see also Coleman et al. 1957; Granovetter 1985). Consistent with this,

studies of productive clusters have long found that firms that are located in geographic proximity to each other are more likely to be innovative. While the original mechanism behind this was ill-specified – Marshall (1920) wrote that knowledge was “in the air” – more recent studies have identified the causal mechanism as information spillovers that are a result of monitoring and supply chains (Krugman 1991; Baptista 2000; Baptista and Swann 1998). However, these studies tend to assume a uniformity of information movement and cluster homogeneity. Others have rightfully treated the uniformity of informational flows as an empirical question and argued that while improved access to information may be a potential consequence of firms’ locations within a geographic cluster, it is by no means assured (Maskell and Malmberg 1999; Maskell 2001).

Networks (both formal and informal) have been recognized as key factors in the capacity of firms to innovate by providing sources from which innovative ideas may be transferred to them (Figueiredo et al. 2007). Giuliani (2007) illustrates the very uneven nature of inter-firm contacts in wine clusters based on business networks and networks of advice giving. In short, while technologies may have greater capacity to be diffused within geographic clusters, much less is understood about the nature of networks and information flows within those clusters. This study seeks to further elucidate the nature of networks and informational flows within clusters, and, consequently, the capacity of the producers within the cluster to access information. It follows the increasingly popular use of social network analysis to formally map out the relations between producers to identify more carefully how network structures affect the availability of information.

If information flows are so critical to the adoption of new technologies within productive clusters, the nature of inter-firm relations within the cluster also becomes an

important determinant of innovation. Social capital at the aggregate level has frequently been tied to positive developmental outcomes, if not specifically to innovation itself (see among others, Evans 1997, Fox 1997, Putnam 1994). While holding that social relations within communities are indisputably important, this study avoids such aggregate conceptions of social capital, largely because it is very clear that there is great heterogeneity within communities and productive clusters, which aggregate measures may obscure. Instead, following Burt (2001), Portes (1997), and others, it conceptualizes social capital as an individual characteristic that stems from one's location within the structure of a network. Instead of talking about civil society "thickening" (Fox 1997), for example, it speaks of the formation of specific types of social relations between actors. Similarly, it focuses on the government's capacity to connect to formal networks, which consist of specific, reliable, and verifiable ties between workshops, along with being "visible" to the state.

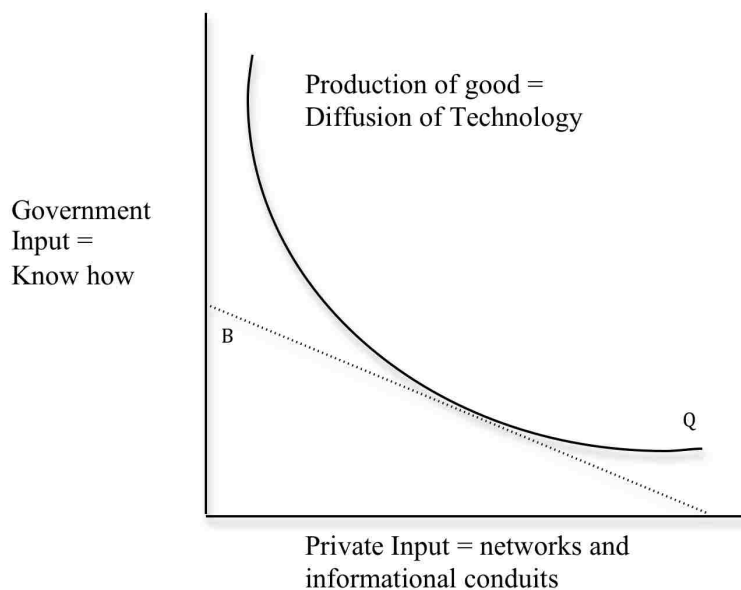
Sharing this more individualistic notion of social ties, Powell et al. (1996) argue that "beneath most formal ties lie a sea of informal ties." What is less understood is the relationship between the kinds of relations, how they might be tied to one another, and how they might help produce or reproduce one another. Fox (1997) argues that social capital in rural areas can be enhanced by state action; this study examines a similar notion in terms of the creation of producers groups and formal ties. This is especially important in the context of states attempting to form linkages to civil society. Informal relations between workshops are likely to be of little use to the state as they are heterogenous and "illegible" to state agents (Scott 1998); this is not to suggest that these cannot be

harnessed into more formal networks that are of use by the state for the purposes of information dissemination.

Co-production of Public Goods

Existing literature holds that innovations like those that have taken hold in parts of the Mexican ceramics sector are better “co-produced” by collaboration between 1) public officials who are committed to their jobs and 2) private producers who are committed to their communities, than produced in isolation by either (Ostrom 1997; Evans 1997; Tandler 1997). Whitaker (1980) and Ostrom (1997) describe co-production as a process whose output depends on complementary, non-redundant inputs from multiple actors; not all necessary inputs are under the control of a single public or private actor. Figure 1.1 (adapted from Ostrom 1997) reproduces a stylized representation of the conditions under which co-production occurs. The budget constraint (B) represents the degree of inputs that each party can contribute; the output curve (Q) represents a set quantity of output. The shape of curve (Q) indicates that the output is not achievable as the required inputs exceed the budget constraint of either actor and not achievable with the inputs of a single actor. A variety of inputs can be fitted into this schema: Ostrom (1997), for example, identifies labor, social capital, and local knowledge as possible inputs from the private sector and funding and information from the public sector. Exactly what the inputs are and where the budget constraints are drawn differs by case. Studies drawing on these insights have largely focused on development projects oriented to the provision of public services (e.g., water, sanitation, health) rather than support for small-scale producers, and the dynamics of co-production in relation to the generation

and diffusion of productive ideas among firms have gone unexamined (excepting Ó Riain (2004)).



The preceding discussions have implied 1) that for small, labor-intensive industries, important new technologies are likely to have to be produced, adapted, or introduced by third parties (e.g. state agents), and 2) the structure of networks as informational conduits determines the extent to which the information will be diffused within the cluster. Moreover, the diffusion of some nonproprietary technologies into productive sectors is reasonably considered a public good, as this outcome has the possibility of improving working conditions, environment, and economic status in productive clusters. Hence, the process of diffusing innovation into low-tech industry may be thought of as co-production: beneficial technologies are diffused through the

complementary inputs of the public sector (i.e. technology) and the private sector (i.e. social ties, informational conduits).

In light of the previous discussions of the generation and diffusion of technology, this schema for the co-production of the diffusion of beneficial technologies as a public good leads to a number of questions. How do state agents come to know precisely what information is needed by the private sector and come into its possession? How is the private sector organized and aggregated such that it can be thought of as providing an input? How do the state and the private sector approach one another in a manner that makes the coordination of these inputs possible? Can the state help shape the structure of firm networks in order to improve the private sector's input?

Selection of Cases: Country, Sector, Cluster

Mexico provides an ideal opportunity to apply the insights of public-private co-production to the study of innovation among small producers facing global markets. First, in Mexico, as in most developing countries, small firms (<250 employees each) dominate the productive landscape and employ the majority of the workforce (Shadlen, 2004), and their ability to develop or exploit productive ideas is therefore of clear material importance. Scaling down even further, the Mexican government has estimated that in Mexico 14.4 million people work in very small family-run workshops (*talleres familiares*) – much like ceramics workshops – just over a third of the employed workers in the country (Secretaria de Economia 2012). While these small and micro businesses are clearly not strong drivers of national economic growth, their role as providers of employment and a basic level of welfare is critical. This is particularly true in rural areas

and outside of the major urban centers where alternative forms of employment are difficult to come by.

Second, Mexico is a prime example of a country that rapidly opened its trade regime and integrated with international markets (Samford 2010). It undertook unilateral trade opening in the mid-1980s, broadly eliminating import licenses and vastly lowering the scope and depth of tariffs, and joined the World Trade Organization in 1986. Mexico entered into the North American Free Trade Agreement in 1994, further integrating its economy with its most important trade partner, the United States, and committing itself to a variety of product and labor standards. Mexican producers therefore have ample experience with the process of international integration and its consequences. Moreover, previous literature has indicated that the capacity to innovate is crucial to the likelihood of Mexican producers successfully exporting to the US (Estrada and Heijs, 2006). Finally, the experiences of Mexican sectors have been highly variable, ranging from the successful absorption of existing ideas to the ambitious development of new ideas to the failure to embrace relatively simple publicly available ideas, with corresponding levels of economic success.

The ceramics sector is a least likely case for innovation and upgrading in the face of the pressures generated by market integration. As discussed at length in Chapter 2, workshops in the sector have typically relied on the same technologies for decades, indicating a high degree of stasis in the productive methods and marketing strategies. This relative non-innovativeness is a consequence of characteristics inherent to the industry: workers in the sector have extremely low levels of education, they are taught their trade from an early age by parents, they tend to be geographically isolated, they face

non-trivial barriers to experimentation, and have poor market information as a consequence of weak market position. In short, many of the factors that have traditionally been used to explain the capacity to innovate are missing from the ceramics sector. As an industry with so little capacity to innovate indigenously, the reasonable expectation would be the complete failure to upgrade in the face of heightened regulatory and competitive pressures. Although adoption has been slow to get started and is uneven across clusters, there is progress being made in the diffusion of the lead-free glaze, which is the specific innovation in question.

Within the sector, the dissertation examines three of the larger ceramics producing clusters in the country: the community of Capula, Michoacán; the municipality of Zautla, Puebla; and the municipality of Santa María Atzompa, Oaxaca. These particular areas were chosen with an eye toward illuminating the variation that occurs between the clusters in the same sector. Capula, Michoacán was identified as perhaps the most advanced cluster (i.e. the cluster that most violates the expectation of non-innovation with a 15-20 percent current adoption rate); for this reason it was chosen as the cluster that was examined in the most detail (see below). What about this cluster has made it much more successful than other clusters that seem to confirm the expectation of non-adoption? Zautla was chosen as a similarly successful case: its current rate of adoption is lower than Capula, but diffusion was started much later. Although different in several respects from Capula (much more isolated, heavily indigenous), for the last several years Zautla has been on a similar track toward upgrading. Santa María Atzompa is discussed as a negative case, where upgrading has made very little progress, in spite of its being less isolated than Zautla. Table 1.1 lays out some of the differences between the three clusters. They vary

by size, location, degree of isolation, but the causal analysis of innovation focuses primarily on the first three rows: the presence and nature of formal producers group(s) in the cluster, ties between the government and those groups, and the rate of adoption.

Table 1.1: Characteristics of Three Clusters

	Capula, Michoacán	Zautla, Puebla	Santa María Atzompa, Oaxaca
Current Rate of Cluster-wide Adoption	Higher	Medium	Low
Local producers group	Yes (since 1970s)	Yes (since ~2008)	Yes (since 1990s)
Tie with Fonart Lead Substitution Program	Yes (since ~2002)	Yes (since 2011)	No
Percent Indigenous	Lower	Higher	Medium
Geographic Isolation	Lower	Higher	Medium
Population	Lower	Higher	Higher

The Capula, Michoacán cluster was chosen as a survey site to provide micro-level data about the characteristics of individual workshops, along with the formal and informal relationships between them.¹ Innovations tend to diffuse in communities in a stylized s-curve: adoption is slow at first as a few early adopters make changes, followed by a quickening of adoption (and steepening of the slope of the curve), and then by a gradual slackening of the pace of adoption as the laggards gradually adopt (Valente 1995). To understand the dynamics of adoption, Capula was chosen as the cluster that had made the most progress up that curve – at roughly 20 percent – and consequently has the greatest variation in adoption. Communities where very few or no producers have adopted would be poor choices because the dynamics of the process are nascent and not

¹ The Appendix provides a more detailed explanation of the survey procedure and rationale, along with the survey instrument.

fully visible. Hence, the fact that Capula finds itself somewhere in the middle of the s-curve makes it the most appropriate choice for detailed analysis.

In short, this analysis attempts to address questions about public-private dynamics and the ceramics sector by shifting its focus between levels of analysis and using a variety of comparative strategies and tools (see Table 1.2 for summary). This telescoping analysis is based on the idea that while firms/workshops are the productive units of the sector, they do not act in isolation and they share many of the same characteristics as their counterparts nationally. In other words, workshops in aggregate are clusters and clusters in aggregate are the sector; to understand one of them, we must understand the relationship between these levels of analysis.

Table 1.2: Summary of Research Design

Level of Analysis	Macro	Meso	Micro
What is a case?	Sector	Geographic Cluster	Workshop
Number of cases	1	3	~180
Comparative Strategy	Implicit/explicit comparison to similar sectors	Implicit/explicit paired comparisons to isolate key causal difference	Explicit large-n comparison of workshop characteristics and outcomes
Analytic tools	Narrative	Narrative	social network analysis; correlation testing; multivariate regression
In chapters	2, 3, 4, 5, 6	5, 6	4, 5

Research Design & Methods

The comparative analysis of subnational units is increasingly accepted as a means of examining processes whose dynamics are obscured by national-level data. Subnational analysis can improve controlled comparison and account for spatially uneven processes (Snyder 2001a, 2001b). By “scaling down,” analysts are able not only to identify

correlations but to more accurately identify the causal mechanisms behind them as well. Moreover, as attention to the context in which causal mechanisms operate is a necessary part of constructing a credible causal explanation (Falleti and Lynch 2009), limiting the number of contexts under study is a useful tool for drawing valid inferences. Here, the cases in question are not subnational political units but rather distinct workshops found in different communities.

The study relies on a mixture of ethnographic field methods, survey, and social network and statistical analysis. The nature of the hypothesized relationship between networks of producers and government agents and analysis of different levels of analysis makes mixed research methods necessary. Interview data generally addresses the nature of the contact between government and producers, the pressures faced by the producers, the role played by formal producer groups, and so forth, as well as providing qualitative evidence about the role of networks in the diffusion of innovations. Surveys and statistical analysis help assess role of networks formally and allow for the analysis of systematically collected individual level data.

Interviews. Semi-structured interviews were undertaken with three types of respondents: 1) ceramics producers; 2) members and leaders of civil society groups linked to each sector (NGOs and producers groups); and 3) representatives of government agencies that were involved in efforts to generate or disseminate new ideas (i.e., Fonart, Cofepris, Casart). Interviews with producers were geared toward elucidating market pressures faced by producers, the dynamics by which the need for innovation was recognized, whether and how they were exposed to potential innovations, whether they played a formal or informal role in developing and diffusing new ideas, and what kinds of

barriers to implementation they faced. Interviews with civil society groups focused on many of the same issues with the inclusion of the perceived role of the group in generating, diffusing, or approaching the government about innovations and the nature of the interaction between the government and the civil society group. Interviews with government agents included the role played by federal agencies in development and diffusion, what motivation there was for government involvement in the industry in question, and what the perceived effects of government involvement were. Because those involved in the processes of knowledge production and diffusion were familiar with others involved, interviewees were selected in part by “snowball” sampling.

Survey. In addition to interviews, a workshop survey was undertaken in the cluster of Capula, Michoacán communities in an effort to map the diffusion of productive techniques across social and production networks in the community. The survey was inspired by Coleman et al.’s classic studies of “network diffusion” (1957) and tracks the effects of network- and producer-level characteristics on the diffusion of new ideas. From Coleman et al.’s formative work to the wave of recent work in political science and sociology on the role of networks in the spread of ideas, it has become clear that survey data and statistical analysis of social groups can yield important findings about the role of networks in the diffusion of ideas, in the case of this project productive ideas and technologies. The survey allows for the mapping of diffusion and the efficacy of formal and informal networks and contacts by asking current and former producers about 1) their business interactions, 2) their formal affiliations, 3) motivations for innovation, 5) the nature of contacts, if any, with government agencies, and 6) their social and economic characteristics (e.g., education, experience, etc.) and productive practices (lead-free glaze

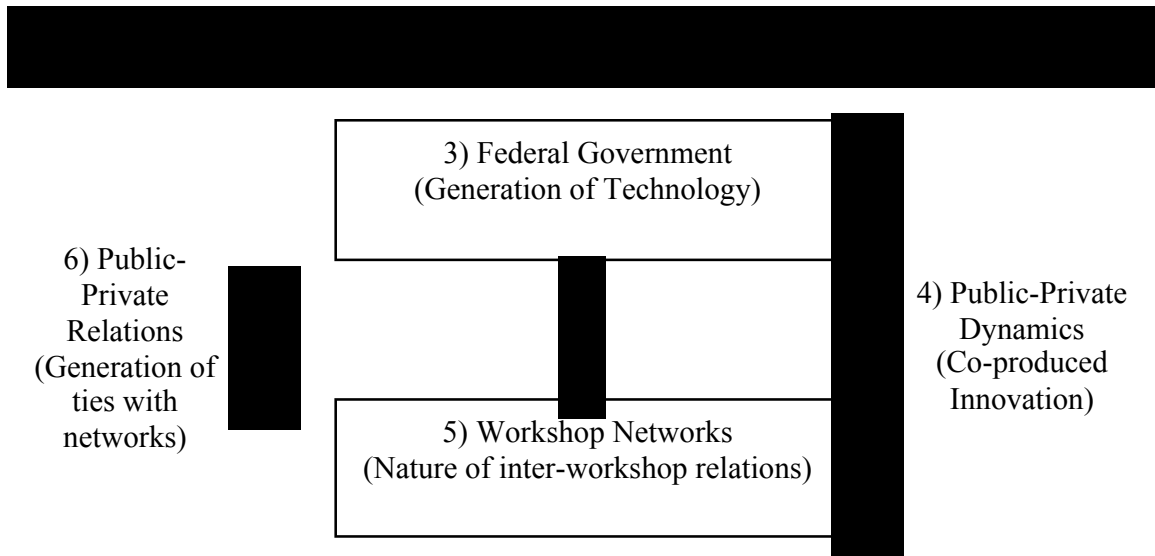
use, level of production, etc.). Statistical methods and data from the producer surveys will be used to assess the relative rates of innovation and to gauge the relative effectiveness of peer networks, government and NGO efforts, in disseminating new ideas.

Overview of the Chapters

As a non-technical companion to this theoretical chapter, Chapter Two offers a largely descriptive introduction to the small ceramics industry in Mexico and to the specific situation in which traditional family workshops find themselves. This discussion includes not only their technological and economic status but also their social conditions, geographic location, and legal conditions. I argue that many of the characteristics of ceramic producing clusters and the workshops themselves – including their organization around nuclear family units – frequently inhibit their capacity to adopt new technologies, a condition likely to exacerbate the condition of this group of artisans, who are already economically and socially marginalized and broadly exposed to toxic working conditions. Although the details of the ceramics sector are, of course, distinct, they are broadly consistent with many of the conditions faced by small firms in other low-tech industries that make it difficult for them to organize, to obtain information about improved alternative technologies and the markets for their goods, and, ultimately, to innovate.

Chapters 3 to 6 examine four different elements of the public, private, and public-private dynamics that are related to overcoming (or not) the barriers to upgrading to lead-free glaze in ceramics workshops. Figure 1.2 depicts the areas of focus schematically: Chapter 3 focuses on federal government efforts to generate a new technology; Chapter 4 addresses on the public-private dynamics by which that technology is disseminated to ceramics clusters; Chapter 5 focuses on the nature of workshop relations within those

clusters; and Chapter 6 examines the formation of linkages between the government and the ceramics sector.



Chapter 3 addresses the role of the federal government in generating the technology necessary for lead-free production in traditional ceramics workshops. In the years after the Mexican government determined that it would promote lead-free ceramics production, Fonart was charged with making this happen in the productive clusters. The chapter addresses the first step in this process, asking how a state agency with little technical knowledge of the productive technology in question could accomplish such a task. I argue that Fonart acted as a “catalytic” agency, drawing together experts from academia and the private sectors in what Lester and Piore (2004) call a “public space” and coordinating the collaborative process by which input from academic chemists, glaze producing firms, and ceramics producers were marshaled toward the generation of an alternative technology. I argue that this intervention is unique in having been more intensive (i.e. involving very active government coordination) yet less extensive (i.e. not a broader system intended to continually produce innovations for the sector) than other government interventions aimed at the production and diffusion of innovations.

Chapter 4 analyzes the dynamics by which this new technology has been diffused among workshops in the sector. How do workshops obtain information about new technologies? How has the Mexican government engaged with the sector? What are the individual and network characteristics of workshops that had adopted? The chapter focuses on the ceramics cluster in Capula, Michoacán, approaching these questions with the workshops as the units of analysis. It draws on data from the formal survey of workshops in the cluster, analyzing their propensity to adopt the new technology with both social network methods and traditional statistical methods. It demonstrates that state agents have approached the task of disseminating the technology by linking to pre-existing formal networks of producers and that members of those networks are far more likely to adopt the new technology. I draw on Evans's (1995) notion of the "embedded autonomy" of state agents who are able to coordinate positive developmental outcomes with business groups, suggesting that this coordinating relationship in the ceramics sector – and more broadly in sectors that consist of small, dispersed firms in low-tech sectors – will necessarily be different. Linkage to "embedded actors" may be as useful as – and far more practical than – embeddedness itself. In underlining the usefulness of formal networks for the diffusion of productive technologies, the chapter also highlights the dangers of firm isolation.

Chapter 5 examines more closely the network relations in the clusters, focusing specifically on the formation of formal networks. How were they constituted and what is the relationship between informal social ties and formal groups? I trace the formation of the producers groups in three of the most significant ceramics producing clusters in Michoacán, Oaxaca, and Puebla, demonstrating key similarities in the state-provided

selective incentives that allowed them to form and the informal dynamics that undergirded the manner in which they were constituted. Moreover I show that these informal dynamics profoundly shape the manner in which information moves within the cluster. The discussion resonates with both political and sociological scholarship on business groups and their relations to states and to sociological and economic geographic work on networks and the uneven flows of information within productive networks. Drawing these two together, I argue that the state sponsorship may be an effective manner of harnessing informal relations into more formal groups that can be used as reliable informational conduits.

The final empirical chapter examines the formation of the ties between state agents and the communities to which they seek to disseminate productive information. How are these ties formed and why have they not been effectively formed to all ceramics producing communities? It focuses on the experience of the municipality of Zautla, which is a temporally compressed and illustrative case of the formation of public-private ties between the National Lead Substitution Program at Fonart and ceramics workshops in the municipality. The chapter goes on to argue based on the experiences of the Fonart agents that the necessary public-private tie has been difficult to form in communities that are isolated and insular. This is particularly the case in indigenous communities, which have a tendency toward greater cultural and linguistic distance from the mainstream Mexican state, an argument that draws heavily on James Scott's (1998) conception of the tensions between diverse societies and homogenizing states.

In addition to making contributions to scholarly literature on globalization, development, and innovation, this project yields findings that are useful to policymakers and development agencies alike. Socio-political studies of science and technology have grappled with questions of how knowledge is produced, who has access to that knowledge, and how social structure, organization, and political resources affect innovation (Frickel and Moore, 2005). While much of the work on innovation and technology development focuses on higher tech industries and the developed world (Lorentzen, 2009), these issues are key to economic development in poor and middle-income countries as well, especially in the era of integrated economies. The international integration of economies appears unlikely to change in the short term; questions of how small producers may adapt to new market conditions through innovation are of concrete relevance not only to scholars but to development agencies and especially to communities in poor and medium-income countries that face the prospect of declining quality of jobs and working conditions in their small, labor-intensive industries. Given the relative ease with which some innovations may be made in these industries and the fact that many potentially viable technologies and ideas are freely available, understanding how they are diffused and adopted by producers is particularly important for how clusters of producers in the developing world may benefit from incorporation into the global economy. Finally, Fox (1992, 1997; also Evans, 1997) has identified dynamics by which government actions may increase social ties, making them more capable of taking advantage of their status as a network. Consequently, in terms of the concrete implications of this project, societal networks and ties need not be thought of as an

accident of history, but rather something that may actually be shaped by government policy.

Chapter 2 Information, Organization, and the Pathology of Non-Innovation

“There have not been changes in how we make [ceramics], in the process. It has always been done like this.”²

~Ceramics Producer, Tzintzuntzan, Michoacán, Mexico

Walk down the street of a ceramics producing village in Mexico and it may look little different from the hundreds of other small villages that dot the countryside. But the telltale signs of a small industry in progress are everywhere. Clumpy reddish earth is arranged in a thin layer over the newly paved road in front of a house. It has been left in the sun to dry (and hopefully crushed by feet, hooves, and the occasional car passing the village streets), after which it will ground into the fine clay powder that is the base of the ceramics pieces produced here. A dull, repetitive thump echoes over a home’s wall as a worker pounds balls of reconstituted clay into thin, flat sheets (*tortillas*) that will be pressed into molds for plates, bowls, casseroles, pitchers, and then dried in the sun. Thin strips of fragrant firewood – often the barky edges cut from trees and discarded from nearby lumber mills – wait in neat piles on the roof or peek out from behind a tarp in an unwalled yard. Wood smoke escapes from the blackened crevices of a *teja* roof, as ceramic pieces, having been dipped in a glazing solution and situated in an adobe kiln, are brought to the temperature necessary to melt the glaze into a thin glassy coat. An occasional dusty truck may pass through the village, tarp tied over a load of ceramic wares padded with straw, bound for Guadalajara or San Luis Potosí.

² “*No ha habido cambios en la forma de hacerlo [producir loza], en el proceso. Siempre se hizo así.*” Quoted in Dietz et al. (1991, 144).

Though the signs of industry may abound, the artisans in this trade are not often seen performing their craft: they work behind the walls of their homes, where workspace and living space exist together and are not carefully delineated. They are families: mother and fathers, perhaps a grandparent or great aunt, and children as they become old enough to press clay into the molds and paint designs reliably. Often their families have been involved in the production of ceramics for generations, and for most the process has changed little over the years. The domestic responsibilities borne by heads of household also include overseeing the molding, painting, firing. Young children play with clay and molds on the floors of their homes, learning the trade as they grow up. They eat snacks of tortillas and cheese leaning against the family's adobe kiln. In this manner, one generation of Mexican potters quietly becomes the next, the basic technologies that they have used for decades and centuries are passed down.

Given the smallness, isolation, and apparent calmness of the individual family workshops in this sector, it is difficult to imagine that they are the sites of mass poisoning, the focus of a federal legal and regulatory struggle, and the unlikely pawns of the international economy. All of this revolves around the workshops's use of lead, a pliable and useful metal and an insidious neurotoxin, which has historically been a central component of the glaze they use to finish their wares. The stability of these family workshops as productive units may have served the artisans well in some respects; in a world where economic success is predicated largely on the capacity to develop or adopt innovations, however, these workshops are now cursed by the difficulty of changing.

This chapter serves as an introduction to the situation in which traditional family workshops find themselves: socially and geographically, legally, economically, and

technologically. It argues that many of the characteristics of ceramic producing clusters and the workshops themselves frequently inhibit their capacity to adopt new technologies, a factor that is likely to exacerbate the conditions faced by this group of artisans, who are already economically and socially marginalized and broadly exposed to toxic working conditions. A companion to the previous theoretical chapter, this chapter provides specific detail about the traditional ceramics industry in Mexico that is necessary for the four subsequent chapters, which address questions related to how state-led programs, formal and informal networks of private producers, and public-private dynamics have mitigated the challenges facing these family workshops.

Historical Foundations of Ceramics Production

Potting or the production of stoneware or ceramics is one of the oldest human occupations, dating back to roughly 10,000 BCE in parts of Asia, and has historically been practiced in most regions of the world. Glazing, or the application of a mineral “slip” that is then melted into an impermeable glassy coating, was a technology that developed more recently, around 5,000 BCE in the Nile Valley. Glazes typically consist of a silicate (typically silica dioxide (SiO_2)) that forms a crystalline matrix when melted and cooled, mixed with a “flux,” a material that lowers the melting temperature of the silica (normally 3100) and improves the diffusion or coverage of the glaze. Historically, lead-oxide (PbO) has been the dominant compound used as a flux (Lehman 2002). The longevity of this technology is likely to be a consequence of its ease of use and desirable characteristics. Used in concentrations of up to nearly fifty percent, lead-oxide flux lowers the melting temperature of silica markedly, is extremely effective at improving glaze coverage, produces a smooth and very transparent glassy coat, and allows wide

production latitude (Lehman 2002). Its popularity is also contemporary: ceramics producers with low-temperature kilns throughout the developing world continue to rely on it.

Small-scale ceramics production has existed in Mexico since before the arrival of the Spanish in the Americas. However, the production process in the region was significantly more simplistic than in other areas of the world: no glazes, not potting wheels, no true kilns. As glazing technologies were unknown, and the products – when finished – were “polished” (*bruñido*), a process that involves covering a piece with a “slip” (a solution with pigments or minerals) and rubbing the surface with a stone or bone to create a shiny, impermeable surface (McQuade 2005; Lopez Cervantes 1983). The Spanish arrival in Mexico brought with it the introduction of silica glazes with lead-oxide flux, which was significantly more efficient in that it both eliminated the need to individually polish each piece and created a more durable seal.

Along with glaze technology, the Spanish also brought the use of the wood-burning updraft kiln. Previously, indigenous Mexicans appear to have fired their ceramic pieces at very low temperatures by placing them within a wood or grass fire, often in a pit. The basic updraft kiln is a simple open-top oven made of adobe bricks; the lower portion of the kiln is a firebox (often subterranean) with a small opening through which wood is loaded and air flows, which is separated by a porous ceramic floor from the upper chamber where the ceramics are placed for firing (see Figure 2.1). This kiln technology was a necessary technological complement to lead-oxide glaze as pre-Hispanic firing methods were unable to achieve temperatures necessary to melt lead-based glazes. Without the use of bellows, the upper reaches of the temperature that the

open-topped wood-burning kiln can produce is around 900C, sufficient for the liquification of glaze with lead-oxide flux (although not for the complete integration of lead particles in to silicate matrix of the glaze, as discussed later). This pair of technological advances were adopted widely throughout Mexico, although some communities continue to produce *bruñido* ceramic pieces and to fire the pieces in open wood and grass fires.³



Over time, the means of ceramics production have remained remarkably stable, as has been the primary unit of production: the family workshop. Home compounds (i.e. the house itself, as well as any outbuildings and land, often surrounded by a fence or wall)

³ The perhaps apocryphal story of the introduction of glaze in the Purepecha region of Michoacán is that it was brought by Don Vasco de Quiroga, Bishop of Michoacán beginning in 1538 (see Foster 1967). As part of his oversight, he attempted to organize the production of goods by the indigenous inhabitants of the area by encouraging the differentiation of activity by village clusters; some were taught wood working, some in metalsmithing, fabric making, instrument making, and ceramics production. The production of ceramics is said to have included the building of kilns and training in the practice of glazing. This dynamic clearly refers to a limited region in the country. Nevertheless, although little seems to be known about the original rate of adoption, it is clear that the technology was diffused broadly (and apparently intentionally) in Mexico and has remained hegemonic ever since.

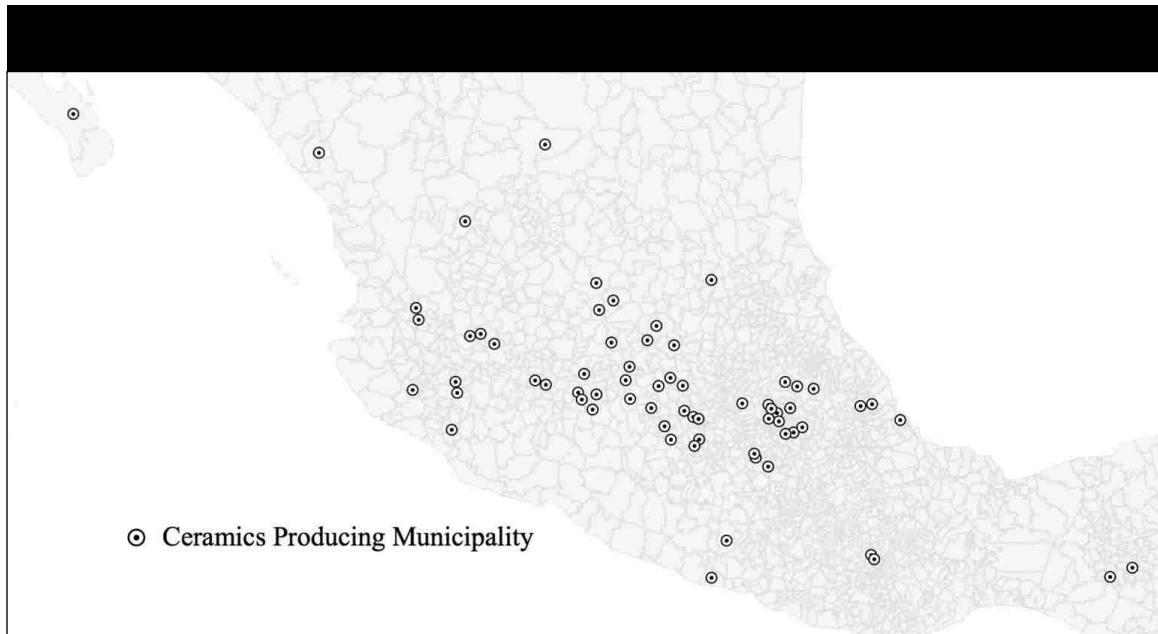
provide both living areas and workshop areas, although the line between these is very often blurred, as cooking and eating often occurs in workshop areas and finished goods are frequently stored in living quarters (see Figure 2.2). The laborers in these workshops are generally the residents of the household who are old enough to work, with children learning the trade and gradually becoming part of the family workforces as they grow up. A recent estimate is that the earnings per full-time worker in this kind of workshop is 23.5 pesos (roughly two USD) per ten hour work day (Cuiriz 2011b).⁴ As a rule, however, members of the family are not paid a wage for their labor; instead the earnings from the sale of ceramics are administered for the family by the head of the household (Dietz et al. 1991). Workshop heads tend to not think of their earnings as business profits (*ganancias*) but instead as money that can provide for the household. One workshop head in Capula, Michoacán remarked: “We don’t earn profits, only what is required by the household.” In financial and organizational terms, then, it is likely that little change has occurred in the ceramics sector over the last several hundred years. Some observers have understood the overlapping family and work roles as a benefit that allows the business to run more smoothly; Foster (1967), for example, remarks that harmonious relations in the workshop seem to be consequence of established family roles. While this may or may not be true, as discussed below in much greater detail, the family workshop as the unit of production has contributed to the isolation of workshops and ultimately to the difficulty of making necessary upgrades to the production process.

⁴ This estimate is based on a three-person workshop with a 15-day production cycle and current prices for clay, glaze, and wood in Santa Fe de la Laguna, Michoacán. Prices may vary a bit from village to village, but the overall estimate is believed to be relatively representative (Cuiriz 2011b).



Distribution of Production

The Mexican government has estimated that the current population of communities heavily dedicated to the production of ceramics is roughly 3.8 million (Secretary of Health 2003). Ceramics-producing clusters are most heavily concentrated in communities in the highland areas of central and southern Mexico, with the heaviest concentrations in Michoacán, Jalisco, Guanajuato, and Puebla (Secretary of Health 2003), the northern states tend to have fewer, if any, ceramics-producing clusters. Figure 2.3 depicts the distribution of the 76 community clusters that have been identified by the federal government as dedicated in part to the production of ceramics.



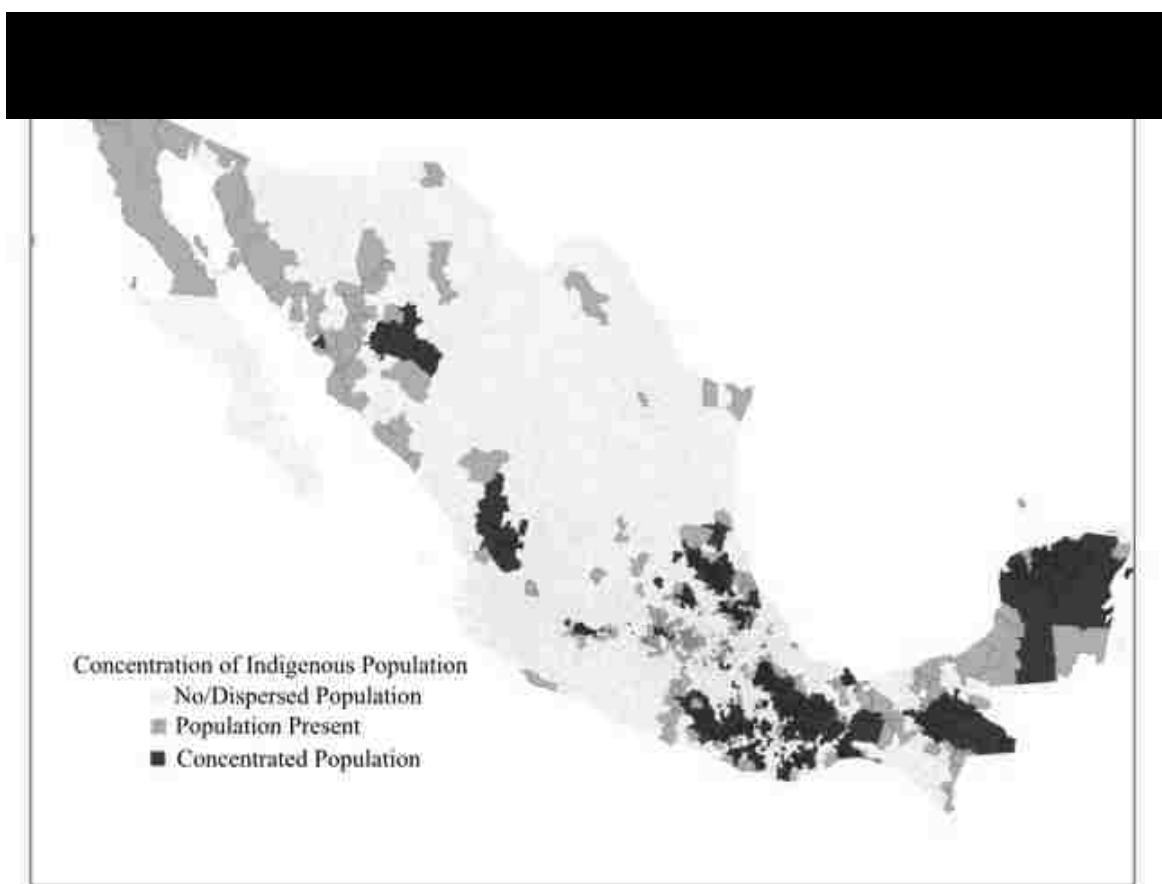
Of the ceramic-producing clusters identified by the federal government, roughly two-thirds are in villages whose populations are predominately indigenous (Secretary of Health 2003, 76). Figure 2.4 illustrates concentration of the indigenous population by municipality; there is some apparent overlap between the communities in Figure 2.3 and the indigenous presence and ceramics production in the Middle and Southeastern states. Although being indigenous is clearly neither a necessary nor a sufficient condition for the production of ceramics, the association between indigenous villages and ceramics production is important for several reasons. First, as ceramics production dates to pre-colonial times, many of the indigenous communities that currently produce ceramics have been engaged in the activity for hundreds of years. Others, such as ceramics producing clusters in Capula, Michoacán (which is discussed at length in Chapters 4 and 5) or Tzintzuntzan, Michoacán have lost their indigenous character to varying degrees over

time while maintaining the production of ceramics.⁵ So for many of these productive clusters, ceramics production is an activity that they have been engaged in for hundreds of years. Moreover, predominantly indigenous areas are, as a rule, significantly more economically depressed and tend to have fewer opportunities for employment. Some 96% of indigenous people live in areas that are ranked “high” or “very high” in terms of economic marginalization; and while they represent only one tenth of the Mexican population, indigenous people account for up to a third of the poor (Molnar et al. 2001). Finally, a point that will gain salience in Chapter 6, indigenous communities have historically been and continue to be relatively isolated from the machinery of the modern Mexican state. This may in part be a consequence of geographic separation from the major metropolitan areas and the consequent incapacity of the Mexican state to fully penetrate its territory, in spite of the PRI’s corporatize project and efforts to “Mexicanize” the indigenous communities. Often at the local level there is organization quite apart from the mainstream state: “There is a strong persistence of indigenous social and cultural organization, including local systems of governance...[which have] historically served a function of cultural survival – assisting communities in maintaining self-sufficient, protecting land and property rights, filtering out integrationist influences, and presenting a palatable image to outsiders (Molnar et al. 2001, 537).

The upshot is that the negative health and economic consequences of lead-oxide use (see below) fall disproportionately on poor and indigenous communities, where there are few other economic activities that might take the place of ceramics production.

⁵ CDI has three rough categories for communities based on the presence of indigenous people: 1) little indigenous presence (“sin población indígena” and “población indígena dispersa”), 2) moderate indigenous presence but not dominated (“con población indígena”), and 3) predominately indigenous (“indígena”).

Moreover, as argued in Chapter 6, the historic isolation of these communities from the machinery of the Mexican state has made it more difficult to promote the use of new technologies in these communities. The nearly 4 million people in these communities both rely economically upon the production of ceramics and face the likelihood of being exposed to lead either directly by laboring or living in a ceramics workshop or through indirect environmental contact. It is also the population that faces the consequences of eroding domestic prices for ceramics products and the incapacity to access more, lucrative foreign markets to sell their goods.



Hazards of Lead-Oxide

The fundamental problem that faces the family workshops is the continued use of lead-oxide as a flux in their glaze. In the last decades, its use has expanded beyond being a major threat to public health, taking on new life as an economic and political problem as well. This change has been driven by rising international consensus that restrictions on exposure to lead should be lowered.

Health Implications. The recognized physiological effects of lead intoxication are wide ranging: disruptions of both central and peripheral nervous systems, cognitive deficits, anemia, attention disorders, motor dysfunction, renal damage, coronary damage, fatigue, and bone and joint degradation. Even in very small doses, lead exposure is responsible for a range of minor problems that are not necessarily visible in an ordinary examination (i.e. “subclinical”) (Landrigan 1990). Many of these physiological effects have been recognized for millennia. Nor is the more specific problem of lead intoxication in ceramics workers newly recognized: Ramazzini, an early champion of occupational medicine took note of lead poisoning among potters in the early 1700s (Landrigan 1990). As far back as 1878, Dr. Gustavo Ruiz Sandoval identified lead as a workplace hazard for Mexican ceramicists and called for reforms to halt the widespread poisoning of workers, their families, and the consumers of their products (Ruiz Sandoval 1878). More recent studies have continued to find alarmingly, albeit predictably, high blood lead concentrations in those who work in glazed ceramics (see McCann 1996). In communities that are dominated by ceramics production, the outward pathological effects of lead intoxication are widespread and easily visible to observers (Cuiriz 2011b).

High levels of exposure to lead-oxide is practically unavoidable given the practices that are ubiquitous to traditional family ceramics workshops, particularly in tasks directly related to the process of glazing: mixing, submerging, and firing. The powdered glaze (mix of a silica and lead-oxide flux) is purchased as powder and mixed with water to create a glazing solution at the time of glazing. The glazing solution is then typically mixed with a bare hand (and again whenever particulates begin to settle out of the solution), submerging the hand and forearm in the leaded solution. Hands and forearms continue to come into direct contact with lead as the individual pieces are fully submerged or partially dipped in the solution to form the “slip” that will become the glassy silicate coating. The use of bare hands in this process is ubiquitous (Dietz et al. 1991). Lead-oxide is readily absorbed through the skin and quickly enough that washing after exposure does little to limit the amount absorbed (Filon et al. 2006), making this common practice an important vector by which lead enters the body (Figures 2.5 and 2.6 are typical images of the unprotected glazing process). The firing of the pieces in open-top kilns also exposes workers to the inhalation of lead particulates (along with wood smoke) that are volatilized during the firing. As these wood-fired kilns must be consistently tended and fed, there is little way to avoid this exposure.

Moreover, the general absence of a system of storage and disposal means that most lead-oxide waste and excess very frequently ends up accumulating around the home and workshop as well. For example, both leftover glaze solution and wastewater used to rinse the remnants of the solution from containers are typically thrown on the ground in and around the home workshop. It is not uncommon to see stains on dirt floors of workshops of the ground around the family compound. These practices contaminate the

ground as well as the air when dust is raised from the dirt floors and inhaled. In part, the sources of exposure of workers to lead might be partially mitigated by, say, the widespread adoption of gloves in the glazing process or broad adherence to particular disposal techniques; these problem of exposure is, however, fundamentally rooted in the use of lead-oxide itself and the danger of exposure will continue to exist even if particular practices are curtailed.



As suggested above, because the ceramics workshops are typically within the walls of the family dwelling, contamination does not only affect those whose work involves direct contact with lead-oxide but also the entire family that lives there. Contact generally occurs in daily activity, such as playing, cleaning, or moving items around the home or workshop, and is known to strongly affect children. Haphazard storage practices present the possibility of glaze powder being dispersed in the air or ingested by children,



an unfortunately common occurrence (Cuiriz 2011a). To provide an example of the extent of exposure, recent blood samples of children between the ages of one and 11 – who may be learning the trade but are typically not involved in production as full-time workers – in the ceramics-producing village of Santa Fe de la Laguna, Michoacán, found average lead levels to be over three times ($31.94 \mu\text{g/dL}$) the nationally and internationally accepted maximum ($10 \mu\text{g/dL}$) (Molina Garcia et al. 2009). These levels are considered far above the threshold that generates detrimental effects on the health and cognition of children.⁶ Lead poses a serious danger to the fetuses of women exposed to lead in the ceramics workshops: along with necessary metals like calcium, lead in a pregnant woman's body is carried across the placental barrier in concentrated amounts, raising the risk of miscarriage and birth defects, and meaning that high lead levels are passed on even before the child is exposed through the environment. This issue is exacerbated by

⁶ Lanphear et al. (2000) find cognitive deficits (reading and mathematical abilities) beginning lower than the accepted blood-lead norms, as low as $5 \mu\text{g/dL}$. This suggests that the levels of blood lead concentration level observed in Santa Fe and other villages are even more harmful than expected.

the fact that glazing is often a task performed by women, while men load the kiln (Dietz et al. 1991). This generational effect of lead guarantees that even if the use of lead-oxide flux ceased immediately, the effects could potentially linger for several generations to come.

Effects of lead intoxication are clearly concentrated in communities that produce ceramics; however, exposure to lead through ceramic products is a problem that faces Mexicans nationwide. The Secretary of Health recently estimated that as many as one-third of Mexicans (over 30 million) regularly consume food or beverages cooked or stored in containers that are glazed with lead-oxide glaze (Secretary of Health 2003). Products that are fired at high enough temperatures do not leach lead because the particles are fully incorporated into the silicate network of the glaze (Lehman 2002). The typical wood-burning Mexican kiln, however, is incapable of achieving that temperature (roughly 1050C), which leaves consumers of the majority of artisan-produced ceramics exposed to lead through food consumption (Fonart 2010).⁷ Although almost any use for cooking and storage can leach lead particles from the glaze matrix into food and beverage, a variety of uses exacerbate the leaching: longer term storage of food and beverages, the consumption of hot liquids, and, most crucially, acidic contents. For example, lemon juice that has sat in a lead-glazed bowl for only a few minutes has detectable levels of lead particles (Cuiriz 2011b).⁸

⁷ In addition to being fired at temperatures unable to completely incorporate particles of lead into the glaze, Lehman (2002) points out that the failure to mix glazes properly can also be a cause of lead particles escaping from the glaze into food or liquid. Given that home workshops generally use rough measurements and mix glazing solutions until they seem right, it is not unlikely that poor mixing may also be responsible for additional leachable lead in Mexican ceramic goods. However, low temperature production is the broader, more systematic problem.

⁸ Detectable levels are generally about 300 ppm.

The unequivocally negative ramifications for public health presented by lead-oxide use in these small family workshops, then, are concentrated on the immediate workers and residents of the homes, but they also clearly extend beyond the communities in which these goods are produced. Ceramics workers themselves – especially those involved directly in the glazing – are exposed to lead at the highest rates; its use, then, is rightfully considered a workplace hazard and justifiably treated as such. However, the transgenerational effects of lead, home and environmental contamination, and leaching into the food and beverage of ceramics consumers makes it an even broader public health issue.

Economic Implications. While lead-oxide use has stood out as a workplace hazard for workers in the family workshops as well as a hazard – although less severe – for the consumers of their goods, relatively recent forces generated by international cooperation and the global integration of markets has made its use even more problematic by affecting the market for Mexican ceramic goods, both domestically and internationally, and the acceptability of the conditions under which they are produced.

Internationally, conversations about the regulation of lead began in earnest in the 1970s, spurred on by a series of studies that clarified the toxicity and effects of lead, the presence of lead in dinnerware, and the deleterious economic effects of lead exposure.⁹

⁹ Landrigan et al. (2002) estimate that each μg of lead per dL of blood results in a loss of .25 IQ points, and that each IQ point drop is associated with a 2.4 percent decrease in lifetime earning. Based on these assumptions and the average blood lead concentration of $2.7 \mu\text{g}/\text{dL}$ in 5 year-old children in the United States, they argue that lead exposure results in a net \$43.4 billion loss per annual cohort of children. This takes into account only IQ deficits. Clearly among ceramics clusters in Mexico, the dynamics are different: average lifetime earnings are much, much lower and earnings in labor-intensive work may be less sensitive to decreases in IQ. That said, a rough calculation using these assumptions is staggering: Molina et al (2009) find an average $32 \mu\text{g}/\text{dL}$ in children in Santa Fe de la Laguna, which would correspond to an average 8 point IQ decrease and over 19 percent drop in lifetime earnings. Included in any calculation among this more

The international consensus was led by the Joint Food and Agriculture Organization/World Health Organization Committee on Food Additives (JECFA), which established its first recommended limits for the weekly intake of lead in 1972, about the time the United States Food and Drug Administration (FDA) established its first threshold for lead leachability in ceramic table ware. As further studies more carefully gauged the toxicity and effects of lead both the JECFA and US FDA lowered the recommended levels of lead exposure; the FDA's lowered limits were put in place in 1979 and, tightened notably in 1991 (Sheets 2000). As a result of these regulations, the FDA inspects incoming shipments of tableware for levels of leachable lead and detains those found to be in violation of the current acceptable levels (currently between .5 and 3.0 micrograms/mL) (Sheets 2000; FDA CPG Sec 545.450). The restrictive levels of leachable lead set in 1991 effectively banned the import of Mexican tableware finished with lead-oxide glaze and fired at the low temperatures achievable in traditional updraft kilns.¹⁰

The US laws prohibiting the import of leaded tableware are technical in nature and were developed and tightened in conjunction with the development of an international consensus on the toxicity and effects of lead. In fact, in addition to import restrictions in the United States, a variety of other developed nations restricted the

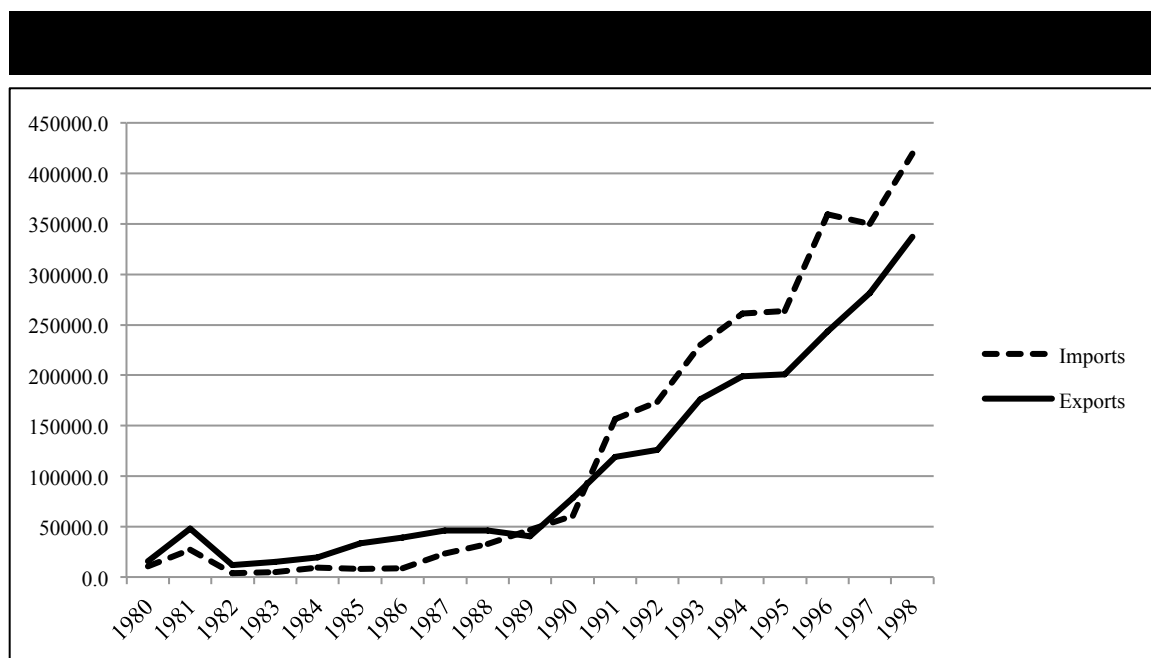
specific population must be the costs of the physical effects that manifest themselves at higher level of exposure, whether those costs are borne directly by the affected person or the national health care system (IMSS) or are indirect costs related to lowered productivity. Although difficult to come to an accurate estimate, the point is that the externalities associated with the use of lead-oxide glaze are extremely high and the cost is typically borne by the producers themselves.

¹⁰ Glazed ceramic pieces that leach more than the acceptable levels of lead may be imported to the United States as long as they are not intended to come into contact with food or beverages. The FDA provides two manners of making such an indication: 1) both a removable label and a permanent molded or fired-on notification to the effect that it is glazed with lead, which is toxic and can leach into food and beverage, and 2) a hole bored through any surface that might come into contact with food, making it unusable for food service (FDA CPG Sec 545.450).

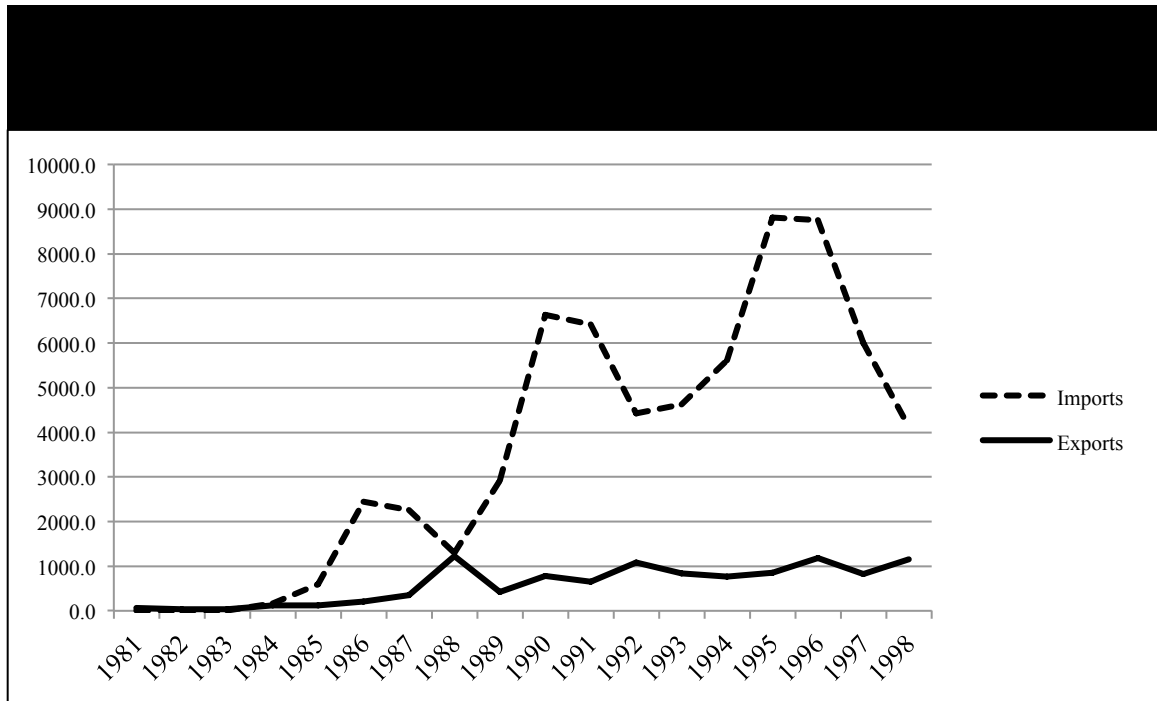
presence of lead on ceramic items in the same period. Among the other most important potential markets are Canada, the European Union, Australia, and Japan. In 1991, the same year in which the US FDA tightened restrictions was also the same year that Mexico began establishing domestic restrictions on the sale and use of lead-oxide in ceramics. Although the domestic restrictions on lead-oxide use have not had the direct economic effect on ceramics producers that the international bans on low-temperature ceramics have, they are the legal justification for the move to eradicate lead-oxide from production practices (discussed at length in the chapters that follow).

At roughly the same time that the anti-lead consensus began to present a problem for exports of traditional Mexican ceramics, a domestic economic restructuring was being undertaken that presented a companion problem: an increase of inexpensive, competing imports. Mexico opened its economy to commerce with other countries in 1986 when it began its trade liberalization program and joined the General Agreement on Tariffs and Trade (GATT), tying itself to the organization's regulations on limiting trade barriers. This resulted in a flood of imports that compete with the traditional ceramics: inexpensive Chinese ceramics, thin metal pots, and plastic ware of all kinds. Moreover, exports of pottery and earthenware (ISIC 3610) from Mexico to trade partners were surpassed by imports to Mexico (See Figure 2.7). This relationship is especially noteworthy regarding trade in these goods with China and East Asia: although less consistent, the value of imported goods have far outstripped the value of exports (See Figure 2.8). Although these figures do not capture the ceramic goods produced by small producers for the domestic market, they are suggestive of the relative competitiveness of artisan produced Mexican ceramics. This dynamic is supported anecdotally by artisans

who readily identify imports of Chinese ceramic ware as one of their chief problems, as they are unable to compete with the low-priced imports.



Thus, the consequences of economic integration, along with the consequent exposure to international quality standards and market competition, has since the late 1980s wedged small ceramics producers into a tight corner: forced to both defend their domestic market against a flood of low-cost imported ceramic ware and competing plastic and metal goods and required to meet international quality standards in order to access foreign markets. Without upgrading technology, then, producers are exposed to the disadvantages of the market integration – increased domestic competition – without being able to take advantage of the potential rewards – improved access to more lucrative foreign markets. Without the capacity to access foreign markets through upgrading, the option left to most ceramics producers is to accept decreases in the prices they are paid for their labor, which, as mentioned above, are already quite low.



Informational Pathologies

The question of why glaze technology has remained in place for such a long time draws attention to the nature of information among family workshops and in the market for ceramic goods (this point increases in salience in Chapters 4 and 5 that discuss how informational barriers are overcome). Stasis in the productive process has long been the rule for artisanal ceramics: the sector has adopted strikingly few innovations in the last several hundred years. For ceramics workshops, this is the consequence of the information failure on two fronts: technical and market information. These failures ultimately stem from the nature of knowledge production and diffusion both within the workshops themselves and in the larger productive clusters.

Learning in the Workshop. As a unit of production, small family workshops in general, and Mexican ceramics workshops in particular, face serious impediments to the adoption of new technologies, even those that are beneficial, nonproprietary and freely

available. These impediments stem in part from the nature of learning in small businesses and family workshops and are often informational.

In such workshops, exercises in research and development are minimal, if they exist at all, inhibiting the formation and adoption of new technologies and techniques and making experimentation unlikely. Small businesses typically undertake less research and development because of the relatively slim margins of profit and difficulty committing limited time and energy to activities that do not produce revenue in the short term (Von Tunzelman and Acha 2005). A more specific obstruction to the development and adoption of new techniques in the ceramics workshops is the fact that traditional firing methods discourage experimentation. Dishes to be fired are stacked inside the updraft kiln and overlaid with flat scraps of pottery (*tepalcate*) that contain and stabilize the heat. Once the kiln is assembled, a wood fire is lit below and stoked for hours to attain temperatures sufficient to melt and harden the glaze. Essentially, a small experimental batch requires almost as much fuel as larger one, but firing a large batch requires an even larger investment in time and primary materials, as well as a greater economic risk, should the firing fail. Producers are therefore conservative in their approach to firing, as the loss of a batch can be economically difficult. Given the equipment in their workshops, then, for most producers there is not a cost-effective means of experimentation, which inhibits both the development of “in-house” innovations and the adoption of existing technologies that may require minor adjustment.

Moreover, as finances for families and the “business,” are generally not kept separate in these kinds of business, obligations to family (e.g., purchase of materials for school, clothing, food) are typically put before re-investment in the business (Whyte

1996; Dietz et al. 1991). This discourages research activities that might have long-term benefit and reinvestment in the equipment in the workshop. The larger and more immediate the short-term family costs are relative to the income earned from the business, the less likely workshop heads are to make investment that needs a longer period of time to accrue benefits (Pérez-Lizaur 1997).

More broadly, these workshops are hybrid organizations that differ in significant manners from firms as they have been traditionally conceived. They are organized along the lines of nuclear family organization and are dedicated above all things to providing for the family. Much work on the behavior of firms has assumed them to be rational and profit-maximizing, carefully balancing risk with reward. There is a basis for believing that these family workshops – and the many other home businesses that resemble them – will behave differently from other firms. Particularly, there is reason to believe that they will be markedly more risk averse and approach altering their productive practices more conservatively. The reason is clear: the subsistence of an entire family depends on the continued operation of the family business; even when non-innovation may lead to a slow decline in the income earned by the workshop, this may be seen as preferable to the chance that an effort to change will be a failure. In other firms – especially those that have more employees and are diversified – failed experimentation may lead to firing workers or reorganization but are unlikely to lead to the marooning of the firm head's family. Even if we recognize that the rational, perfectly profit maximizing firm is an ideal type, these kinds of home businesses fall very far from that type. They are not, however, rare in the developing world: in middle-income Mexico, for example, about one-third of the work force is employed in small family businesses (Secretary of Economy 2011).

This speaks to the importance of understanding the decision-making processes of these very common forms of organization based on their internal characteristics and the conditions they face.

A final feature of the family workshop that discourages the adoption of new techniques and technologies is that teaching in the family workshop occurs in the typical craft manner, with the rising generation trained in the production methods by older, expert workers. Although the primary activity in a particular community may be the production of glazed ceramics, because the older workers are the parents and grandparents who instruct their own children, learning occurs “vertically” within families; there are no means by which young trainees are instructed “horizontally” with their peers, which would increase the spread of production information between workshops.¹¹ This condition is further exacerbated by the belief held by many ceramics workshop heads that the competition between workshops is so keen that specific information about production, particularly advancements that result in one producer’s work being more desirable than a rival’s, must be protected (see Dietz et al. 1991). When asked who they give or receive advice about production from, the vast majority of workshop heads reply that they share information about production with no one, including extended family members (see discussion of survey in Appendix). Thus, family

¹¹ Dietz et al. (1991) discuss earlier efforts by government agencies (Fonart and Casart) to promote the formation of “training workshop” (*talleres-escuela*), which would allow for the standardization of production and the diffusion of productive innovations. By 1990, these efforts had been abandoned as failures in large part because the structure of teaching as groups conflicted directly with the traditional model of learning within the vertical structure of the family and the home as the productive units. In this model, young people old enough to have an apprenticeship in the *taller-escuela* were already versed in the basics of production; as one informant said, “The training course and workshop setup doesn’t work, because everyone learns [the methods] in their home individually... [W]e already know how to make ceramics, so we don’t need courses!” (*Lo de los cursos y talleres no funciona, eso cada uno lo aprende en casa, particularmente... ¡[Y]a sabemos hacer loza, no necesitamos cursos!*)”

workshops and their workers are isolated in terms of information about production practices and tend to perpetuate practices that have traditionally been used within the family and the sector as a whole is very slow to adopt newly available technologies.

Even within community clusters, workshops tend to be isolated from one another and there is surprisingly little overt sharing of knowledge about production between workshops (Aguila 2010); that said, many communities have some form of formal ceramics producers organization that allows the workshops to cooperatively petition support from the state or federal authorities or coordinate direct sales at seasonal markets. As discussed in much greater detail in Chapters 4 and 5, these formal groups differ in the timing and reason for their formation, their size, and internal rules. However, one of the common characteristics of these groups (and those in other industries) is that they provide channels of communication between workshop heads in the form of meetings and regularized communications. The extent to which these formalized channels are used for the explicit diffusion of information about production and new technologies seems to be relatively low; they do, however, seem to function effectively at allowing for the coordination the government-sponsored training and informational sessions. The majority of producers in most clusters do not belong to a formal producers group, making even simple coordination a difficult task (Aguila 2010).

As discussed in detail in Chapter 3, Fonart coordinated the generation of an alternative lead-free glaze that was adapted to the conditions under which family workshops have produced their pieces (i.e. low temperature, loosely controlled conditions). Despite the presence of a freely-available alternative, however, these informational barriers that have made innovation in the sector rare continue to prevent

workshops from adopting the new glaze regardless of its long term benefits. Most fundamentally, there is a shortage of basic know-how preventing the adoption of the alternative lead-free glaze for use in traditional kilns. Artisans who have long mastered lead-oxide glaze do not know in which proportions lead-free glaze should be mixed, or how it interacts with pigments below the glaze, or the temperatures and times it must be fired to produce commercially viable products. The manner in which the lead-free glaze behaves in the kiln is sufficiently different from the lead-oxide glaze to necessitate research, training, or experimentation; again, however, levels of research and development tend to be very low in these workshops.

Market Information. The lack of technical information about the application and use of lead-free alternative is accompanied by a paucity of reliable information about the market for ceramics goods, which further undermines the motivation to adopt the new technology. Although this stems in part from the informationally isolated nature of the workshops described above, it is also a function of the weak position of the producers in the market for ceramics in Mexico. Most workshops have production cycles of about two weeks, at the end of which they sell their goods in bulk to *acaparadores* (literally, “monopolists” or “hoarders”) in their village or who come from larger cities to re-sell in markets around the country. Because there are far fewer *acaparadores* than there are workshops, the workshops have little capacity negotiate the value for their goods and are price takers (Dietz et al. 1991). *Acaparadores* can easily find another family to provide them with essentially the same goods for the price they are willing to pay. One ceramicist summed up the relationship to the *acaparadores*: “They pay very little, but selling to them at least provides a stable income.” This market weakness makes the producers

extremely risk-averse, unwilling to jeopardize the sale of a production cycle or their relationship with their buyer. Thus, producers who fear losing a buyer should their product look or feel slightly different are loathe to adopt new methods or modify their process in ways that might affect their sales in unpredictable manners.

Moreover, because they sell primarily to middlemen and have little access to the direct consumers of their goods, producers have few means of obtaining information about lucrative markets abroad. Given that family-trained artisans have relatively low levels of formal education, limited connections outside their communities, and few resources to commit to seeking out importers or buyers abroad, these prospective markets are far beyond their reach. For the few artisans who have made direct contact with foreign clients, the most common story is that the clients visited their shops in Mexico or were referred by friends, neighbors, or family. Most artisans, however, simply produce the pieces that are ordered by domestic *acaparadores*; as such they have little knowledge of foreign demand for lead-free ceramic goods, and, as a result, little economic incentive for adopting the new technology. Without information about the market for lead-free goods abroad, the dominant pressure for producers is to simply sell their goods more cheaply in the domestic market.¹²

Theoretically, in a perfect market, informational, financial, and technological barriers would not pose such problems for those seeking to comply with restrictions on lead-oxide (see Debreu 1972). With better information about the foreign market and the costs of upgrading along with the long-term benefits, these family firms could make efficient decisions about the benefits of upgrading and the costs (including the negative

¹² According to at least one importer in New York City, there is unfilled demand for lead-free Mexican Ceramics. Two of the key problems from her perspective are locating lead-free producers and having them produce enough ceramics to fill regular orders.

health and environmental externalities(see Arrow 1983)) of not upgrading, and actively engage in marketing their products to external markets, rather than selling to a few local distributors under near monopsony. These barriers are, however, the kind of market inefficiencies that are common to the small businesses in the developing world.

Ambivalence about the use of lead-free glaze is a consequence of imperfect flows of information (as well as the presence of misinformation) in the market, as well as the impediments to engaging in research and development.

Making the issue much more intractable is the fact that these technical and market information failures are intertwined, making it of little use to address only one of them. For example, even though producers may be trained in the use of lead-free glaze, without the market information to ensure adoption will be economically worthwhile, they have proven resistant to adoption. Similarly, those who have better information about the market are unable to adopt the lead-free alternative without technical knowledge of how to use it. In short, because these ceramics producers face not only substantial market barriers but barriers that must be bridged at the same time, the continued use of lead-oxide glaze is hardly surprising, even given the unacknowledged danger it poses to ceramics workers and their families.

In spite of these the difficulties laid out here, simple technical advances have been made in the ceramics sector: in some workshops electric milling machines (*molinos*) have replaced the older practice of crushing dried clay into powder (*polvo*) by hand; some have replaced the pre-Hispanic practice of pressing pounded flat pieces of clay (*tortillas*) into molds with electric potting wheels; lead for glaze is no longer ground by hand in the

workshop but instead purchased in powdered form mixed with the silicate.¹³ By and large, however, very little technological upgrading has occurred in family workshops over the last several hundred years; this stability is noted by the artisans themselves (Dietz et al. 1991). It is in part the nature of production and training in family workshops that has obstructed the development and diffusion of innovative production practices, making the chances that an indigenous innovation to replace lead-oxide use would have been developed by and diffused to the workshops in the sector in a cluster making vanishingly slight.

~

Although the details of the issues facing the sector are its own, there are numerous aspects in which it is representative of other small industries in the developing world, from relative isolation and difficulty organizing to lower capacities to conduct research and development activities to the failure of market information. Yet small firms are typically numerically dominant in countries in the developing world, as they are in Mexico (Shadlen 2004). This dominance gives the kinds of informational barriers they face an outsized influence on the success of small businesses in integrating economies.

The regulatory elimination of lead-oxide use has the potential to both increase the competitiveness of artisanal Mexican ceramics on domestic and international markets and improve working conditions that have poisoned the artisans for generations. In spite of the legal ban on lead-oxide use, in a sector characterized by a variety of conditions that prevent innovation (family-run workshops, low profit-margins, little to no research and development, and weak market position) workshops have been slow to adopt the

¹³ These upgrades are technically much simpler to adopt than the adoption of lead-free glaze (although they may require a larger investment) and have more immediately perceptible consequences for the productive process.

alternative lead-free glaze that has been available (and no more expensive than the traditional) for a decade. Instead, accepting lower prices per unit of production (and failing to explore export markets) has been their primary – largely passive – manner of attempting to remain competitive in this new economic and regulatory environment. The view of proponents of free market economic policy may be that this downward pressure is a part of the Schumpeterian “creative destruction” visited upon inefficient firms and industries as a natural part of a domestic economy becoming more efficient as a consequence of integration. There are, however, a variety of reasons the situation is of concern to Mexican policymakers, for whom the displacement of this work is an undesired outcome. In part, the economic damage caused by this process accrues to clusters of workshops in areas that already tend to be highly marginalized, have few options for replacement work, and are often ethnically indigenous. The slow grinding down of the incomes of the families engaged in this economic activity is believed by many in the Mexican government to be unacceptable given the marginalized position and the lack of replacement jobs for displaced workers to fit into. Finally, the technological improvement is relatively simple and the innovation was established by the mid-1990s and was expected to take hold in the sector quickly. Yet, over a decade after, only an estimated 10 percent of workshops have upgraded and are compliant with the beneficial regulation. The following chapters explore the public-private dynamics that have led these workshops to innovate and upgrade as well as the conditions that have kept the vast majority of workshops producing goods with lead-oxide as they have for decades.

Chapter 3

State-Led Research and Development?: Bureaucrats Catalyzing Innovation

“It is hardly possible to overrate the value... of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with those with which they are familiar... Such communication has always been, and is peculiarly in the present age, one of the primary sources of progress.” John Stuart Mill, 1848¹⁴

“The competition unleashed by globalization, technical change, and deregulation has reduced the scope for conversation and interpretation in private industry. This in turn has created a need to expand such places outside industry itself, in sectors of society where competitive pressures do not naturally reach.” Richard Lester and Michael Piore, 2004¹⁵

Although historically poor and often isolated, the economic outlook for artisanal producers of ceramics in Mexico was worsened in the late 1980s and early 1990s with the integration of the Mexican economy and the tightening of international restrictions on the use and trade of products containing leachable lead. Forced by these circumstances to defend their domestic market from inexpensive imported items but locked out of export markets by foreign restrictions, these small producers have faced the option of either upgrading their production practices or accepting reduced wages without hope of gaining access to more lucrative foreign markets. However, in the early 1990s, there was no existing alternative glaze that was suitable for use in low-temperature kilns, leaving the workshops without an easy, non-capital-intensive means of upgrading. The arrival of an alternate technology in their communities has involved two distinct steps: first, the actual innovation that led to the existence of a suitable, nonproprietary alternative glaze, and, second, the diffusion of the new technology to workshops throughout the country. This

¹⁴ (Mill 1848[2004], 174)

¹⁵ (Lester and Piore 2004, 177)

chapter deals with the first of these processes, which took place in fits and starts between the period of 1991 and roughly 1998 and in which the Mexican government played a critical role. It seeks specifically to explain how government agencies – maligned in popular discourse as the very antithesis of innovativeness and, in fact, often lacking in technical expertise – successfully coordinated the generation of suitable lead-free technology. It also contrasts this discrete intervention with more common modes of state intervention.

I argue here that the state's role in the production of the glaze innovation that would address the problems facing the artisanal production of ceramics was "catalytic." Research in the areas of business management and social networks has consistently found that the breaking down of barriers between departments with specified roles and people of varied expertise has an important stimulating effect on the generation of ideas and innovations. For managers seeking to have their companies generate productive innovations, this kind of "boundary management" (Lester and Piore 2004, 14) is catalytic in the sense that it speeds the generation of new ideas. Insofar as the action taken by the Mexican National Fund for the Development of Artisan Goods (Fonart) to address the technology gap in the ceramics sector was catalytic, its role is distinguishable from other kinds of interventions in the economy: more limited, more direct, and more active than most.

Additionally, I suggest that this kind of state-led action is particularly appropriate strategy in the case of ceramics producers – and other small businesses – that suffer from both lack of resources and for whom upgrading by adopting even simple nonproprietary technologies can mean improved competitiveness or better working conditions. First,

catalytic state action can assist small businesses, for whom “boundary management” means little because of the size and limited scope of their businesses. As suggested in the previous chapter, these kinds of businesses are inherently less likely to innovate because of their size and organizational characteristics. For those businesses (or their representatives), a government-created public space for problem-solving can provide a forum that is inherently missing from their business operations and that can incorporate actors from outside the businesses’ immediate experience. Moreover, in a world where the margins for experimentation are being eroded by the swiftness of the competition generated by globalization, publically generated spaces sheltered from the pressures of the market, are increasingly important, particularly for businesses that are less competitive in the global market (Lester and Piore 2004). Third, this state-led approach to generating innovations (or fitting existing technologies to specific local conditions) makes sense when these nonproprietary technologies stand to make a great deal of economic, health, or environmental improvement to the sector in question, not uncommon in labor-intensive industries. Finally, although accession to the World Trade Organization (WTO) or other trade agreements entails limitations the policies that governments can adopt to advantage domestic firms over international firms. One thing that Mexico’s obligations (and those of many other countries) do not legally limit is investment into research and development (Shadlen 2005), making this model of intervention allowable even in the more restricted policy environment created by market integration.

The chapter begins with a discussion of the benefits that accrue to firms by blurring standing disciplinary or departmental barriers and defines catalysis in those

terms. It then progresses to a narrative description of the way in which Fonart replicated this kind of activity and how this catalytic action began to address the problems facing the ceramics sector. The final portion of the chapter discusses the broader implications of this kind of state action, how it differs from more common forms of state action on the economy, and the extent to which Fonart's action might provide a model for upgrading in similar kinds of small businesses throughout the developing world.

Collaboration and Innovation

Although it may initially seem distant from the role of state agencies in the economy, there is a long literature in managerial sciences and social psychology on the hypothesized benefits of “brainstorming” as a means of generating new ideas, innovations, and unique solutions to existing problems. The seminal publication was produced by the advertising executive Alex Osborn, who described the activity as a kind of process by which a “contagion” or “chain reaction” of ideas among a group of participants that produced more and better ideas for the resolution of defined issues (Osborn 1953, 154). Although his work may have codified the perceived value of brainstorming sessions and has been broadly influential, it has been undermined by experimental studies in the field of psychology that have found the production of ideas to be no better in groups than when the group’s individuals worked alone (Mullen et al. 1991; Diehl and Stroebe 1987; Nijstad et al. 2006). Instead of a benefit from the group dynamic, these studies have found that the quality and quantity of ideas produced declines as numbers of participants in a group increases. The exception to this “group deficit” is in situations where individuals in the group come from diverse backgrounds or varied expertise, which raises the number and quality of ideas produced (Stroebe and

Diehl 1994). In such heterogenous groups, “the knowledge structures of different group members [...] complement each other” rather than simply overlapping, as the parallel gaps in knowledge structures do in homogenous groups (Stroebe and Diehl 1994, 296).

In language more familiar to sociologists, Burt (2001, 221) has linked the improved production of innovative ideas among diverse groups to the fact that the group interaction produces a forum in which there is the combination of ideas that have not been previously brought together: “The value of group brainstorming depends on the group facilitating the exchange of ideas across structural holes that separate members in the absence of the group.” In other words, organizational structures that promote the brokerage of ideas between groups or individuals and across the “structural holes” that typically separate them allow for the combination of previously uncombined ideas, and, consequently, are likely to generate more positive outcomes. In this vein, studies of business management have repeatedly found that organizations that promote the formation of collaborative networks that include bridges to other areas of technological knowledge or expertise are likely to be more creative, innovative, and learn more quickly. Small manufacturers that have more non-redundant ties outside of the firm have greater access to innovative ideas (McEvily and Zaheer 1999) and are more likely to be able to implement these ideas when they have a more diverse base of customers (McEvily and Marcus 2000). Lester and Piore (2004) find that innovations such as the cell phone (which combined radio and telephone technology) would not have been developed without combined expertise. More quantitative studies have found that firms that engage in alliances and joint ventures with other firms are not only more innovative and have higher rates of patent applications (Ahuja 2000; Calabrese and Silverman 2000) but also

experience faster growth in earnings (Calabrese and Silverman 2000; Koput and Powell 2000) and higher rates of survival (Koput and Powell 2000; Podolny 2001; Powell et al. 2005). In short, there is ample empirical evidence of the value of “bridging” ties between individuals and groups of varied experience and expertise with regard to the production of innovations.¹⁶

Lester and Piore (2004) offer a somewhat different perspective, identifying two complementary processes that are necessary to the development of innovations: “analysis” and “interpretation.” Analytic activity is the stuff of management theory historically: the identification of particular problems with a product or technology and the pursuit of concrete steps to solve those issues. Interpretative activity – on which they place emphasis – is, in many ways, the opposite: the open-ended, free-wheeling, barrier crossing “conversation” about products and potential changes in technologies. This latter element is closely related to the kind of bridging behavior described above in which the confluence of different kinds of expertise helps produce new ideas, but it does not necessarily include creating bridges to achieve a particular end. “Analysis” assumes that all problems can be known and understood; the interpretative process often generates innovations that were not even identified as necessary. Lester and Piore argue that innovation relies on an appropriate balance of these two elements: enough open-ended, barrier-crossing interpretive activity to generate new ideas and potential projects (even if many of them are not immediately applicable), but enough analytic decision-making to

¹⁶ As discussed in greater detail in the following chapter, “network bridges” (a term used by graph theoretic social network analysts (see Wasserman and Faust 1994)) and the filling of “structural holes” (a concept employed by Burt 1992, 2001) describe similar phenomena: the linkage of two (or more) distinct subgroups by social ties, creating the possibility of information flow between them.

determine when the interpretive process should stop and what should be drawn from it and applied.

Although they see a need for balance, Lester and Piore (2004) leave the specific manner in which these elements are combined within organizations less clearly specified. I propose that there is at least one identifiable type of combination: catalysis. Catalyzing innovation within an organization involves the strategic arrangement of personnel to speed the production of a novel solution. Catalysis in this context then, refers to the analytic (i.e. managerial) identification of a problem or bottleneck to be solved and the bringing together in an interpretive space people or groups with varied expertise that might be brought to bear on the generation of an innovative solution. The managerial role is largely the oversight, coordination, and mediation of those involved in the interpretation, catalyzing the generation of a innovation by bringing together the right combination of expertise to produce a novel solution to an identified need.

This definition of catalyzing innovation departs from what Lester and Piore (2004) suggest is the ideal interpretive space: universities. Although the innovations they describe were generated primarily in large firms, they view universities as prime locations for the development of innovations outside of firms themselves, largely because they draw together people of very different expertise into the kind of public space in which ideas can be debated, research can be undertaken, experiments conducted, all without the short-term pressures of the market forcing “analytic” decision making to impede on the interpretive process. Hence, government support for universities is often predicated in part on this function as a generator of innovations and potentially useful technologies.

As much as these efforts to generate product innovations may seem appropriate in the scholarship about business organization and universities, they seem less at home in the discussion of state bureaucrats. In market economies, the role of state agencies has typically been to encourage innovation within or between firms in the private sector (or universities) by setting policies that create financial incentives for businesses to innovate: direct grants and subsidies, targeted tax incentives, profits protected by intellectual property rights. While policy may shape the incentives, the creation and tailoring of improved technologies has been the work of firms. Even for those who question the assumption that innovation is accomplished primarily by entrepreneurs and producers (e.g. von Hippel 1988, 2005), the primary locus of this activity is the private sector. From Weber (1947) on, bureaucracies have largely been considered good for control, uniformity, and regularity but “inappropriate for innovation,” a pathology that stems from hierarchical organization, defined goals and tasks, and a lack of incentives (Thompson 1965, 1). One might add to this list a deficit of expertise, which is presumed to be lower among public sector than among the firms dedicated to employing technologies.¹⁷

The catalytic efforts of Fonart to generate a lead-free alternative run counter to many of these presumptions, not only because of the level of expertise in the agency but because of its capacity to act as an effective manager. The most instrumental parts of Fonart’s intervention were its accurate diagnosis of the situation that would prevent the generation of a solution within the sector and the coordination of an analytic public space that allowed it to occur under the auspices of the agency. The following sections describe the role of the Mexican government in the generation of a low-temperature lead-free

¹⁷ An area where related arguments are seen is in criticisms of state-owned enterprises, which are broadly perceived as technological laggards, neither attracting the kind of expertise nor providing the right incentives for employees to generate innovative ideas.

glaze appropriate for use in traditional home workshops, beginning with misguided efforts to simply mandate a technological change and then proceeding to Fonart's active catalytic efforts to generate a suitable alternative technology.¹⁸

Mandating Innovation

The mission of Fonart is “promote artisanal production in the country and thus contribute to improved income for artisans by virtue of their human, social, and economic development” (Fonart 2012). Since its founding, the traditional role of the agency has been to provide cheap loans or credits for the purchase of materials, to act as a clearinghouse for the marketing of artisan goods, to publicize artisanal work by holding competitions and giving awards. For some observers, the primary role of the agency was originally to subsidize artisans for political ends, to provide a reward for political support for the dominant PRI; this charge is perhaps oversimplified as the agency does deal with the production of goods that are, among other things, considered culturally important (Lopez 2010). As a consequence of this role, Fonart agents did have contact with many ceramics producers and had an understanding – if not great expertise – of the nature of production which had developed from contact with them.

In 1991, the Mexican Secretary of Health (Secretaría de Salud) responded to both the tightening of global norms for lead exposure and a domestic media campaign by the Group of 100, an environmental advocacy group, and announced that it would take action

¹⁸ Much of Fonart's documentation of these efforts was destroyed when the PRI was replaced by the PAN. Top-level appointees were replaced and documents were cleared out (Covarrubias 2010b). Much of the narrative in the following two sections are based on interviews with the director of the National Lead Substitution Program and on sections of unnamed electronic documents that he allowed me to read, along with a brief, official narrative (Fonart 2010). Much less detailed versions of the same narrative were provided by other interviewees (Aguila 2010; O'Leary 2009). Although these accounts differed in the level of detail, they did not contradict each other.

against the sources of lead in the environment. It began drafting legal regulations that would restrict and control the use of lead across a variety of industries, including the traditional ceramics sector.¹⁹ In this latter sector, the Secretary of Health specifically indicated that it would set in motion the elimination of lead-oxide in glaze used in traditional production of ceramics, which would have the benefits of reducing direct exposure of workers, reduce the exposure of users of traditional ceramics, halt the rise of ambient lead levels in affected communities, and allow artisans to meet international norms for their products. To this end, the Secretary of Health brought together a working group consisting of representatives from a wide variety of agencies: Fonart, Amacup (Association Mexicana de Arte y Cultura Popular), INI/CDI (Comisión Nacional para el Desarrollo de los Pueblos Indígenas), and artisans organizations from states such as Puebla, Michoacán, Jalisco, and Estado de Mexico.

The Secretary of Health's original plan was simple: they would have the ceramics workshops that glazed at low temperatures agree to use an unspecified alternative technology that did not contain lead-oxide. The federal and state agencies that were invited had interests (of different natures) in the communities where ceramics workshops are clustered; they would be the agencies that would contact the workshops, inform them of the new statutes controlling the use of lead, and ask them to sign a document agreeing to the cessation of lead-oxide glaze use. Among the working group, the plan was reportedly met with a measure incredulity. Representatives from agencies like Fonart and INI/CDI that had significantly more contact with traditional ceramicists and were more familiar with their means of production, marketing, and local conditions, resisted on the

¹⁹ These regulations (NOM-004 [Use of Lead-Oxide] and NOM-011 [Levels of Lead in Ceramics]) were issued officially in 1993.

grounds that the Secretary of Health's plan did not take into account the nature of the industry. They argued that the artisans were diffuse and difficult to organize, that they did not have a great deal of assistance and support from the government in general and were unaccustomed to oversight, and that they typically produced for the informal market making monitoring of the statutes difficult. In essence, the consensus among the working group was that the approach advocated by the Secretary of Health was naïve and would be unsuccessful, and the idea of making artisans sign a pledge was left behind.

In retrospect, resistance to the Secretary of Health's plan appears to have been well reasoned. Not only were the agencies correct in their assessment of the difficulty of contacting and organizing workshops (as later chapters discuss more fully), the Secretary of Health was also unaware that an alternative low temperature glaze did not even exist, making investment in an expensive gas kiln and major changes in production practices the only option for becoming compliant with the new regulations. Experience to date suggests, moreover, there were even more barriers to upgrading than just diffuseness and informality. As discussed in the previous chapter, difficulty with experimentation, the nature of learning, and reliability of information all posed challenges to altering traditional production practices.

Catalyzing Innovation

In the period following the collapse of the Secretary of Health's original plan, Fonart began developing its own plan to eliminate the use of lead. It developed a plan ("Plan Estratégico...") that laid out the agency's proposed approach to eliminating the use of lead-oxide glaze. The agency's mandate is the social and economic development of artisans, and, as such, it does not have the legal authority to enforce regulations on the

use of lead. The agency realized that although the use of lead-oxide ran counter to the health and social development and was increasingly problematic economically, immediate and rigid enforcement of the ban would be counterproductive.²⁰ Fonart's concern stemmed in large part from uncertainty about what alternatives were available to the workshops, along with the capacity of these family workshops to discover and adopt them. A change in the glaze was the simplest imaginable solution, which would have the benefit of allowing the other elements of production to remain the same. In the 1980s, some had abandoned traditional methods for high-temperature ceramics; however, the process and materials are significantly different and the upgrade to gas-fired kilns is capital intensive.²¹ Without access to a reasonable alternative technology, enforcement of the new regulations would damn nearly an entire branch of artisanal production. In its strategic plan, the agency seems to have developed the view that enforcement of the restrictions on lead use were important, but that the agency's approach to the issue had to include technological assistance, in order to keep the enforcement of regulations from being an economic disaster for workshops and their communities.

By 1994, when Fonart's "Strategic Plan" was finally approved and funded, it had become clear to the agency that determining what usable alternative technologies existed would be necessary at the outset. Without a specific direction in which to push the family

²⁰ As discussed in following chapters, this is also the position that Cofepris (Commission for the Protection Against Health Risks) eventually took as well: rigid punitive enforcement would ruin the workshops they would be able to monitor. In its later agreements with Fonart, Cofepris has adhered to a more "tutorial" approach to compliance, allowing Fonart to train producers into compliance, rather than forcing workshops into compliance or out of business by means of seizures, fines, and the like (see Schrank and Piore 2007 for discussion of tutorial approach to regulation).

²¹ Most who had upgraded to gas-fired kilns had done so with government support, or had been involved in unsuccessful programs such as Michoacán's "*talleres escuelas*" program that were intended to teach ceramics production more horizontally through apprenticeship programs and had managed to maintain control of one of their communities gas kilns (Dietz et al 1991).

workshops, there would be little point in pushing them to change. Again, Fonart's traditional role had been as a purchaser and retailer of artisanal goods of all sorts (ceramics, textiles, wooden goods, musical instruments) and a provider of small credits to artisans in these areas; while the agency also undertook other activities that promoted the production of artisanal goods in Mexico, such as sponsoring competitions, these former roles were predominant. While Fonart agents understood the basic dynamics of the production and marketing of ceramics, they did not have highly specialized knowledge of glazes or glaze chemistry. Government agents themselves, in other words, did not have the knowledge that would make the development of an alternative glaze possible; what the agency did have, however, was an understanding of the problems facing home workshops that used lead-oxide glaze and the capacity and resources to find experts that might have some input into what glazes existed, whether those would be suitable or adaptable, or, failing that, know how to generate a new glaze specifically for the Mexican industry.

Fonart's approach was to assemble a group of experts, who were knowledgeable about some element of ceramics glazes and production. Although there is no indication that Fonart administrators thought of it specifically in these terms, the information that was necessary to generate a viable alternative glaze ran along two axes. The first of these axes is the scope of the information: one end of this spectrum representing local knowledge about particular practices and conditions in the ceramic-producing communities themselves; the other, general information, such as knowledge of chemical processes, not limited to the conditions in particular communities and workshops. The second axis extends between technical information on one side and human or cultural

knowledge on the other. Figure 3.1 illustrates the mix of general technical information, local technical information, and local cultural knowledge, all of which were necessary parts of determining what a suitable replacement technology would be. Fonart agents likely fit near the middle of the diagram, with somewhat limited technical and specific cultural knowledge. The National Lead Substitution Program, however, did recognize the need for more diverse sources of information and ideas if it was to be able to discover an alternative that could actually be implemented in the traditional workshops.

Figure 3.1: Information Needs for Glaze Development

	General	Local
Technical	Chemists (UAM - I) Domestic Glaze producers (CSJ)	Low-temp ceramicists
Cultural		Low-temp ceramicists Anthropologist

Lester and Piore (2004) describe “boundary management” of a firm’s departments as key to the generation of innovations. There are many reasons this description does not literally fit the actions taken by Fonart’s Lead Substitution Program: small family workshops have no departments, expertise came in large part from outside the workshops themselves, the agency has no official managerial capacity of the workshops, and so forth. That said, the mechanism that Fonart set in motion in the interest of the family workshops was precisely the same: it explicitly brought together people with different expertise – areas and levels of expertise generally not available in the average family workshop – to discuss a solution to the technological problem exacerbated by health

regulation, labor concerns, and broader economic policy. In effect, the agency acted as a sectoral manager by identifying the specific bottleneck to be addressed, outlining preferences about how it would be addressed, and then bringing together people from different fields (departments) to address the problem. Over the next few years, the Lead-Substitution Program worked to coordinate a “conversation” between these fields to generate an innovation that would meet both the particular technical requirements and the cultural specifications of the family workshops.

General technical information was one of the first areas addressed under Fonart’s program, with central contributions from both glaze chemists and Mexican glaze producing companies. The primary question was whether there was an existing type of glaze that might simply be used to directly – or with minor alteration – replace the lead-oxide glaze: one that was free of toxic chemicals and that would melt at comparatively low temperatures. After being assured by the domestic glaze-producing firms that they produced only glazes for higher temperature kilns, Fonart agents contacted 84 glaze-producing firms worldwide requesting samples of lead-free glazes that fired at around 1000 degrees (slightly over the temperatures achievable by traditional kilns). They received some 37 samples from 18 countries (including Germany, Italy, and Spain), which were given to a team of chemists who worked in an advanced chemistry laboratory at the Universidad Autónoma Metropolitana – Iztapalapa (Autonomous Metropolitan University – Iztapalapa Branch). The technical equipment in the laboratory was provided in part by Fonart with funding from FONAES (Fondo Nacional de Apoyo para Empresas en Solidaridad).

The role of the glaze chemists was not only to fire and run laboratory experiments on potential glazes to determine if they fit the general specifications (most importantly, a melting point of around 850 to 900 degrees), but to determine whether or not they would be compatible with the type of clay used by the major ceramics clusters in Mexico. This first task simply involved firing the glazes at staggers of 50 degrees (beginning at 800 degrees) to determine the stage at which they could be said to have fully melted and bonded. The more complicated task involved determining the suitability of the glazes with the kinds of clay bases employed in Mexico.²² Over the course of the first year, Fonart representatives made nearly a hundred trips to the clay quarries in ceramics-producing communities to collect samples of the clay most commonly used for production in nearby workshops. With these collected specimens of clay, they produced some four thousand ceramic bowls and bars to cover and fire with the glaze samples they had solicited. Equipment well beyond the expertise of Fonart agents – x-rays and mass spectrometers – were used to assess each of the glaze’s melting temperature, coverage, and binding capacity. This process determined that only four of the sample glazes both bonded at the temperatures generally achievable by the standard Mexican updraft kiln and were generally compatible with the traditional earthen bases. Of these, however, two were found to use lithium-oxide rather than lead-oxide as a flux, and were dropped from consideration because the toxicity of lithium, which, while not as grave as lead, would have continued to present a risk to ceramics producers.

²² Variations in the mineral content affect such elements of production as the coefficient of expansion as pieces are fired and the capacity of the glaze to bind to the piece. Clay used for the production of ceramics is generally quarried very near the villages that produce the goods and can vary substantially in mineral, and, hence, can behave quite differently when glazed and fired.

The two remaining glazes (of Spanish origin) became a starting place from which the National Program for Lead Substitution worked. As the chemists finished their analyses, they were brought into conversation with the firms that were producers of ceramic glaze in Mexico (primarily Cerámicos San José and Macesa). The intention was to put the glaze producing companies in the position of working with the glaze chemists (along with their own staff chemists) in order to use the results of the outcomes of the extensive tests to generate a domestically produced glaze based on those that met the necessary specifications. Drawing domestic glaze producers into the program served a number of purposes beyond simply generating an alternative glaze. Fonart officials felt that involving domestic firms in the production because they were more likely to be open to working with agency officials and coordinating the development and production of the lead-free glaze. Additionally, Fonart officials believed that the prices and availability of the glaze would be more constant and reliable if they were produced in the country, rather than by a foreign firm that would have to transport it to Mexico and might be subject to conditions beyond the control of the government.²³ Finally, since the 1990s lead prices on the international market have been highly volatile: from \$81/lb in 1990 to \$45/lb in 2000 to \$240/lb in 2011 (World Bank);²⁴ Fonart officials hoped that a domestic producer using

²³ From the perspective of the domestic glaze-producing firms, there was clearly a business opportunity with the potential for a great deal of growth created by the possibility of a sector-wide change in glazing technology. Much Fonart-sponsored research had already gone into identifying the basic contours of a formula that would fit the needs of traditional workshops, lowering the costs associated with R & D and beginning production. If the thousands of workshops in the country were all required to transition to a new glaze, there would be quick growth and consistent demand for the new glaze, and, given the slow rate of change in the sector, the consumers might well be more or less locked into purchasing the same lead-free glaze for years to come.

²⁴ Lead prices are expected to remain very high (near the \$240/lb) for the foreseeable future. This spike in lead prices has had the effect of making the glaze with lead-oxide a more costly input than the lead-free alternative.

materials that were less volatile on the international market would help stabilize and keep down the cost of the new glaze.

While the glaze chemists and the glaze producers brought together by Fonart were able to generate a lead-free glaze that fires at low temperatures, a gulf still existed between the experience of firing ceramics in a laboratory setting and firing them in a workshop. That is, while the chemists were able to create a glaze that in carefully controlled conditions met all of the requirements specified (lead-free, otherwise nontoxic, low-temperature, functional with local clays, inexpensive), they were not able to test it as it would actually be applied. A variety of factors are introduced at the workshop level depart from the ideal conditions under which the lead-free glaze was developed and tested. Lack of careful measurement in the mixing of glaze can produce glaze slips of different thicknesses from one firing to the next. Fuel wood is often inconsistent and creates issues not accounted for in controlled laboratory tests; for instance, different types of wood burn at different temperatures or for different durations, or barky edges tend to produce less heat and more smoke, which can produce sooty stains in the glaze. Moisture content of the wood is reported by workshop heads to affect the temperature and rate at which the wood burns, as well as the humidity within the kiln. Temperatures in the adobe updraft kilns can vary significantly from the bottom – right above the firebox – to the upper opening of the kiln where heat escapes. Finally, while in a laboratory setting, kilns can be programmed with the temperature at which and time for which the pieces are to be glazed. The practice in workshops – where neither temperature nor time are carefully noted – is to observe the appearance of the pieces at the top of the kiln and make a judgment based on the color of the uppermost pieces (often described as “white-hot”). In

short, while some of these departures might be mitigated with more careful workshop practices, the typical family workshop does not even approach the systematically controlled conditions of the chemist's laboratory.

Recognizing that the results of the innovation might not be replicable because of these inherent differences, Fonart developed a practice of mediating communication between the glaze producers and the workshops in which the lead-free glaze would be put to use.²⁵ Because ceramic glaze is typically bought in bulk by middlemen, who then resell to small workshops by the kilogram as it is needed, there is little organic contact between the glaze producers and the thousands of small workshops that apply the glaze. The consequence is that little information would flow between producer and consumer, making the provision of feedback to the glaze producers about the performance of their products unlikely. While the same condition is true of those who produce and apply lead-oxide glaze, as the longstanding and accepted technology, little communication about the applicability of the glaze was necessary; only with the newly formulated and untested lead-free alternative was this feedback very important, as it would affect the willingness of workshops to adopt it.

Fonart would send a field technician – an agent at least partially familiar with local production and with the new glaze – to ceramics producing communities, where the technician would work with a workshop to test the glaze. The field technician would provide the new glaze and wood to fuel the kiln, while ceramicists would bring a few of

²⁵ National Lead Substitution Program claims that this intermediated system of information exchange still exists when producers have complaints about the glaze. In communities where the glazes are augmented with an oxide pigment, this process has taken longer. Production in Santa María Atzompa, Oaxaca, for example, frequently includes the addition of copper to produce a green glaze; the field tests in that community took much longer and required many re-configurations of the glaze (Covarrubias 2012).

their unglazed pieces. The technician would demonstrate how to mix the new glaze and each of the ceramicists would dip their pieces, getting a feel for how the glaze differs in viscosity or texture. The glazed pieces would then be loaded into the kiln and fired in the required manner (i.e. to about the same temperature as the lead-glazed pieces, but for a slightly longer period of time). Once cooled and unloaded, the participants could examine the pieces, compare to their usual lead-glazed pieces, and reflect on the experience of using the glaze.

Upon completing the exercise, the Fonart technician would gather comments about the new glaze, its performance, appearance, and so forth, which would then be communicated back to the responsible parties at Cerámicos San José. Common complaints have been that the new glaze does not become as transparent as the lead-oxide glaze, that it interacts with pigments differently making colors appear slightly different, and that pieces have a tendency to stick together more than with the lead-oxide glaze. The company could then make small adjustments to the glaze in order to improve its performance in the respect that concerned the participants in the field trials. Most of the alterations made to the glaze were incremental changes or changes that made the glaze more flexible in application, more resistant once applied, or capable of being mixed with other elements or compounds that generate a colored rather than transparent glaze. The altered glaze would then be sent out in the same manner for more field trials. This iterative process effectively brought together the expertise of the glaze producing companies and the scattered ceramics workshops, thereby generating a means by which small workshops and the lead-free glaze producers could fine-tune the glaze through

consultation and trial. This process clearly would not have taken place without the initiative and active participation and coordination of Fonart.

In addition to testing glazes in the home workshops, Fonart's field agents observed how the producers themselves responded to the new glaze, hoping to identify elements of the process of adoption that might prove difficult for reasons beyond the strictly technical. For much the same reason, the Lead Substitution Program also sought the expertise of an anthropologist. This seems to have been early acknowledgement by Fonart that the diffusion of the glaze would need to fit both the technical specifications of the existing workshops and the social and organizational traits of the workshops (O'Leary 2009). The anthropologist's role was reportedly to assist in the understanding of ceramics communities and, more important to this part of the project, the characteristics of the home workshops that might affect how the glaze would be used. For example, he could attest to the conservative nature of learning in the workshops (i.e. vertical "craft" training) and to the fact that much of the work is done by "experientially," rather than by written rules or formulas. Powdered glaze, for instance, is mixed with water according to perceived viscosity rather than with carefully measured portions. Given that these kinds of practices were likely to continue in the home workshops, the anthropologist was able to make recommendations about the glaze in development, primarily pertaining to the need for the glaze to be as forgiving as possible, given the imprecision and inconsistencies in mixing and firing.

Catalytic Intervention in Perspective

This narrative depicts a government agency that identified barriers facing the ceramics sector that stemmed from the mode of production and characteristics of

workshops in the sector. In the absence of the possibility of an indigenous innovation in the private sector, it was incumbent upon the state to shoulder the burden of generating the innovation, if there was going to be one. It did this by acting as a kind of sectoral manager that catalyzed the production of an innovation by breaking down barriers between different “departments” to create a collaborative public space. The Fonart agents themselves did not possess the expertise to generate the new technology. Instead, they understood that one of the inputs that was obviously missing from the process that would eliminate the use of lead-oxide glaze was a suitable alternative, and they recruited, coordinated, and mediated the interchange of expertise in a way that allowed for such an alternative to be generated.

Much of the literature on innovation policy has looked at how the economic environment in a country as a whole either promotes or retards innovation, rather than focusing on a particular innovation. Policies to stimulate innovations on generating the conditions and incentive under which innovations are likely to be produced and involves numerous policy areas: education, finance, trade (World Bank 2010, 9). Perhaps the chief example of this is research on so-called “national innovation systems” – defined as “the network of institutions in the public and private sectors whose activities initiate, import, and diffuse new technologies” (Freeman 1987, 1). Although troubled by a lack of agreement over what exactly those institutions are and how they fit together, studies in this area primarily focus broadly on agencies that fund and promote technology development, universities, institutions and firms doing research and development (see Nelson 1993). The more limited concept of “sectoral systems of innovation” encompasses related agencies, policies, institutions that promote innovations in a

delimited productive sector (pharmaceuticals, telecommunications, automobiles) (Malerba 2005).

Classifying Fonart's efforts to eliminate lead-oxide glaze as part of either a national or sectoral system of innovation would miss the fact that Fonart's intervention has been 1) more intensive, in the sense that it has gone beyond simply trying to broadly generate the incentives for innovation to occur in the private sector and took a more managerial (i.e. analytic) and coordinating role, and 2) less extensive, in the sense that it is geared toward the solution of a discrete technical barrier, rather than attempting to generate continuous innovation. As mentioned previously, small producers are in some senses more like farmers than they are larger firms; brief comparison to a quintessential sectoral innovation system like the US agricultural extension program helps illustrate the extent to which Fonart's actions are distinct from more systemic efforts at sustained innovation.²⁶ United States land grant universities and related field research stations were established and funded with the Morrill Act (1862), with the goal of establishing sites where research into crop production and land use could be performed. With their funding guaranteed through land grants, these institutions could commit themselves in large part to research into publically beneficial and regionally appropriate agricultural research. Fifty years later, the Cooperative Extension Service (CES) was established, the purpose of which was to help disseminate information and innovations made at the universities and field stations to farmers, which made up an estimated 60 percent of the US population at the time the extension was established (Cash 2001). These permanent institutions created a system whereby constant, publically funded, incremental

²⁶ This comparison also implies extension programs in other countries that are modeled on (or similar to) the US program; there are something like 140 countries worldwide that have some sort of agricultural extension program meant to help develop improved agricultural practices.

innovations would be generated in the university public spaces and those would be diffused by the CES to agricultural practitioners.

The question of why publically funded centers for agricultural innovation were deemed necessary in the United States returns us to the barriers to adoption facing small ceramics producers in Mexico discussed in the previous chapter. At the time of the extension's establishment, farmers were typically geographically (and therefore socially) isolated from other farmers, and as a consequence had few reliable sources of information about agricultural production. Moreover, they had low levels of education, owing to distance to school and the tendency for children to be engaged in work on the farm rather than being sent to school. Given the uncertainty involved in agricultural production, farmers are risk-averse and are susceptible to giving too much consideration to the potential costs of new technologies relative to the benefits (Birkhaeuser et al. 1991). Finally, the development of innovations for agricultural producers have traditionally been seen as informational public goods, which improved both the production of the farmers themselves and provided food for a growing nation. And while some information traditionally provided by extension services is excludable (e.g. information about a particular piece of land), it has largely been a public good in that it is both non-rival and non-excludable (Anderson and Feder 2004). In short, recognizing the informational and market barriers facing both innovation and the diffusion of technologies – as well as the potential public goods that could be produced by the diffusion of innovation – the US government created and funded “public space” in land grant universities where bridging contacts could generate productive innovations.²⁷

²⁷ The US scheme also included the creation of “boundary organizations” that managed the movement of information between the land-grant colleges and research stations and the farmers

In spite of the similarity of conditions faced by small farmers and family ceramics workshops, the actions that led to the generation of a suitable, alternative lead-free glaze were a discrete policy intervention. Funding, equipment, and a variety of experts were marshaled to address a single, well-defined problem: ceramicists were both poisoning themselves and increasingly marginalized by the process of market integrations. It was not aimed at any of the other problems facing ceramics workshops – other unsafe working conditions such as smoke inhalation or problems generated by selling their goods in an oligopsony.

Although obviously far from perfect, Fonart's efforts to catalyze the generation of an innovative technology may be a potentially useful mode for government agencies that are concerned with the labor, environmental, or product standards in low-tech firms. Lester and Piore (2004) decry the loss of "interpretive spaces" in the United States, which they argue will have the consequence of lowering the innovative capacity of the US economy. Moreover, they warn that "spaces for interpretation have grown steadily narrower over the past two decades, as competitive pressures in the U.S. economy have increased" (176). The mechanisms that they identify as being responsible for this narrowing are heightened competitive pressures and public policy that seeks to extend the reach of market incentives, which is driven by the notion that innovation is driven solely by competitive pressures. Competitive pressures generated by market integration undermine the potential long-term benefits of allowing interpretive public spaces by increasing short-term financial pressures on firms. This reduction of interpretive space in

themselves by providing both training to farmers and feedback to researchers (Cash 2004). It is also worth noting that estimated rates of return from US-style agricultural extension programs are high: around 100 percent returns in the US, up to 80 percent across Latin America generally, and up to a staggering 500 percent in parts of Brazil (Birkhaeuser et al 1991; Umali 1997).

large firms is arguably paralleled by a reduced capacity or willingness for governments to generate them through extensive programs.

In contrast, more circumscribed, directed interventions may be more useful for a variety of reasons. First, micro-firms like those in the ceramics sector are unlikely to be able to benefit from many of the policies that have scholars have proposed will aid in the spread of innovations to and within developing countries. For instance, one of the key recommendations is the adoption of liberal foreign investment policies, which are presumed to attract to developing countries foreign firms in possession of more technical capabilities and know how (Romer 1986, etc.; World Bank 2010). As foreign companies set up shop in developing countries where labor is less expensive, knowledge presumed to be passed to domestic entrepreneurs and firms. Small, labor intensive firms, however, are very unlikely to be the targets of foreign investment or to have contact of any sort with foreign parties, limiting the extent to which international spillovers of know-how are relevant.

The more indirect, oft-used policies to generate incentives for firms to innovate – cheap credit, subsidized R&D, educational programs, intellectual property protections, and the like – are similarly unlikely to affect micro-firms like those in the ceramics sector. As outlined in the previous chapter, limited capital and information resources, isolation, and low levels of educational attainment, and low-tech production mean that these kinds programs are poorly targeted at micro-firms. Subsidizing research and development activities never would have led the artisanal ceramics producers to invest in experimentation to find a solution to the problem that the technology they used was technically illegal, in large part because of they lack training and knowledge necessary to

test ad experiment on a new glaze. Moreover – and it is worth repeating – the chief problem for developing countries is not the generation of new technologies but the absorption of them (World Bank 2010). Fonart’s first steps were to determine what existing technologies existed and if an existing glaze formula could simply be adapted to suit local conditions. If an existing glaze had been suitable, the process of coordinating its production domestically would have been simpler, but coordination still would have been necessary to tailor its use to local conditions. In many similar situations the work that needs to be done is the identification of key technological needs in workshops and the bringing together into an interpretive space experts and heads of the industry in question to discover a means by the technology might be adapted and disseminated.

Finally, this kind of limited, catalytic intervention has the benefit of being relatively flexible and inexpensive. Rather than funding an open-ended interpretative space that might generate useful innovations at some point, this more circumscribed approach to identifying important technology gaps in an industry and coordinating the effort to determine how they might best be tailored, if necessary, for domestic use. For small, labor intensive industries, technological needs are relatively apparent and often technologies are readily available, making necessary only their identification, perhaps their adaptation to local conditions, and their diffusion. Pires (2009) implicitly identifies flexible labor inspectorates as one kind of agency that might be able to use its capacities to help firms solve their technology gaps.

Conclusions

The fact that an innovation was essentially generated for the private sector by a poorly-funded (but committed) bureaucratic program in a country known more for its

historical reliance on trade protections than on its innovation policy may strike many observers as surprising. Yet, in some senses, it seems wholly appropriate and may be a useful model for the first steps of promoting simple innovations in other low-tech, labor-intensive industries that are faced by similar barriers to adopting new technologies or practices, and when those provide some public good (such as improved labor conditions). First, the innovation in question was almost assuredly not going to be developed within the sector and diffused, regardless of the incentives provided to ceramics workshops. The domestic glaze-producing firms were unlikely to have produced it, given the uncertainty that it would be adopted by the family workshops, and the lack of an effective line of communication between the glaze producers and the home workshops. The project was also relatively cost-efficient, relying in part on government funding, but also on private sector and university contributions of labor and knowledge. Moreover, as a discrete effort, rather than a broader system meant to continually generate innovations (such as agricultural extension programs), the development effort had a well-defined goal. While the “interpretive” process of finding an innovation to meet that goal was flexible, at times ad hoc, and iterative when necessary, the fact that there was a relatively clear goal provided the kind of ending point that Lester and Piore (2004) argue is also critical to the process of innovation. This clear end point also allowed the project to be dismantled once it was complete.

Perhaps most importantly, what Fonart agents lacked in specific expertise, they were able to make up in organizational capacity and the ability to bring a group of experts into a public interpretive space to generate a solution. In this final sense, the agency’s efforts very much paralleled managerial behavior that has been identified throughout

literature on organizations and innovation and network-derived social capital as being important for the generation of new ideas and technologies. Although there is little existing literature on the production of innovations for the private sector by state agencies, there are numerous suggestions in organizational literature that what Fonart achieved was in keeping with effective innovation practices of firms (see Burt 2001). Early studies of bureaucratic structures argued that greater group dynamics would be important to innovation within hierarchical, segmented bureaucratic organizations (Thompson 1965) and that effective groups would need to be “shielded” from rigid administrative control and financial pressure (Hlavacek and Thompson 1973). These are clearly echoed in Lester and Piore’s (2004) call for shielded interpretative space and Styhe’s (2007) claim that in the age of “fluidity” the importance of bureaucracy’s capacity to diagnose problems is paramount to static expertise. Insofar as Fonart’s Lead-Substitution program acted as a kind of super-manager for a large, deeply-challenged sector, catalyzing the generation of an important innovation, it seems to have followed these managerial precepts well.

Given the success of this catalytic, managerial model in this case, the normative question is when discrete interventions of this type should be undertaken by government agencies. Several obvious requirements stand out: when a technology gap is readily identifiable by firms or the agency in question, when the innovation or adaptation is plausible (i.e. when outside intervention is likely to actually help), when the firms/workshops in the sector are unlikely to adopt a new technology or practice on their own. Finally, this type of direct intervention is best when it is likely to a common good and the benefits do not only accrue solely the private sector but to the public at large as

well. This is the case with many technologies that can improve not only the quality of the products but the conditions under which the workshops labor. The lead-free glazes developed under Fonart's program are an excellent example. Not only do workshops that adopt it raise their likelihood of reaching lucrative external markets, but their cessation of lead use has the potential to eliminate the negative externalities associated with it that are borne by the public: damage to health of producers and their families, along with consumers of their goods, and environmental damage. These costs are borne by the public more broadly, directly through programs such as the national health service (IMSS) and indirectly through lost productive potential.

~

The *production* of the innovative low-temperature, lead-free glaze is only one part of the story of upgrading in the ceramics sector. Based on Fonart's apparently accurate assessment of the state of the artisanal ceramics sector, indigenous innovation was clearly not going to take place. If upgrading – and the consequent public goods provided to ceramics producing clusters (i.e. broadened market opportunities and reduced levels of lead poisoning) – were going to occur, Fonart understood that its contribution would have to be the improved technology. Otherwise, enforcement of the new regulations would simply force home workshops out of business (cf Schrank and Piore 2007). The “co-production” of a public good involves the contribution of complementary inputs by parties that unable to provide all of the inputs on their own (Whitaker 1980; Ostrom 1997). As the subsequent chapters make clear, although generating of the alternative technology was clearly a necessary condition for upgrading in the sector, it was neither sufficient condition for upgrading (i.e. without the contribution of the ceramics producers

themselves) nor was it the extent of Fonart's contribution. It is to the distinct process of *diffusing* the technology that the following chapters turn.

Chapter 4

Networks, Embeddedness, and Innovation Diffusion

While small, high-tech firms are praised for their innovative capacities, their low-tech counterparts are just as frequently viewed with hopelessness. Like the traditional ceramics sector in Mexico, these latter firms often lack the capacity to develop innovations on their own (Von Tunzelmann and Acha 2005), despite the fact that even minor improvements in technology can have profound effects on both the quality of their products and the conditions under which they are produced. Because of their lack of innovativeness, their access to flows on information about productive technologies is of primary importance (Von Tunzelmann and Acha 2005). Consequently, the issue of how informational flows about particular technologies might be increased, broadened, or directed to the low-tech producers is a salient political question when it comes to the development and regulation of low-tech sectors dominated by small firms.

Studies of industrial policy in the 1990s often focused on how state agents were able to coordinate technological advance with the private sector and spur economic growth (*inter alia* Evans 1995; Amsden 1989, 2001; Wade 1990). In his comparative articulation of how this coordination occurred, Evans (1995) argues that state agents were “autonomous” enough to equitably enforce regulation yet effectively shaped policy to fit the specific needs of the sector by virtue of their “embeddedness” within those private sector groups. Studies of how state actors and the private sector engage each other, however, have been dominated by discussions of large firms or conglomerates, advanced sectors, and highly organized peak associations, given that they tend to be interested in rapid industrialization and economic growth. As the role of generation and diffusion of

technology has taken a more prominent position in studies of development, the experience of smaller firms in more labor-intensive industries – those that are the least likely to develop new technologies and or adopt existing ones – has similarly been left behind. Coordinated public-private efforts to overcome these firms' inherent barriers to innovation are potentially of great benefit. Given their inherent differences from more advanced sectors, are “embedded” relations possible with smaller, more isolated firms in less organized industries? Can they be used to broker information about beneficial technologies to these firms?

Using Evans's (1995) notion of “embedded autonomy” as a point of departure, this chapter argues that public-private ties between state agents and small industry may be inherently distinct from ties with larger, and more advanced sectors; effective coordination and information brokerage is still possible, although it is dependent on the structure of private networks as on the capacity of state agents to forge ties to the private sector. Autonomous bureaucrats' reliable ties *to* a networked sector may serve as functional equivalents of network ties *within* the sector. Social network analysis is used to emphasize that embeddedness can be understood as the presence of network ties that allow for the brokering of information among and between public and private actors: this brokerage of technological information is critical for firms that are not generators of new technologies. When information brokerage is brought to the forefront in this manner even simple methods developed for social network analysis can shed light on the coordinating ties between state agents and the private sector. The implications of this argument are far-reaching: it underlines the necessary differences between public-private ties with sectors that have very different firm profiles, yet confirms Evans's (1995) insight that

bidirectional informational ties between the state and industry are critical to effective policy design. It comes with important policy prescriptions about the pursuit of embeddedness or functionally equivalent ties to private networks, as well as demonstrating an alternative manner of approaching applications of the concept of bureaucratic embeddedness with more analytical rigor.

The following briefly reviews the concept of embedded autonomy as Evans (1992, 1995) defines it and introduces the notion of brokerage and asserts its centrality to the concept of embedded autonomy. It then moves to the efforts of a Fonart's Lead Substitution Program – an autonomous government agency – to use links to actors who are embedded in a particular ceramics cluster (Capula, Michoacán) in order to diffuse this new technology.

Embedded Autonomy and Brokerage

Embedded autonomy is a concept synthesized by Evans (1995) from two disparate strands of literature: 1) Weber's work on the nature of bureaucracy and 2) the work of Gerschenkron (1962), Hirschman (1977), Johnson (1982), Amsden (1989), and Wade (1990) on late development in Europe and East Asia. From Weber, he draws the notion that bureaucrats and state agents should be autonomous, or have a corporate coherence that drives them to use their positions to pursue public goals rather than private goals motivated by other social relations. Only when they are committed to the impartial enforcement of legal mechanisms can bureaucracies become the "essential adjunct" to the market (Evans 1995, 32). This corporate coherence implies insulation from and the incapacity to be swayed by the interests of particular social groups. While retaining the idea of corporate coherence, Evans (1995) departs from the notion that complete

bureaucratic insulation from society is ideal for transformative economic projects. Instead, in order to formulate effective and appropriate policies and strategies for economic advancement, bureaucrats should be “embedded” in civil society. Embeddedness comes from close contacts with members of interested private industries and groups; it allows for movement of information and coordination between bureaucracy and private actors. Gerschenkron (1962), Amsden (1989), and Wade (1990) stress that it is the close public-private relations that allow for state interventions to be appropriately tailored to conditions in the private sector. Where autonomy is necessary for the state to have the capacity to formulate its preferred developmental goals, the successful implementation of these goals is dependent upon embeddedness.²⁸

Much criticism of the concept of “embedded autonomy” has tended to focus on its apparently “paradoxical” nature and on the difficulty of operationalizing it.²⁹ I suggest that the concept of embedded autonomy is more coherent than the critics would have it; the case for the conceptual coherence of embedded autonomy relies on understanding embeddedness (and ties to embedded actors) as a necessary condition for information brokerage rather than as a threat to bureaucratic autonomy. In other words, rather than necessarily being indicative of “capture” of public agencies or relations that undermine

²⁸ Following Wright (1996), I discuss embeddedness and autonomy as two independent conditions that are jointly necessary for transformative economic activity rather than discussing embedded autonomy as a compound condition that can be fitted along a single spectrum. There are several reasons for this: 1) as logically distinct concepts, it is perfectly plausible for one of the conditions to be present in the absence of the other and 2) embeddedness is the concept that has created more scholarly concern (see Portes 1996).

²⁹ First, the combination of two seemingly irreconcilable concepts is found to be problematic: the concept of embedded autonomy is incoherent, “oxymoronic” (Schneider 1998; Harriss 2006), “ambivalent” (Weiss 1998), or “a striking paradox” (Moore 1998). Second, a related line of criticism takes up the issue that the concept is “vaguely specified” and “not readily operationalized” (Remmer 1997). Moore, for example, writes that “if treated as an analytic construct rather than as a general insight, the proposition appears almost irrefutable: one can find a bit of both in most situations” (Moore 1998, 429; see also Portes 1996 and Fine 2006).

the integrity of bureaucratic coherence, regularized public-private ties may simply be informational conduits that allow for informational brokerage between the two spheres. Brokerage is the act of filling “structural holes” in social networks, which allows for the passage of non-redundant information between the two otherwise distinct networks (Burt 1992; 2001). Burt defines structural holes as spaces that “separate nonredundant sources of information, that is, sources that are more additive than overlapping” (2001, 156). Burt’s metaphor of structural holes overlaps significantly with the graph theoretic notion of network “bridges,” which fill gaps between otherwise disconnected “subgraphs” (see Wasserman and Faust 1994, 114). Although Burt (1992, 2001) typically focuses on the individual advantage that is gained from filling a structural hole, theory and empirical evidence suggest that the effect of brokerage can be a net positive for the distinct networks separated, resulting in the broader spread of information that can lead to greater mutual understanding, capacity to negotiate, and innovation (see Burt 2001 for review).

My rendering is broadly consistent, albeit perhaps more precise, with the original formulation of the concept. Evans defines the state of embeddedness as being located within “a concrete set of social ties that binds state to society and provides institutional channels for the continual negotiation and renegotiation of goals and policies” (Evans 1995, 12). Key here are two elements: 1) ties cross the public bureaucracy-private industry divide rather than simply existing among a single type of actor, and 2) those ties are reliable enough to provide institutional channels for the effective passage of information (i.e. not unidirectional, temporary, unreliable, or *ad hoc*). While these roles have generally been conceived as being met by the bureaucrat’s position within a dense private network, they may also be met by bureaucrats’ reliable ties to key actors in dense

private networks. Note the subtle difference: in the former conceptualization, the bureaucrat is a full-fledged member of the network, whereas in the latter he or she is more distant and operates by earning the trust and loyalty of key nodes in the network. By working through these key nodes, the bureaucrat develops a means for information to be aggregated from the private sector and conveyed to interested state agencies and back, and for the conditions of policy to be negotiated or expressed. The relationship is made clear with the use of social network analysis, which makes it possible to establish where these information ties exist and where they do not. In doing so, the chapter addresses one of the major critiques of embedded autonomy: that it is vague and non-falsifiable.

Woolcock (2000) approaches embedded autonomy from the perspective of social capital: “bonding” and “bridging” ties inherent in state and social institutions generate social capital which is in turn responsible for a developmental outcome. This analysis deals with ties that, while different in nature (formal, informal, public, private, and public-private), serve a single purpose: the brokerage of information about the production and marketing in a particular productive sector. In so doing, it makes a specific claim about how these ties matter for a discrete productive cluster rather than making any broader claim about the kinds, levels, or consequences of social capital. These specific informational ties might be understood as the basis of social capital, perhaps by scholars such as Burt and Portes who understand social capital to be produced by the structure of individuals’ connections (rather than at an aggregate community level).

Public-private brokerage is central to successful development policy because it is the manner in which professional bureaucrats obtain information about the needs and capabilities of private industry. This knowledge of targeted private industry is key to the

formation and effective implementation of policy intended to affect some positive developmental outcome, as is the capacity to pass information – whether about state policy or intent or actual technology – back to the private sector. Regularized meetings, committees, liaisons, and other institutionalized forms of consultation are all potential examples: the key is that information can be brokered through these public-private ties on a regular basis and bi-directionally. Although not defined as such, examples of the role of brokerage among newly industrializing nations are plentiful. Silva contrasts the early, disastrous period of Chilean economic liberalization in which the policy prescriptions mandated by insulated and autonomous policymakers undermined the confidence of a broad swath of domestic industry with a later period in which policy the formation of “channels of communication” with business organizations led to policy implementation being “negotiated on the basis of technical criteria” and information that was previously not taken into account by the state (1997, 166). In the latter period, he asserts that information was effectively brokered between the peak business organization, which represented a broad coalition of domestic industries, and professionalized bureaucrats, resulting in the more pragmatic and ultimately more successful implementation of an export-led development model. The presence of public-private ties apparently had no deleterious effect on the professionalism and corporate coherence of state bureaucracy. Similarly, Amsden claims that information brokerage allowed the capacities (and weaknesses) of the *chaebol* to be understood by South Korean bureaucrats, promoting the effective design of subsidies and export targets that led to the progressive improvement in the quality of Korean industrial goods by “get[ting] the control mechanism right” (Amsden 2001, 11). Regular meetings of top officials and industry leaders were intended

to “enable bureaucrats to learn and lessen the problems that prevented companies from exporting more” (149). These institutionalized ties also provided industry leaders with full knowledge of government’s goals regarding growth through exportation and the conditions under which they would benefit from government assistance. In short, state agencies filled with professionalized bureaucrats – if they are to be successful in pursuing their goals for the private sector – must have some regularized means of both sending and receiving information to affected portions of private industry.

Amsden’s focus on relations with Korean *chaebol* and Silva’s on peak associations make salient a second critique of Evans (1995) and related studies: their attention being limited to organized, key sectors (steel, automobiles, textiles, hi-tech electronics, and the like). Given the interest in rapid industrialization and economic growth, this focus is logical. However, the exclusion of sectors that consist of smaller, more isolated and geographically dispersed, and lower-tech firms, produces the impression that public-private ties will look roughly similar irrespective of the nature of firms and organization in the sector in question. Clearly, for bureaucrats, maintaining these regularized informational ties to private sector is more tenable when that involves the leadership of several dozen Korean *chaebol* than when the firms are much more numerous, more dispersed, less organized, and less cognizant of the potential gains from public-private coordination. Under these conditions, the kind of embedded ties with firm leaders that are described by Evans (1995) or Amsden (2001) are unlikely to ever exist. In spite of this, effective information brokerage and regulatory coordination between industries (or portions thereof) and autonomous bureaucrats is not necessarily unachievable. The formation of informational ties that link public agents with key actors

in dense private networks may be as effective the embeddedness of those agents within that network. In the empirical section that follows the effects and limitations of embeddedness are demonstrated by way of formal network analysis.

Bureaucratic Autonomy in Fonart

The ideal type of the Weberian bureaucracy has played a central part in discussions of development. As organizations they are hierarchical, have defined roles for their agents, and well-defined forms of accountability, along with employing agents who share an *esprit de corps* that commits the bureaucrats to each other and the larger goals of the organization. Studies of development have tended to identify the key feature of such bureaucracies as their capacity to resist “capture” by the private sector: their ability to implement rationally designed development policies without the difficult parts of those policies being watered down by resistance to them. The strength of the private sector elite in Latin America – and their ability to undermine the potential autonomy of state bureaucracies in their countries – has been identified as a developmental problem for region more broadly (Amsden 2001). That being said, pockets of relative efficiency and autonomy potentially exist in states where the bureaucracy more typically falls well short of the Weberian ideal (Geddes 1990), and may be effective in their particular area of operation.

While potentially untrue of the federal agency as a whole, Fonart’s National Program for the Substitution of Lead in Low Temperature Ceramics is sufficiently autonomous to withstand pressure from producers that would undermine the program’s efforts toward generating a public good. The program is directed by a *técnico*, who has been involved in the program for 14 years, through major political change at the federal

level, and staffed at the federal level by experienced trainers. The director is himself from a ceramics background and both aware of the challenges facing the sector and convinced of the need to change the conditions under which people labor in workshops (even by more stringent methods than Fonart is legally provided). Believing that the norm is in the best interest of the producers, the Lead Substitution Program has been resistant to calls by artisans to relax the regulation that only lead-free ceramics can be purchased and sold in the Fonart's stores throughout the country, an effort to reward those who are in compliance with the norm. Moreover, the agency has neither control over the norms for lead use (which adhere to international standards) nor the ultimate authority to enforce the norms, there is little threat of abuse of their position by program agents, who largely serve in educational and coordinating roles. Finally, the perspective of Fonart agents is that the restrictions on lead should be enforced outright through fines and seizures, a much sterner line than they have been able to take because regulatory power rests with Cofepris; the agency's role has been to help tutor producers into compliance. In short, there is both a personal commitment in promoting the use of lead-free glaze among the professional staff and little opportunity to benefit personally from ties to individual artisans and producers groups.

To offer a contrast, Casart (Michoacán State Center for Artisan Goods) is a parallel state agency whose lack of autonomy has made it vulnerable to pressures from civil society that negatively affect the goal of eliminating lead use. For example, the director has bent to pressures from reticent ceramics producers to continue selling lead-oxide glaze in ceramics producing villages, at the same time that it is ostensibly working to eliminate its use (Herrera 2011). Casart is a state agency that has been affiliated since

its inception with the UNEAMICH, a union that represents a broad group of artisanal producers that is capable of exerting significant pressure at the state level. Its upper administration – consisting of political appointees – has been sensitive to ceramics producers' claims that the cessation of subsidized provision of lead-oxide will create unbearable economic hardship (Herrera 2011). No comparable national union exists, and Fonart, consequently, faces relatively less organized pressure (See Tandler (2002) on the “devil’s deal” between small firms and local politicians).

Embeddedness and Diffusion

Nearly 200 ceramics producing workshops in the village of Capula, Michoacán were surveyed in an effort to study the network of producer and the dynamics of adoption. According to Fonart, Capula is village that has made earlier progress toward becoming compliant with workplace lead restrictions (about 20 percent, as compared with roughly ten percent nationally), and may thus represent the future of similar villages (Covarrubias 2011). Surveys inquired about a battery of workshop characteristics and production practices, and if and when adoption of the new technology had occurred, as well as asking workshop heads to identify other workshops with which they had contact. An estimated 80 percent of the village population of several thousand is economically reliant on the production of ceramics (Fuentes 2010). Rather than tackle the challenges of sampling from a population that was unknown because of informality, the survey was undertaken on a door-to-door basis in an attempt to incorporate as large a percentage of the population of ceramics producers in the village as possible. Government officials familiar with the village estimated that the nearly 200 surveys represent over three-quarters of the active workshops in the village.

Although Fonart's Lead Substitution Program is autonomous in the sense of being corporately coherent and clearly not "captured" by family workshops, autonomy has clearly been insufficient for Fonart to achieve its goal of curbing the use of lead-oxide. Adoption has not progressed in the absence of a more hands-on role for the agency. While policies banning the use of lead-oxide and broader goal of reduction may have been formulated in isolation from the workshops that those policies would affect, implementation has relied heavily on ties to key actors that are embedded in networks in the producing communities, which allows for the brokerage of information between the agency and among the workshops. In productive clusters, workshops with information brokering ties have made much greater progress toward lead-oxide replacement than workshops to which Fonart agents do not have indirect network ties.

Diffusion of technology and know-how through guided training lies at the heart of the efforts to increase the use of lead-free technology. Fonart claims that, nationwide, several thousand laborers have participated in their lead-free training sessions (Fonart 2009). These sessions are applied: producers bring unglazed wares to finish with lead-free glaze provided by the government and fire them in a variety of kilns, the fuel for which is provided by the agency. This allows producers to experiment with small batches of their goods, with no glaze or fuel costs; the risks and expenditures of experimentation are thus mitigated and producers gain hands-on experience with the alternative technology.

The diffusion of information, however, is very much shaped by the formal networks within the communities that Fonart is attempting to address. The Lead Substitution Program has no permanent presence in most producing communities, aside

from a single embedded community contact person, generally a local resident and producer, with whom the agency has direct contact. In order for the agency to effectively offer training and financial assistance, it must have a method for communicating with communities about these programs, a task that is complicated by the rurality and dispersion of the clusters across the country, the relative isolation of workshops from each other, and low levels of educational attainment. Many ceramics-producing communities have some form of preexisting formal networks of producers.³⁰ In the state of Michoacán, for example, most communities have a union of ceramicists that is officially affiliated with the Casart through the Michoacán State Artisans Union (UNEAMICH) (Acosta 2010). Because unions and other existing groups hold regular meetings and develop systems of spreading information between members, Fonart uses these existing networks as points of linkage with the communities. For state agents, who must impart information about available technology or programs, these embedded local contact people efficiently multiply their capacity to do so. In addition to existing networks, Fonart has also encouraged the formation of new groups of producers (such as requiring the formation of collectives in order to qualify for loans for primary materials) in order to reach more producers with fewer resources. Beyond receiving financial assistance as a group, these small groups tend to have formal meetings as well as regular contact with each other because of shared resources (R. Martinez 2010). All of these formal groupings are of particular consequence when Fonart seeks to advertise a training session or assistance program. Rather than notify each producer in town individually, the

³⁰ In spite of this, most consider the workshops to be quite isolated from each other and the ties between them to be relatively weak (Aguila 2010). Formal groups often include only a small portion of the community's workshop heads, leaving many workshops unaffiliated for a variety of reasons.

agency's community contacts tend to contact people in key positions (union or other group leaders) and ask that the word be spread about a particular training or program (Martinez 2011). Consequently, those who are tied to a formal group are much more likely to be notified than those who are isolated from formal organizations, although unaffiliated workshops may receive information secondhand. A frequent complaint from unaffiliated producers is that they are simply uninformed about programs, speaking to the weakness of this method of spreading information.

Figure 4.1 represents what this flow of information looks like in the productive cluster in Capula, Michoacán both through public-private and inter-firm social ties.³¹ The round nodes at the top of the figure represent Fonart employees (the Director of the National Program for lead replacement and the Fonart director for the state of Michoacán). The bottommost, shaded round node represents the agency's village level contact, who is both a ceramics producer and a part-time employee of Fonart. Each of the diamond-shaped nodes represents a single workshop head who participated in the survey. The community contact sits in the structural hole that separates Fonart's bureaucratic network from the network of workshops in the community, with formal ties up to Fonart agents and down to three leaders of community producers groups (along with several

³¹ Gathering data on the full network was not possible given that the population of producers itself was unknown. Instead data were gathered on personal "ego networks," in which respondents were asked to identify other workshop heads with whom they had contact. Data gathered for ego networks obviously makes the generation of a complete social network problematic; for this reason while I present visualizations of all of the workshops (nodes) and their formal and informal ties, I do not make a more formal quantitative analysis of the full network of producers. This manner of constructing networks assumes that personal networks have remained unchanged over the 10 years since producers have been adopting lead-free glaze. While this assumption is always cause for concern in studies that are time-sensitive, in a small village setting, where population and location tend to be quite stable, kinship and friendship relations are likely to change less than in other settings. That said, the assumption is also motivated by the very real difficulty of collecting reliable time-series data on personal contacts over the past decade through a survey.

informal ties to other workshops).³² Solid lines are indicative of the formal ties that link workshop heads through shared membership in the producers groups, both the village group of the state artisans union and the Fonart-supported small groups; these workshops are clustered near the center of the figure. Dotted lines indicate nondirectional informal ties (typically friends, neighbors, or kin) among workshop heads along with formal ties. These are ties that workshop heads reported when queried about their primary contacts with other ceramics producers in the community and represent the potential for the movement of information through less formal channels.

Among producers, there are four visibly distinct groups represented in roughly concentric circles: 1) those who have formal ties to other producers through formal groups, which are tied by the village contact to Fonart's Lead Substitution Program (clustered in the middle), 2) a secondary group that has informal, weak ties to formally connected workshops (radiating out from the central cluster), 3) those that have ties to other workshop heads but are structurally separated from the formal producers groups, and 4) a group that reports no ties to other workshop heads, or isolates, which appear along the bottom of the figure.³³

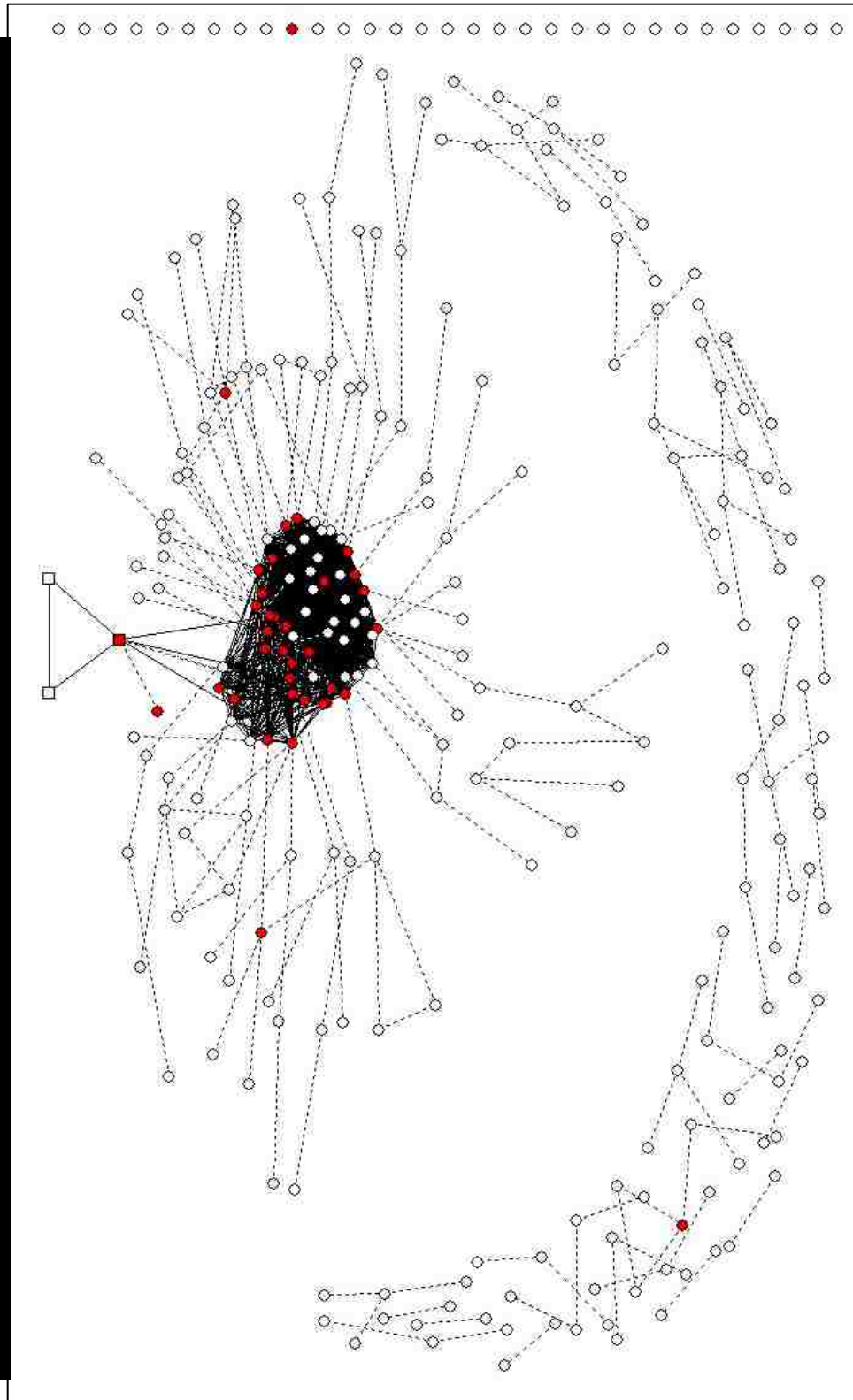
Understanding that each of the ties in the figure represents the potential for (if not actual) flow of information, the most important brokerage relationships are those between the community contact and the state and federal Fonart agents and between community contact and the leaders of the formal producers groups (the head of the artisans union, UNEAMICH, and two leaders of Fonart-supported producers groups). Through this first

³² Clearly there is a much larger bureaucratic network attached to the state-level Fonart representative and the national director of the lead-free program. Nodes for other bureaucrats are not included because surveying of the bureaucracy was not undertaken.

³³ Included in the final group are both those workshop heads who reported no specific ties as well as those who refused to respond to the survey question about informal ties.

relationship, information about Fonart programs is distributed: what kind of assistance is available, when training courses will be offered, when state-level Fonart representatives will come to the village to speak with producers as a group. Through the second relationship, information from or about ceramics producers can be aggregated by leaders of producers groups and passed to the government agents: what the barriers to lead-free adoption they face, what particular interventions they feel are necessary, how frequent and where training courses should be held, and so forth.

Insofar as it is this public-private brokerage that stems from a tie to key actors embedded in the community, these network visualizations offer insight into that relationship. First, they visually emphasize the importance of the community contact, who is both contracted by Fonart and is an independent producer and whose role is to fill the structural hole between local networks of producers and the government agency. Remove his node from the network, and the result is two independent subgroups: public bureaucracy and private producers group. Second, they illustrate the fact that this form of communication is relatively efficient for Fonart: a single embedded village contact can serve as both spreader and aggregator of information without the necessity of having direct ties all of the several hundred workshops in the village. At the same time, however, these figures clearly depict the fact that many workshop heads lack the social contacts necessary to either come into possession of information issued from Fonart and intended for producers in general or to have their particular concerns and ideas aggregated for presentation to the agency. The structure of relations between workshops (or firms), then, affects the extent to which embeddedness is achievable: Fonart agents have little apparent



capacity to communicate with the isolates and detached groups that occupy the periphery of Figure 4.1, while there is a brokerage relationship through the community contact and formal and informal ties with those represented in the center.

Data gathered in the workshop surveys confirms the centrality of the Lead Substitution Program's use of formal networks as points of contact with ceramics-producing communities; it is almost exclusively members of producers groups that receive the direct training that government provides, even though unaffiliated workshops expressed interest in the trainings. Table One shows a very strong relationship between membership in a formal network of producers and receiving training: almost none of the workshops that do not belong to one of the formal producers groups have been trained, while over half of the networked workshops have been. This relationship is in small part a consequence of Fonart's push to have producers form groups, but it is primarily indicative of the fact that those outside the producers organizations have less access to flows of information about sources of informational and production support. A common complaint from unaffiliated producers is that they are not "invited" or do not know about the trainings. Not all who receive these benefits do become compliant (see Table Two), but the survey results indicate that membership in a producers group is very nearly a necessary condition for receiving governmental assistance with compliance.³⁴

³⁴ The number of workshops reported in Tables One and Two differ because the relevant number of respondents differed. Of the 175 workshops who provided complete data, some 40 reported producing raw, unglazed, or high-temperature pots, making them technically compliant with restrictions on lead-oxide, although not because they upgraded to the new technology. For this reason n=136 in Table Two. Table One reports all complete responses because all are eligible for training, regardless of product.

Table 4.1: Membership in Formal Producers Network
as a Predictor of Training

		Formal Network	
		No	Yes
Recipient of Training	No	120 96.8%	22 43.1%
	Yes	4 3.2%	29 56.9%
Pearson $\chi^2 = 67.9$, $p = .000$ N = 175 (total interviewed workshops)			

Table 4.2: Training as a Predictor of Compliance
with Restrictions on Workplace Lead Use

		Training	
		No	Yes
Compliant with Lead Regulations	No	96 90.6%	16 53.3%
	Yes	10 9.4%	14 46.7%
Pearson $\chi^2 = 22.3$, $p = .000$ N = 136 (interviewed workshops that use glaze)			

Visually, the location of workshops in the network is key to which workshop heads receive training and which do not. In Figure One, those workshop heads that have been trained are shaded, and appear, for the most part, among the dense formal connections at the center of the network. In short, although ultimately each of the family workshops is responsible for itself, local contacts that are embedded in producers groups have been used by both federal agencies as multipliers for the contacts they make and the information and support they disseminate. This is reflected by the fact that over 95 percent of recipients of outside training are members of a formal network of producers. In

this sense, formal producers groups have been crucial to Fonart agents' efforts – if not to embed themselves in the producing communities – to use reliable ties to actors who are embedded in order to broker information about the use of lead-free glaze and mitigate the costs of adoption for workshops.

While the upper left quadrant of Table 4.1 – which shows nearly two-thirds of workshops without formal training in lead-free technology – may be troubling, it is relatively easy to understand: the network visualizations show that, overall, family workshops in community are not densely connected through formal producers groups. However, the group that has tended to be more frustrating for Fonart is represented by the lower left quadrant of Table 4.2: the roughly half of workshops that have been formally trained but remain incompliant with restrictions on the use of lead. It is this group that underlines the importance of reliable market information that assures producers new technology represents an improvement over the old – along with the government's potential limitations on providing it.

For family workshops that have used the same glazing process for generations, the knowledge that the lead-free technology actually represents an improvement over the traditional glaze has been a secondary informational hurdle to adoption.³⁵ Even for producers who have been trained, informational uncertainties still surround the adoption of the new glaze, which stem largely from the producers' weak market position (Dietz et

³⁵ For most producers, “improvement” has a primarily short-term economic connotation: their goods can be produced more efficiently or for less and sold more broadly or at higher prices. Very, very few of the interviewed workshop heads indicated any interest in the long-term health or environmental externalities associated with the use of lead.

al 1991).³⁶ As described in Chapter 2, the primary outlet for ceramics producers is through *acaparadores* who re-sell in markets around the country. The relationship to these resellers – in which their goods are relatively easily replaceable by those from another workshop – makes alteration of their productive practices risky. While Fonart has made an effort to make the transition to lead-free glaze a commercially viable and certain option, its efforts in this respect have been far from successful. The agency purchases verifiably lead-free products from producers who request the service and markets the products in Fonart shops around the country; there are, however, limitations on how much and how often Fonart can purchase their goods. Since artisans tend to use sales to the agency only as an occasional supplement, the intended financial incentive of this outlet carries very little weight with workshop heads. In short, the structure of production and market for these goods perpetuate uncertainty about the upgrading, which modest government efforts at commercialization have failed to address. Without the commercial viability of the endeavor assured, government efforts to increase compliance through the diffusion of knowledge regarding lead-free glaze through formal networks have been only partially successful.

Without exception, in Capula those who have adopted the lead-free glaze identified their motive as economic (rather than based on health, environmental, or other concerns). In open-ended interviews, many adopters also indicated that they had committed to upgrading after seeing someone close to them make the transition successfully. The majority of workshop heads report little explicit sharing of detailed production information between workshops; however, it seems likely that these informal

³⁶ This is consistent with the notion that the solution to one barrier may simply reveal another sticking point and that, consequently, a sequential or experimentalist approach may be the most appropriate means of pursuing development (see Sabel 2004; Rodrik 2004).

ties allow producers to monitor the general behaviors of the workshops they have ties to (whether or not they have upgraded, if their goods seem to be selling, if their fortunes have changed greatly, etc.). As such, informal ties between producers seem to act as important conduits of information about the commercial viability of lead-free production, transmitting the knowledge that the lead-free glaze represents an improvement over historical methods. This impression is supported by statistical analysis of the workshop survey from Capula, Michoacán.

The workshop survey, in addition to its other objectives, gathered information about the possible explanatory factors for which workshop heads might chose to upgrade. These data include the number of workers regularly employed in the workshop and the amount of production, based on the amount of clay used on a monthly basis. The workshops that use less primary material tend to be those that add greater value to their products by dedicating more effort to producing high quality products, suggesting that more production size may be inversely associate with willingness to upgrade. Typically, levels of experience and education (i.e., measures of human capital) would be expected to correlate positively with the capacity to upgrade or adopt innovations. In this case, where the technology is very simple and barriers to adoption appear to be primarily informational, human capital is less likely to play a role. Data were also gathered about whether the workshop had received external training or financial assistance, again, both of which are provided primarily through formal producers groups.

Finally, in order to gauge the effects of informal networks, workshop heads were asked to identify other workshops with which they had contact. A “personal network exposure” (PNE) figure was calculated for each workshop head based on the “alters” they

identified and the workshop heads that identified them (Valente 1995). The PNE consists of the ratio of each workshop head's contacts that had adopted lead-free glaze prior or in the same year. The PNE, in other words, is an effort to capture the level of exposure to successful innovators experienced through informal personal networks. Initial results from the community survey bear out the importance of personal networks. Producers who have adopted the technology have much higher mean PNE (.37) than those who have failed to upgrade (.04) ($p < .01$). A similar relationship is visible if limited to the producers who have been formally trained (see Table Two): mean PNE of those who went on to adopt is .38 and .11 for those who have not ($p < .05$).

Incorporating a broader array of the characteristics of the workshop and workshop head, Table Three reports the results (both coefficients and marginal effects) of a multivariate probit regression that models the likelihood of adoption of lead-free glaze.³⁷ Training in lead-free methods – for which a near prerequisite is membership in a formal producers group – and higher rates of exposure to previous adopters through informal personal networks are both found to be strong predictors. Other workshop characteristics – with the exception of amount of raw materials consumed – are found to have no significant effect on the workshop head's decision to adopt the lead-free glaze. Production size is likely to be negatively associated with adoption because those whose strategy is to focus on smaller but higher quality firings are more likely to experience direct market pressure from exporters or foreign buyers than those who produce in bulk primarily for the domestic market.

³⁷ See Appendix for definitions of variables used in the probit regression, descriptive statistics, and correlation matrix.

The regression results underline the importance of both participation in one of the training courses offered through formal producers networks as well as informal relations in a network of ceramic-producing neighbors, friends, and extended family that contains early adopters. Even among extended family and friends little information about production flows between the workshops, so rather than the kind of technical information that is disseminated through the training courses, the informal networks allow monitoring of slightly more public information: have other workshop heads one knows adopted lead-free glaze, and, if so, do they seem to be successfully marketing it? This firsthand information about the viability of the glaze may not be technical, but as long as the technology is only being slowly picked up by early adopters, it may be more difficult to obtain and no less important.³⁸

³⁸ Diffusion of innovations are often seen to follow an S-curve in which rates of adoption are slow at early stages, then increase, and then decrease again as the last hold-outs adopt (Valente 1995). In Mexico, where an estimated ten percent of ceramicists have transitioned away from lead-oxide glaze, those who have are very much “early adopters.” Even in a village like Capula, Michoacán where almost 20 percent have adopted the diffusion is still very much in the early stages, although anecdotal information suggests that the rate of adoption may be increasing in such villages.

Table 4.3: Probit Regression, Adoption of Lead-Free Technology

	Coefficient (Std. Error)	Marginal Effects
Training (bivariate)	1.34 ** (.47)	.32 * (.14)
External Financial Assistance (bivariate)	-.47 (.49)	-.06 (.05)
Number of Workers	-.01 (.16)	.001 (.02)
Amount of Production	-.03 * (.01)	-.004 * (.001)
Years of Experience	.002 (.01)	-.000 (.002)
Education Level	.56 (.35)	.09 (.05)
Personal Network Exposure	2.50 ** (.74)	.39 ** (.15)
Constant	-1.61 * (.79)	
n	134	
LR χ^2	49.1 **	
Pseudo R ²	.40	
** p <.01; * p<.05		

NGO and International Support

As a final note to state-led efforts to diffuse the lead-free glaze developed under Fonart's auspices, brief mention should be made of an alternative effort led by a non-governmental organization and underwritten by international development agencies. Barro sin Plomo (Clay without Lead) was established as an alternative organization to diffuse the lead-free glaze, and differed significantly from Fonart in approach.³⁹ BSP's strategy for diffusion was significantly different from that of Fonart, particularly in that it

³⁹ Disagreement over the means by which the technology should be diffused to workshops and the efficacy of Fonart's nascent efforts reportedly led to the formation of the NGO, the founders of which had been involved in Fonart's efforts to generate the lead-free glaze as described in Chapter Three.

avored “depth” over “breadth.” The organization’s agents understood very well the economic motives for updating and made one of the centerpieces of the group’s efforts its role as a commercial outlet for the goods produced without lead. When they identified a workshop that was potentially interested in adopting the lead free glaze, the organization would set up an inspection and remediation of lead in the of the workshop, often help construct a new kiln, work at length training the family members in the use of lead-free glaze in their own workshop, and then order and purchase lead-free products from them on an ongoing basis (Aguilar 2010; O’Leary 2009).⁴⁰ In short, the organization’s focus was intensive but narrow, very effective at improving the production of the workshops they worked with, but extremely limited in scope (perhaps several dozen workshops).

BSP representatives were typically dismissive of the shallowness of Fonart’s interventions – providing training without a great deal of follow-up or a means of marketing lead-free goods (beyond Fonart stores) – and the two did cooperate very little in spite of their common goal (O’Leary 2009). BSP operated in Mexico as part of a transnational group of NGOs (Aid to Artisans) and development agencies (USAID, World Bank) and private funders (American Express Foundation). Even with the financial support it received internationally, and the somewhat high profile it developed internationally, its reach was limited to a few producers in a handful of communities primarily in Michoacán (the NGO’s base of operations in Mexico). Workshop by workshop, those BSP trained and worked with are more likely to have adopted lead-free glaze but the absolute number that they worked with was far smaller than those trained by Fonart’s Lead Substitution Program. However, the NGO has ceased its operations in

⁴⁰ It is unclear exactly how BSP picked the participants in its program. Most of those who worked with the NGO appear to have already been relatively high profile in their communities as skilled producers previously, so they may have been approached on that basis.

Mexico, seemingly as a consequence of the incapacity to make its model of diffusion work, and it is relatively clear that it would never have reached the scale necessary to train workshops nationally.

Conclusions

For the Mexican government, the decision to engage in the promotion of lead-free glaze was motivated by both health and economic developmental concerns. The substantial role the government has adopted in helping develop and diffuse an alternative technology has been an alternative to a more hands-off approach to production and a more punitive approach to regulation of workplace exposure lead. Given the barriers faced by the workshops as a consequence of their relative isolation, production practices, and manner of training and learning, it seems likely that a strictly punitive approach to enforcement of restrictions on lead would indeed result in the loss of jobs in many remote and already marginalized communities throughout central and southern Mexico. At the same time, these same conditions would mean no upgrading in the case of government inaction, and, consequently, continued downward pressure on artisanal ceramics producers. The government-led efforts to promote upgrading to lead-free glaze have been aimed at avoiding both of these outcomes by creating a more competitive and safer industry. Where these efforts have begun to be successful are in areas where the relatively autonomous Fonart has been able to engage actors embedded in local networks, allowing for effective brokerage of information both between producers and government agents and among producers.

Insofar as bureaucratic embeddedness or reliable ties to embedded actors is the source of the capacity to broker information across the public-private divide, rather than

necessarily a source of competing loyalties, it is more coherent as a concept that its critics have allowed. This is obscured in studies of embedded autonomy that focus on sectors with a fewer and larger firms, where the relations between bureaucrats and private sector actors are few enough that they appear to be more than informational conduits.

Realistically, for bureaucrats in agencies of limited means facing the prospect of coordinating with thousands of micro-firms, the formation and utilization of contacts with actors who are embedded in the productive communities is a more manageable strategy that can allow for the same beneficial information brokering. Institutional relations among bureaucrats, professional inter-workshop contacts, and regularized public-private contacts, though all capable of brokering information, are distinct types of ties that are neither competitive with one another or mutually exclusive. The emphasis on the informational role of embeddedness offers an opportunity to focus the use of the concept of embedded autonomy on patterns of observable informational ties and on how those patterns affect outcomes in a falsifiable manner. Here, this has allowed for the identification of a distinct pattern of relations, as demanded by the nature and number of the firms in the sector.

The emphasis on ties to embeddedness as an enabler of informational brokerage allows for more specific policymaking recommendations, especially regarding the use of existing networks of producers and the strategic formation of others. As the network visualizations and quantitative data presented here emphasize, the strategy behind the use of formally organized groups as points of articulation with the community allows for the bridging of the structural holes between agencies and networks in the private sector. For family workshops producing simple goods, “professional” isolation and semi-informality

is the norm and the relational landscape between workshop heads is dominated by holes rather than informational ties. The broader Mexican context makes this necessity even more stark. Fonart estimates that there are ceramic producing clusters in over a hundred communities spread throughout 26 of the 31 Mexican states, almost none of which have any meaningful contact with one another. The consequent necessity of using community contacts, liaisons, or street level bureaucrats to broker with existing networks of producers is clear, whatever the nature of those networks may be (union, cooperative, etc.). While perhaps not ideal, this approach may be one of the few methods available to motivated and autonomous state agents limited by budgets and a lack of existing institutional ties to producers to embed themselves in the private sector they seek to affect.

The shortcoming, naturally, is that the in-group dynamic also produces a systematically excluded out-group. In other words, the boundaries of these formal networks – where the ties of formal affiliation end – are also the limits of embeddedness and, thus, the limits of upgrading. As long as existing networks of producers remain the primary means by which the bureaucrats link to the private sector to diffuse information about production, this in-group/out-group division will likely continue to pose challenges for sector-wide upgrading as structural holes will continue limit the information available to unaffiliated producers. The augmentation of formal producers groups or the formation of new ones (as in Fonart's program that requires the formations of small groups to receive financial assistance) is a means by which the agencies might reduce the scope of the problem. Fonart currently generates the incentive to form small producers groups by offering financial assistance to create primary material banks, where members can

purchase subsidized inputs. As the inter-workshop ties in small, newly-formed Fonart groups are apparently as effective at passing information between as the ties in the pre-existing union (a vestige of corporatist rule), the case for active efforts to build producer networks as a means of raising the informational capacity of public-private ties is strong. This latter point foreshadows the arguments made in the following chapter about the formation and nature of the networks with which Fonart seeks to work. In short, it is the existence of formal networks that is important to the agency, rather than the original political or economic rationales for their formation.

Bringing the informational role of embeddedness to the forefront also allows for the brokering function of embeddedness to be more carefully observed; this study suggests that methods designed for the analysis of social networks may be particularly suited to this task. The empirical portion of this paper relies on very basic applications of social network analysis methods: workshop surveys, network visualization, and basic ego-network calculations. Although scarcely scratching the surface of available tools for network analysis, the analysis of the ties and informational flow in the Capula ceramics cluster illustrates the potential rigor that these methods may bring to bear on the analysis of state-society relations. A central complaint facing the application of the concept of embedded autonomy has been the difficulty demonstrating where embeddedness exists, where it does not, and where it may exist to a limited degree and linking those conditions to falsifiable claims about the effects of embedded autonomy. Network analytic methods offer the potential to overcome that pathology by concretely identifying where structural holes exist, where bridges are able to affect the brokerage of information between public and private actors, the nature and extent of ties between private actors, where key players

are (or could fruitfully be) located in the network, and so forth. There is a long list of other potentially meaningful specifications of embeddedness that may be clarified with network analytics. For example, demonstrably denser informational ties between an agency and the private sector might be shown to be a more effective structural arrangement than the reliance on ties with a few keenly located representatives (as in the Capula cluster or Silva's Chile). The methodological approach is likely to be especially beneficial in the developing world where contacts between the state agencies and private sector and between firms and between firms themselves are often not systematically documented.

Finally, the case of upgrading ceramics production in Mexico underlines the notion that the enforcement of regulation can improve rather than impede the competitiveness of targeted industries. Although the short term costs and uncertainties associated with upgrading to lead-free glaze are discouraging, for Mexican ceramics producers ultimately the key to accessing global markets lies in using a technology that meets the quality standards of the developed world. Moreover, defending their domestic market against imported ceramics, plastic, and metal ware will best be achieved by lowering production costs, which is also be achieved in part by adopting the less expensive lead-free glaze. This case is not alone in running counter to the belief that improved working standards are more costly and therefore antithetical to survival in the face of global market pressures. This is broadly true of labor-intensive industries in the developing world, where poor, isolated producers are likely to use older, less efficient, and often dangerous technologies. Like the Mexican ceramics workshops, these producers face myriad informational barriers and short-term uncertainties that prevent

them from adopting improved technologies, even when those are non-proprietary. Under these circumstances, regulation that prods producers to upgrade their technologies is likely to improve the quality and costs of their goods as well as the working condition under which they are produced. For sectors that are primarily faced with informational barriers to upgrading, what Schrank and Piore (2007) call a tutelary, rather than simply punitive, approach to coaxing producers into compliance is appropriate. In this scenario, consistent with the information-brokering role of embeddedness, regulators can use their ties to private industry not to simply punish noncompliance but to diffuse information necessary for upgrading.

Chapter 5

Friends, Family, Colleagues, Competitors: Overlapping Networks in Ceramics Clusters

As Chapter 4 makes clear, established contacts between the government and formal networks of private producers have allowed for the dissemination of information about and participation in Fonart's lead-free training program, which has meant that the preponderance of those trained are members of a formal producers group. This finding that formal networks have played such a critical role in the diffusion of the critical lead-free technology underlines the question of what the nature of those formal ties is in ceramics producing clusters. How do we think of these networks of workshops? Are they a consequence of geographic proximity, as some of the literature on production in clusters has suggested? Or are formal relationships forged by some other means? How are formal and informal relationships related? What role do the workshops themselves play in the formation, expansion, and maintenance of formal organizations? Based on the narratives of the formation of the formal producers groups that currently operate in three of the most noted ceramics clusters (Capula, Michoacán; Santa María Atzompa, Oaxaca; and Zautla, Puebla), the chapter argues that in spite of the fact that government sponsorship has been critical to the formation of their formal organizations, these organizations are largely undergirded by informal social ties between producers. This is supported by data from individual workshops from the survey in the Capula cluster. As such, the formal producers groups exist in part as codifications of informal ties, a form of organization that is more "visible" to the state. Building on a more sociological understanding of how information moves unevenly in productive clusters (as opposed to

the more economic assumption of uniform flows), the final portion of the chapter argues that the nature of this unevenness can be engaged and even shaped partially by state agents. These questions are of theoretical importance to studies of business organization that have focused on the relations between firms and the state and to the scholarship on innovation and the behavior of firms in clusters.

The chapter first advances through parallel narratives that describe the formation of the producers organizations in the three clusters in question. The portion following the narratives extracts three salient similarities between the clusters: their incentives for group formation, the insider/outsider dynamics, and their constitutional reliance on informal relationships between producers. The third major section draws these findings into the discussion of networks and innovation in productive clusters and attempting to “bring the state back in” to innovation within clusters.

The Constitution of Three Producers Organizations

As noted in Chapter 4, formal groupings of producers within the ceramics producing clusters have been critical parts of Fonart’s strategy to promote the adoption of lead-free glaze. It is these formal groups that are the points of articulation for the agency and that allow for the information about training programs to be disseminated and coordinated and for information to be passed from producers back up to the agency. The key feature of the formal groups that Fonart has made contact with in the communities is that they are precisely that: formal. This implies that they are established, have relatively stable memberships, have clear requisites for admitting new members as well as internal rules governing the behavior of the members and the group as a whole, they have regularized meetings or forms of communication, and they generally have some form of

leadership positions. By design these characteristics ensure the movement of information among the members of the groups, which is particularly important for the diffusion of information. However, their presence as organized groups with regularized meeting also makes them “visible” to Fonart (or other state agencies). The formation of these groups that Fonart has used as points of contact differs from community to community, as the following narratives demonstrate. In spite of the differences in the manner in which they were constituted, the incentives for formation and several of the key dynamics are consistent.

Capula, Michoacán. In Capula, and throughout the state, the Unión Estatal de Artesanos de Michoacán (UNEAMICH) is the dominant formal organization. It originated as an effort by the then dominant Institutional Revolutionary Party’s (Partido Revolucionario Institucional (PRI)) nation-wide corporatist project that it had pursued since the 1930s. The Casa de las Artesanías (Casart) was founded in 1970 as a state-level analog to Fonart and was dedicated to the distribution of assistance in the form of credit and subsidized materials, the organization of fairs, and the purchase of artisanal goods for resale. Under the gubernatorial administration of Cuauhtémoc Cárdenas, which began in 1980, the artisans union was officially established under the auspices of the Casart; at the same moment, the state agency took on the role of issuing credentials to the artisans, which were required to receive the benefits Casart distributed. The organization was done by local representatives of the PRI and Confederación Nacional de Campesinos (CNC) along with agents from Casart (and, by some accounts Fonart) (Dietz 1994).⁴¹ Although

⁴¹ Although the involvement of the CNC may seem curious, because they also traditionally had fields in which they grew corn and beans, ceramics producers were classified as *campesinos* (“peasants”). Under corporatist PRI rule, rural areas were organized by the CNC, which was the means by which goods were distributed from the government and electoral support organized. As

only organized at the state level, UNEAMICH was clearly part of the corporatist structure that was built up and reinforced in the post-Revolution.

As with corporatist structures in Mexico, UNEAMICH was strained by the diversification of political parties in Mexico, which essentially decoupled the relationship between resource provision and electoral support. UNEAMICH's critical moment came during the 1988 presidential election. Cuauhtémoc Cárdenas and allies announced the formation of the *Corriente Democrática* (Democratic Current) within the PRI, in part to promote a more open process of selecting candidates for office, and was expelled from the PRI. Cárdenas in turn ran for president under as the candidate from the coalition *Frente Democrático Nacional* (National Democratic Front) against Carlos Salinas, the PRI candidate. Many state residents, including artisans, felt they owed their allegiance to Cárdenas himself and to the broader project of *cardenismo* begun by his father, rather than to the PRI, Cuautémoc's erstwhile political party. Their efforts against the official party violated the understood relationship between the artisanal sectors and the party drew the ire of the PRI, which maintained control of the state government until 2002.⁴² The "witch hunt" ("*cacería de brujos*") that followed took a serious toll on organization within Michoacán ceramics clusters, dividing producers against each other and laying bare the political nature of the UNEAMICH.

As the two major organizing principles of life in Michoacán – *priismo* and *cardenismo* – diverged, UNEAMICH was caught somewhere in the middle, no longer

discussed in greater detail, it is possible that the formation of the UNEAMICH was a response to the weakening position of the CNC in the countryside.

⁴² The successor of Cuauhtémoc Cárdenas, Luis Martínez Villicaña, sided with Cárdenas and even attempted to recognize him as the legitimately elected president in the 1988 election, which led in part to his removal from office by the PRI under pretense of a federal appointment (the minor Federal Director of Bridges).

unified in support of the PRI. Funding distributed through the Casart was reduced by the PRI state government and many of its programs in the communities began to unravel. Membership in the union at the local level became politically sensitive, and, according to accounts by interviewees, became much less programmatic and much more personal and cliquish. Membership declined precipitously in communities around the state; in Tzintzuntzan, for example, between 1988 and 1990, membership fell by approximately half. Nevertheless, as an organization UNEAMICH has survived in this changed form through the present. It has maintained its ties to the Casart, and its members still occasionally receive support from the agency in the form of subsidized materials and purchases of products, as well as being able to participate in fairs (*tianguis*) organized by the Casart.

Membership in a local branch of the union is technically open to any artisanal producer in Michoacán. Moreover, any other formal group of producers can apply for affiliation with the Casart and gain the same status as UNEAMICH (Acosta 2011). In practice, it is unclear whether union membership is that open as interviews suggest that the local leader has a great deal of say in the matter, that there are ways of discouraging unwanted producers from applying for membership in the group, and there are no other ceramics producing groups affiliated with Casart. Membership remains relatively stable, and, as discussed below, the occasional new member appears to have prior informal ties to members of the group.

Santa María Atzompa, Oaxaca. A more recently formed and geographically limited formal organization is the Unión de Artesanos y Alfareros de Santa María

Atzompa in the state of Oaxaca.⁴³ Although there is a lack of clear documentation about the exact reasons for its formation, it was undertaken under circumstances that are suggestive. Around 1990, an estimated 90 percent of the population of Atzompa was economically reliant on the production of ceramics (Thieme 2009), much of the production being glazed with a green lead-oxide glaze common in the area.

Thieme (2009) documents at the community level the problems generated by the dual problems of the opening of the Mexican market to international trade and rising concerns with lead (as discussed more broadly in Chapter Two/Three). At the same time, tourism to Oaxaca was increasing and tourists more frequently exploring the areas around the capital city, where Atzompa is located. Before this period, the purchase of ceramics produced in Atzompa was overwhelmingly dominated by resellers, who took the goods to Oaxaca City or to other markets to sell. Very few made the very short trip to Oaxaca City to sell in the markets themselves and direct sales to clients in the village were uncommon (Thieme 2009).

It was in this context that the Union was formed with the sponsorship of the Oaxaca Secretaria de Turismo y Desarrollo Económico (STYDE) in 1991. Some 70 workshop heads were invited to join, of which approximately two-thirds did. Existing conditions (stagnating sales, loss of income to middlemen, and increasing tourism) had produced an interest in direct sales, so with funding from STYDE, along with federal contributions, the group constructed a market building in the community where members could sell their own products directly to clients passing through the village. The sale of goods continues to be dominated by re-sellers, but direct sales have allowed members of

⁴³ In a state known for its indigenous population, 19 percent of the residents of Santa María Atzompa are classified as indigenous, with about half that number actually speaking the Zapotec language (CDI).

the Union to diversify their sources of revenue and earn higher profits for the products they manage to sell directly.

The primary “selective benefits” of membership in the organization have in the past and continue to stem from its affiliation with the state of Oaxaca’s STYDE: the assistance with the original market building in the community and continued support in the form of small financial assistance and information. The benefits of membership in the organization have lead the group to grow in size from about 40 shortly after its formation to about 120 currently (Thieme 2009), out of an estimated 500 workshops. It is unclear to what extent the organization is technically open to new membership, because limitations on the number of stalls available in the market building generate a practical ceiling on the number of members who will be permitted in the Union.

Zautla, Puebla. Very recently formed formal organizations of producers are found in the municipality of Zautla, Puebla, the location of several ceramics producing communities, one of the highest concentrations of ceramicists in Mexico. Historically, the area appears to not have had formal organizations dedicated to the particular needs of ceramists. This changed in 2008, when the first non-PRI president of the municipality, Enrique Iglesias Contreras, came into office seeking to correct what was perceived as the PRI’s programmatic neglect of more rural residents in favor of the residents of the more urban communities in the municipality (particularly Santiago Zautla, the municipal seat, and San Miguel Tenextatiloyan) (Contreras 2012).

As part of this broader developmental agenda Iglesias undertook the task of organizing the ceramics producers in the municipality into voluntary formal organizations. He put out a general call to ceramicists to organize themselves into groups

of 15-20 members, placing importance on the geographic proximity to each other that would facilitate group meetings and communication as well as the distribution of support and materials that are difficult to transport. All told, about 1,100 people organized into some 80 small groups; as part of becoming legally constituted, each was required to establish its own internal rules for meetings, for accepting new members, sanctioning misbehavior, and the like, and was required to have to at least monthly meetings (Borgoneo 2012).

As someone with experience in the ceramics sector himself, the municipal president felt that isolation was detrimental to ceramics producers and left them at the mercy of *acapardores* for the marketing of their goods; however, the impetus to organize workshops in the sector was also clearly related to the distribution of government resources. Specifically, the organizational effort was part of an effort to bring resources to the ceramics workshops from federal agencies.⁴⁴ For example, as Zautla is largely indigenous, with some 59 percent of the municipality's residents classified as ethnically indigenous (Nahua) and 35 percent of the population as speakers of Náhuatl.⁴⁵ The federal Commission for the Development of Indigenous Communities (CDI) offers

⁴⁴ The phrase interviewees used in speaking about this process was to "*bajar apoyos*" or "*bajar recursos*," literally to "bring down" support or resources. The phrase itself is telling: subnational governments (states, and, to an even greater extent, municipalities) are dependent on the federal government to provide revenue to operate; while much is meted out by formula and earmarked for particular purposes, other forms of funding from federal agencies are provided by application. To "bring down" resources, then, implies a strategic effort to extract funds from governments at a higher level of aggregation. The capacity to do so may be seen as an important skill for elected local officials. For example, some advertisements in the municipal buildings touting the accomplishments of the Zautla municipal administration brag that they come from 100 percent federal funding; given that it is unlikely that a PRD administration would advertise this on behalf of the PAN-controlled federal government, it seems to be a statement about the municipal administration's capacity to make effectively represent the residents' needs to the federal government.

⁴⁵ There is much variation in the ethnic makeup of the municipality, as discussed in much greater detail in Chapter 6.

assistance to small producers, but they must belong to a legally constituted formal organization that is recognized by their local government. The Iglesias Contreras administration promoted the formation of the small organizations in Zautla and assisted their applications for support from the CDI. Applications made during the administration 2008-2011 brought in clay mills (*molinos*) for processing dried clay into powder and mixers (*batidoras*) for reconstituting and preparing clay powder for working. The current municipal administration of Victor Manuel Iglecias Parra (2011-2014) has continued to encourage the groups to obtain assistance from the federal government, including from Fonart (see Chapter Six for more developed discussion), which was provided training in lead-free methods and financial and logistical support for obtaining gas kilns.

Incentives and the Dynamics of Group Formation

There are several points to be drawn from these three brief descriptions of formal organizations in Michoacán, Puebla, and Oaxaca. Despite the fact that they are all formal producers organizations in the sense that they are legally constituted groups with regular meetings, rules for operation, and established modes of communication, there is a great deal of variation among them. They differ with respect to when they were formed, from being tools (and now vestiges) of the PRI's corporatist machine to being very recently constituted organizations. The original rationale behind their formation also differs: as a part of the corporatist exchange between the PRI and Mexican civil society; as an effort to assist producers in adjusting to changing markets; or as an aid in the extraction of funds and resources from higher levels of government that have revenue streams. Fonart itself has also begun to promote the formation of groups of producers by requiring applications for credit and aid for material inputs to be made by groups of producers who

must later manage the distribution of the materials amongst themselves (in so-called *bancos de material prima* or primary material banks) (Enciso 2012). They also differ greatly in size, from an average of roughly 15 members in the small groups in Zautla to around 100 member workshops in the union group in Atzompa and the community of Capula (although the entire UNEAMICH has a much larger membership base).

Incentives for Organization. Despite the variation between the formal groups, there are a number of important features of the major formal organizations that are consistent. First, although they all rely on voluntary participation, the impetus for their formation has tended to come from “above” (i.e. from state or federal government) and the “selective benefits” (Olsen 1965) of group membership are typically provided at least in part by state agencies (market spaces, cheap credit, grants, and so forth). This is wholly consistent both with the widely-held notion that these workshops are not easily organized and appear to have no natural inclination to cooperate with one another (e.g. Foster 1967; Dietz 1994). While some have suggested that the difficulty in organizing these workshops is a consequence of lack of education or some kind of *campesino* backwardness (Foster 1967), the fact that small businesses of all kinds face difficulty organizing undercuts the notion that this is characteristic of the mentality of ceramics producers. The logic that underlines the barriers to spontaneous self-organization among ceramics producing workshops, in other words, is the very same that prevents it from occurring in small and micro-firms more broadly.

Shadlen (2002, 2004; see also Offe and Wiesenthal 1980) argues that small firms are typically less able to overcome the barriers to collective action than either large businesses and entrepreneurs or workers. Although these ceramics producers do operate

in the same sector, they confront three of the barriers that Shadlen identifies: isolation, competitive pressures, and an incapacity to fund the selective benefits provided to members of the organization. As discussed in (Chapter Two), the home workshops in question have a tendency toward isolation, if not geographic then certainly intellectual isolation. Teaching and learning are done in vertical fashion within the home in the craft tradition, and there is little in the way of inter-workshop consultation and coordination.

Competitive pressures stem from the manner in which goods are marketed, being sold in large part to bulk re-sellers. These *acaparadores* are many fewer than the producers themselves, creating an oligopsony for ceramic goods at the level of the cluster. Most producers tend to have ongoing relationships with their buyers, who make orders to be filled and sometimes provide monetary advances to pay for the necessary inputs (clay, pigment, and glaze). In spite of these ongoing relationships, many producers feel – and are apparently correct in their sentiment – that their goods are easily replaced by those of the workshops around them. This belief is accompanied by a corresponding belief that specifics about production must be guarded from other workshops. In short, it is very common for workshop heads – even those who are neighbors and extended family members – to maintain distance from each other in manners related to production, complicating professional organization.

Funding the selective benefits of membership is perhaps the largest impediment group organization. Without some benefit to membership, most are loath to tie themselves to organizations that are unlikely to produce some material benefit (or whose social, political, or economic costs outweigh the benefits). However, ceramics workshops operate on a thin margin and the blurring of the distinction between family/business

funds creates disincentives for business investment (as discussed in Chapter Two).⁴⁶ Consequently, formal organizations that consist of these workshops have little capacity to provide their own selective benefits. This is consistent with Shadlen's (2002, 2004) argument that groups with larger firms (either exclusively or in part) are better able to provide benefits for members. Ultimately, not only does this inability affect the maintenance of a cohesive organization – witness UNEAMICH's partial unraveling with the reduction of benefits to members – but also makes it highly unlikely for them to organize solely based on their own volition. So, whether vestiges of the corporatist era or more recent efforts to assist producers (probably with political ends), ceramics producers groups are typically encouraged or enabled by government actors who are in a position to provide some form of benefit for membership. Often the benefit may not cost the group's sponsor much – a stall in the village's artisan market or the right to sell at *tianguis* – but the externally provided benefit is omnipresent.

Insider/Outsider Dynamics. The second salient similarity between these groups is that, as with all in-groups, there is a corresponding out-group, which in this case consists of workshops that are not affiliated. Each of the organizations discussed here represents only a fraction of the producers in the cluster, perhaps only as much as a quarter of the workshops in each of the areas. Although the leadership of the formal producers groups tend to make claims about the openness of their organizations to new members (Fuentes 2011), in practice, it appears that members are accepted on a much more restrictive basis. Specifically, because of the sense of competitive pressures on the

⁴⁶ Workshop heads in Michoacán frequently cited the mandatory monetary contributions (*colaboraciones*) required from members as reasons for not participating, even though these contributions – which are said to be for administrative costs – are estimated at only about 10-20 pesos per month (roughly .80 – 1.60 USD) (Acosta 2011)

workshops described above, the limitations of the groups' selective benefits are keenly perceived. Perhaps the most concrete examples of this are in Capula and Santa María Atzompa, where membership literally provides physical space in a market building and at seasonal markets where goods can be sold. Space is limited, so each new member admitted to the group is perceived as reducing the area of the market available to each member and there is, therefore, a strong incentive to keep membership levels stable. Based on interviews with unaffiliated workshop heads – both those who desire to be affiliated and those who do not – membership is only provided to those who are favored in the eyes of the organizational leadership. As one respondent in Capula put it, in the union “*hay mucha mafia,*” indicating that membership is based on a cliquish concern with who one knows, is related to, and gets along with rather than openly available to all producers. For the newer, smaller groups in Zautla, a similar insider/outsider dynamic is visible. These formal groups, after all, were explicitly formed among people who were already known to each other and who then established the rules that govern the admission of new members. These rules often require majority approval, ensuring that new members meet the approval of the existing members and that petition alone is not enough to become a member (Borgoneo 2012). In short, in each of these cases there is a strong division between members and non-members, and those boundaries tend to be more rigid than the formal producers groups tend to admit.

As suggested above, the issue of membership is tightly linked to the provision of selective benefits. Members of the producers groups are the potential recipients of goods that are excludable by membership and tend toward being non-rivalrous (i.e. “club goods”). In the cases of Capula and Santa María Atzompa, the limited nature of the

primary selective benefit (i.e. locations for direct marketing) creates incentive for tightened access to membership. As long as membership in the organization does not exceed the capacity to provide members with a permanent *puesto* or access to seasonal markets (*tianguis*), they tend toward being “non-rivalrous” for members. In the small groups in Zautla, the primary selective benefits are assistance from federal agencies, such as clay mills for all members of the applying group. As all members receive the same benefit and these are limited to members of the organization (or other similar groups), these benefits also approach being characteristic of club goods (i.e. non-rivalrous but excludable).⁴⁷ In short, the insider/outsider divide in these ceramic producing communities is reinforced by the presence of the selective benefits (or club goods) that are enjoyed by members of the formal organizations.

A point to be emphasized, the obtaining informational support to transition to lead-free production is not perceived as the only (or even the most important) selective benefit of group membership. One of the key characteristics of the lead-free technology (and non-proprietary information in general) that it is neither *inherently* “excludable” or “rival”; that is, it is neither information whose ownership can be tightly controlled nor a stock that is diminished by increased numbers of claims to it.⁴⁸ However, as seen in Chapter Four, because the dissemination of the technical information by government

⁴⁷ The benefits discussed here may not always be strictly non-rivalrous. Take the example of the mixers (*batidoras*) that were distributed around 2011 in Zautla by CDI: there are a discrete number to be distributed among the members of an applying group, but that number included one for each member workshop. So while the use of a mixer by a given workshop technically eliminated the possibility of its use by another workshop, all workshops were accounted for in the distribution and the fact that the machines are used repeatedly makes reduced-labor clay mixing a more or less non-rivalrous good for the group members who benefitted.

⁴⁸ In fact, there is likely to be a case made that the dynamic is opposite of rivalry: the more users of lead-free glaze there are, the greater the broader industry’s claim to being safe for consumers and having produced its goods under acceptable labor conditions. This is potentially more important for artisanal goods than for others.

agency is undertaken in conjunction with existing formal networks, the flow of this non-proprietary information is largely limited to the group members themselves. That is, while most consider non-proprietary information to be a public good (non-rival and non-excludable), the imperfect flows of information about production using lead-free glaze move this technology in the direction of being a “club good,” another of the selective benefits enjoyed by insiders in ceramics producers groups.

Constitution. The final salient characteristic of these organizations is that effective formal ties can apparently be generated in a relatively short period of time. Both formal networks that are vestiges of a bygone era of PRI corporatism and those that are much more recent efforts to adapt to the changing market for traditional Mexican ceramic goods function as the conduits through which information is disseminated by Fonart to affiliated workshops. With the appropriate impetus (again, largely from above) and the provision of a selective benefit, these formal groups seem to have little trouble forming, at least in a manner that does not necessarily include all workshops in a community.

While this may at first appear to be the generation of formal organizations *ex novo*, on closer examination, it is clear that these formal organizations are based – at least in part – on pre-existing informal ties among workshop heads. Instead of creating organizational ties between workshop heads where no relationships existed before, the processes have instead involved the formalization or codification of existing informal networks between relatives, friends, and neighbors. This is the clearest with the formation of formally constituted groups in the municipality of Zautla, Puebla, where workshops were explicitly asked to form groups among friends, family, and neighbors (Borgoneo 2012). It seems to have also been largely true with the formation of the producers group

in Atzompa, where only a selected group of the ceramics producers (only about 70 workshops in all according to Thieme (2009)) were invited to join the union; the invited workshops were not randomly chosen but were known already known to each other and generally of a higher profile – more connected – in the community. In other words, the legally constituted formal groups formalized some of the existing informal relations between workshops in the communities.

This impression is supported by formal evidence that also suggests a clear overlap between the informal community relationships that tie workshops together and formal organizational ties. In responding to the workshops survey in Capula, Michoacán, members of the formal organizations on average identified a significantly higher number of informal contacts than those who are not affiliated with the groups: the average for the 28 percent of respondents who are affiliated was 1.7 informal contacts, while the 72 percent of unaffiliated producers reported only 1.3 informal contacts ($t=-2.35$, $n=174$).⁴⁹ In the context of the entire cluster, where workshop heads both identify and are identified by others, this divergence in informal connectedness becomes even clearer. In terms of “degree,” a measure of network centrality that measures the total number of ties (in this case informal ties) that a workshop head has (either incoming or outgoing), there is an

⁴⁹Two-sample t test (Number of identified contacts by group membership)

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	126	1.309	.091	1.031	1.127	1.491
1	49	1.714	.142	1.000	1.427	2.001
combined	175	1.422	.078	1.035	1.268	1.577
diff		-.405	.172		-.744	-.065
diff = mean(0) - mean(1)				t = -2.351		
Ho: diff = 0				degrees of freedom = 173		

average degree of 2.3 for affiliated members versus an average of 1.5 for others ($t=-3.80$, $n=174$).⁵⁰ Network degree is a simple measure of the extent to which an individual node (workshop head) is tied to other nodes in the network by the kind of relation in question. Findings for an alternative network measure, “betweenness centrality” are similarly suggestive: mean betweenness score of 215.9 for members and 34.2 for non-members ($t=-5.43$, $n=174$).⁵¹ Betweenness captures the likelihood that a node (workshop head) is on a randomly chosen shortest path between one node and another, and as such is a measure of the one’s importance in the passage of information between other nodes as a

⁵⁰ Measures of network centrality for the respondents in the cluster were calculated with UCInet/Netdraw.

⁵¹ Two-sample t test (network degree by group membership)

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	127	1.527	.1030	1.160	1.323	1.731
1	49	2.326	.2090	1.463	1.906	2.747
combined	176	1.75	.0979	1.298	1.557	1.943
diff		- .799	.210		-1.214	-.384
diff = mean(0) - mean(1)				t = -3.797		
Ho: diff = 0				degrees of freedom = 174		

Two-sample t test (network betweenness by group membership)

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	127	34.245	10.881	122.630	12.711	55.778
1	49	215.891	46.048	322.337	123.305	308.477
combined	176	84.817	16.165	214.459	52.913	116.722
diff		-181.65	33.446		-247.657	-115.634
diff = mean(0) - mean(1)				t = -5.431		
Ho: diff = 0				degrees of freedom = 174		

third party. In short, those who are tied to one another through a formal producers group are more likely to also be better connected through social ties.

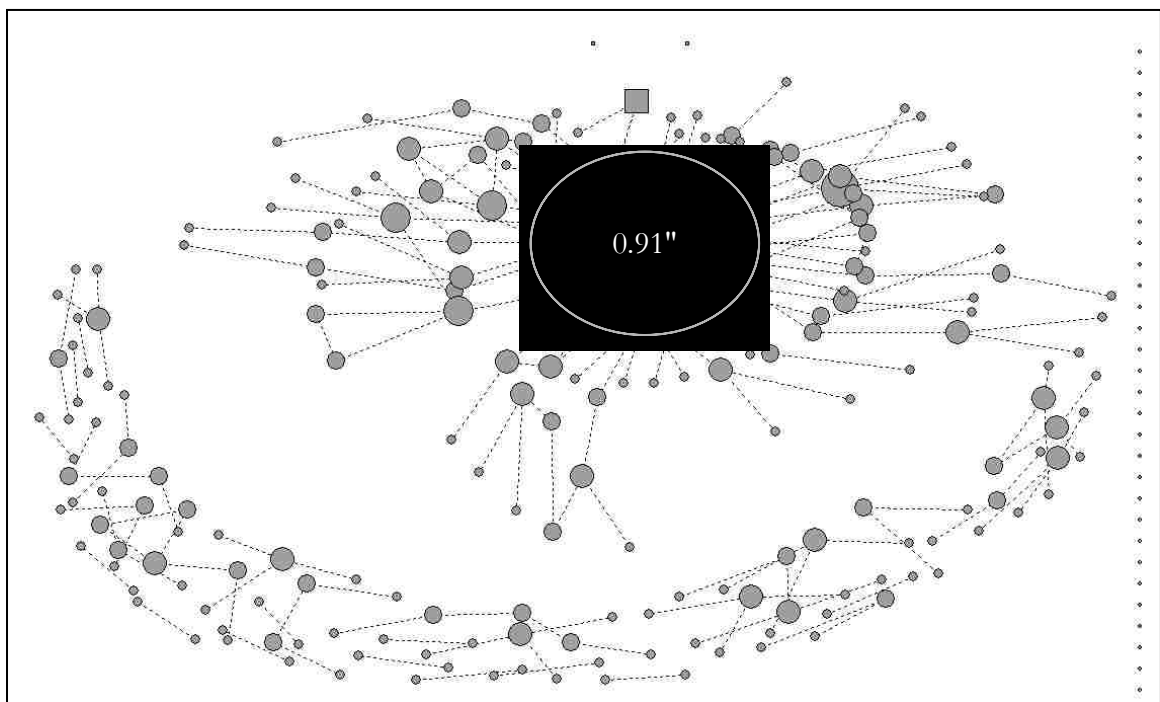
These informal relations are varied: friendship, kinship, and neighborhood. Although one might suspect – given the family-based orientation of the individual workshops – that of the informal relationships between workshops would be dominated by ties of extended kinship, there is evidence to suggest that this is not the case. When workshop heads were asked to identify their contacts, they also identified the nature of their relationship with the other workshop head. Extended familial ties, including relationships through marriage (e.g. *cuñado/a* (brother or sister-in-law) or *suegro/a* (father- or mother-in-law)) were coded as ties of extended kinship and differentiated from contacts identified as neighbors, friends, or *conocidos* (associates). For those in formal groups the mean number of contacts identified as extended kinship (.531) is statistically indistinguishable from the mean number of kinship ties identified by unaffiliated workshops (.532).⁵² This finding strongly suggests that while informal ties are denser within the formal organizations that group membership is not strictly – or even predominately – determined by extended kinship ties. Interviews also suggested that,

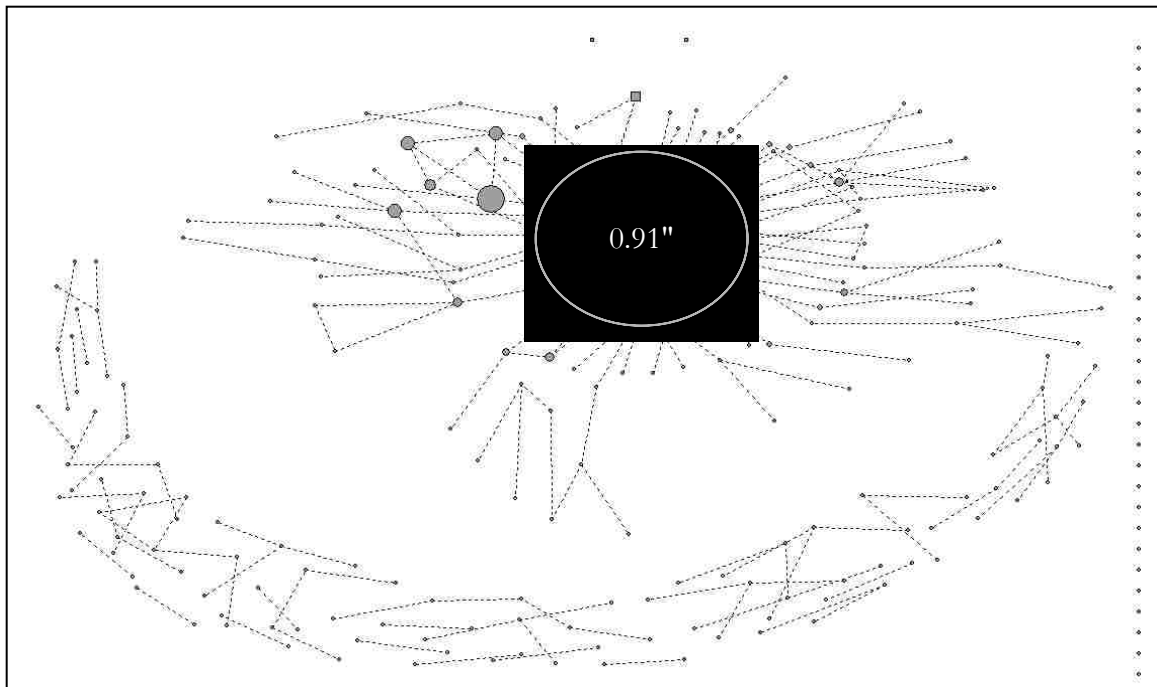
⁵² Two-sample t test (extended kinship ties by group membership)

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	126	.532	.071	.797	.391	.672
1	49	.531	.101	.710	.327	.735
combined	175	.531	.058	.772	.416	.647
diff		-.001	.130		-.256	.258
diff = mean(0) - mean(1)				t = .009		
Ho: diff = 0				degrees of freedom = 173		

while there were cases of cooperation between workshops connected by extended kinship ties, that this was the exception rather than the rule.

To illustrate the elevated levels of informal contacts within formal organizations visually, the difference in the concentration of identified informal ties is illustrated in Figures 5.1 and 5.2. These figures are network visualizations like the one presented in Chapter 4, but show only the reported informal ties. The size of the nodes reflect the value for their network degree (5.1) and betweenness (5.2) within the central circle of the figure are those that are members of a formal group and those outside the circle are unaffiliated and have a lighter concentration of informal ties.





In short, there is significant evidence that the generation of formal organizational ties between workshops has been grounded in existing informal social ties of friendship, neighborship, or kinship. That is, the formation of producers groups in these ceramics producing clusters has, to a large extent been a process of laying an additional (i.e. formal) relationship over the top of existing informal ties; not a redefinition of the nature of relationships between workshop heads, from friendship or family into relations between firms, but an added layer. This is especially clear in the groups formed in Zautla, Puebla and the Fonart-sponsored “bancos de materia prima.” It is however, also apparent in the least likely of these cases: the union in Capula. Although older members have been affiliated since it was a tool for PRI corporatism, younger members tend to join because of their informal relations to affiliated members. One workshop head in Capula reported being encouraged (unsuccessfully) to join the union by his father and brother, who

offered to speak to the Union President on his behalf. Another reported joining because his uncle was a member and had benefitted from membership.

Although the network data from the survey are consistent with the notion that inter-workshop ties are not created from whole cloth but instead rely on existing informal relations, alone they are unable to distinguish between two processes: the formation of informal relationships between members of the Union through interactions facilitated by membership and the incorporation of workshop heads because of their existing ties of friendship, kinship, or neighborhood. That is, are informal ties a causal factor or the outcome of the manner in which formal networks are formed?⁵³ Without accurate time-series data network data, this question is difficult to answer with these data. And although there is a clear case for the former interpretation, it is highly likely that there is some formation of informal ties that is encouraged and facilitated by joint membership in the formal organization. This process of informal tie formation in the producers group is likely to occur at a slower pace than the formation of formal ties. It is also more likely to occur in the larger groups (Capula and Santa María Atzompa) where members are exposed to more workshop heads than in smaller groups (Zautla). In short, the probability that formal and informal ties between workshop heads are to some extent “mutually constitutive” cannot be wholly discounted, irrespective of the fact the primary narrative

⁵³ A recent debate has raged among social network analysts about how or whether SNA methods are able to distinguish between homophily (similar nodes (people or organizations) bunching together by virtue of their similarity) and causality (social ties making people more similar). Much of this debate was set off by Christakis and Fowler’s (2009) work, which makes strong causal claims based on network structures. Although a genuine methodological concern, the debate may have been driven in part by the boldness of claims possibly made for purposes of publicity, such as, “Your colleague’s husband’s sister can make you fat, even if you don’t know her.”

suggests that informal relations typically underlie the efforts to form formal organizations.

Intra-Cluster Networks

Although the details of the relations between workshops in these ceramics clusters in Mexico are specific, the preceding discussion of the informal and formal relations adds a dimension to the understanding of information and innovation within productive clusters. A long literature in economic geography has argued that location within spatially delimited geographic clusters makes firms more likely to be more competitive and innovative (e.g. Baptista 2000; Baptista and Swann 1998; see also Krugman 1991). The mechanism that has most often been used to explain this increased capacity to innovate is that proximity to other firms in the same or in linked industries generates informational spillovers that can be absorbed by firms in the geographic area. This notion goes back to the work of Marshall (1920) who famously wrote that ideas were “in the air” in industrial clusters; the notion that the contact between firms made unavoidable by proximity was adapted by Arrow (1962), and became fundamental to the so-called New Growth economists, who sought to endogenize the rate of technological growth that was typically assumed in neoclassical growth models (e.g. the Solow model (Solow 1956))

While perhaps an appealing metaphor, the notion that ideas are “in the air” waiting to be snatched by an entrepreneur says little about the mechanisms by which proximity actually generates informational spillovers. Perhaps the simplest, most literal conceivable mechanism that would make more sense in a low-tech sector like ceramics is that very close geographic proximity may allow some producers to monitor the work of

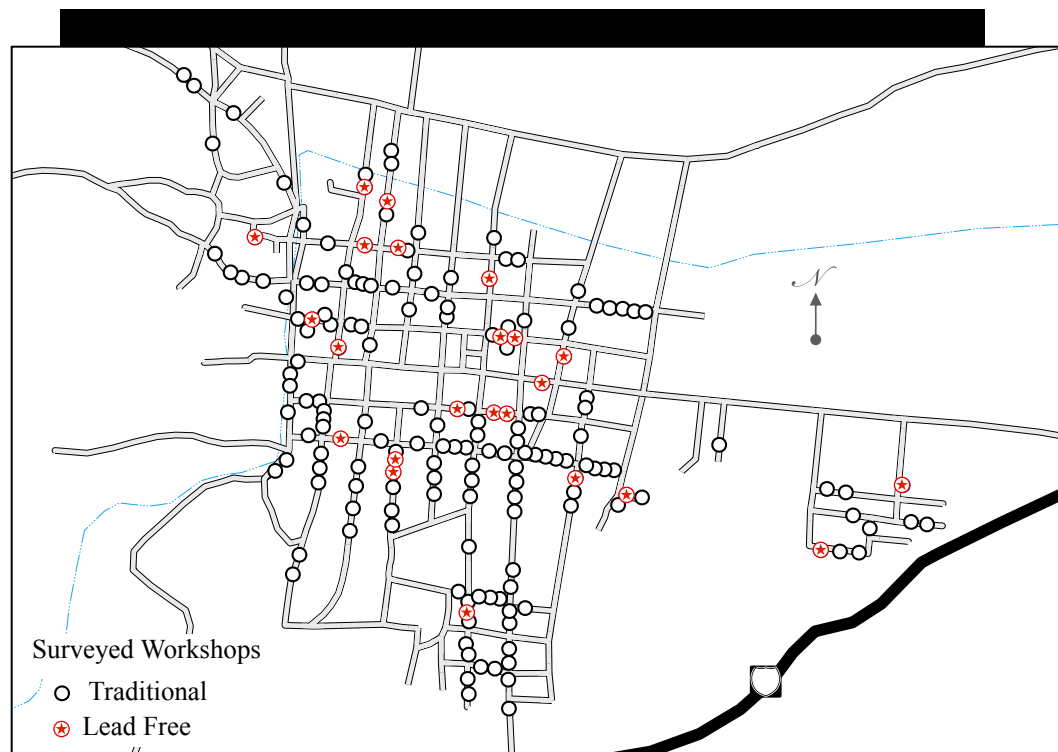
other producers in their immediate vicinity. For example, an observant head of a home workshop would likely be able to observe the kinds of inputs (clay, wood, perhaps sacks of powdered glaze) used by a neighbor as they are moved into the home from the street; similarly he might be able to observe the final products as they are brought back out: the forms used, the designs, the quality and perhaps type of glaze.⁵⁴

In spite of the relative plausibility of the capacity to monitor close producers, there is no evidence that the degree of concentration of workshops in ceramics clusters has any observable effect on a cluster's propensity to adopt the alternate glaze. The rate at which the communities discussed here have reported adopted the new technology differ (from 15-20 percent in Capula to a single family in Santa María Atzompa, Oaxaca) differ without apparent correlation to concentration of workshops (Covarrubias 2012). On an even smaller scale, within clusters there seems to be little evidence that innovation occurs in groups of geographically proximal workshops. In the community of Capula, for example, producers who have adopted the lead-free glaze do not appear to be clustered in any part of the village. Figure 5.3 depicts a map of the streets in the village, each workshop surveyed is represented by a circle: empty for non-adopters and with stars for adopters. There is no readily visible pattern that describes the location of workshops that have adopted the technology. This impression is supported by data drawn from the survey of workshops. For each respondent, a value was calculated that indicates the proportion of identified workshops on their block and contiguous blocks that adopted the new

⁵⁴ Many workshop heads were demonstrably curious about the work of their neighbors. During the process of conducting the door-to-door survey in Capula, it was not uncommon to be asked by ceramics producers what their neighbors had said about one thing or another. Ethically, the guarantee of anonymity for respondents, of course, precluded the sharing of this information. On a more practical level, sharing reported information would almost certainly have undermined the confidence of the respondents and affected their willingness to respond.

technology (i.e. innovative workshops that they might have easy occasion to monitor).⁵⁵

Not only do these proportions fail to support the notion of clustering within the community, they suggest that non-adopters have higher concentrations of lead-free neighbors than lead-free producers do ($p = 1.848$, $n = 174$).⁵⁶



⁵⁵ For those who had adopted the lead-free glaze, this proportion only counts those neighbors who adopted in the same year or prior, in order to take into consideration *when* this monitoring would have taken place.

⁵⁶ Two-sample t test (Neighborhood L-F concentration by L-F Production)

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	153	.124	.011	.130	.104	.145
1	23	.071	.025	.118	.020	.122
combined	176	.117	.010	.130	.098	.137
diff		.053	.029		-.004	.110

diff = mean(0) - mean(1)
Ho: diff = 0

t = 1.848
degrees of freedom = 174

These findings regarding proximity in ceramics clusters are broadly consistent with more recent studies by economic geographers of innovation in clusters; they have challenged the notion that geographic proximity is so straightforwardly beneficial for innovation (Maskell and Malmberg 1999; Maskell 2001).⁵⁷ Instead, these studies have proposed particular types of relationships through which information flows, contravening the notion that proximity is sufficient to generate flows of information that promote innovation. In other words, the manner in which firms are *socially* (rather than geographically) embedded in the cluster is critical to the manner in which (or whether) they would receive flows of information. With evidence from social networks in wine producing clusters, Giuliani (2007) demonstrates that information has the potential to move very differently through “Business Networks” and “Knowledge Networks,” because these networks are structured quite differently. Business networks are generated by trade in goods and services, while knowledge networks consist of voluntary consultation on business matters. The previous chapter argued the presence of two kinds of ties: informal ties, which are social ties that may be weakly consultative like the “knowledge networks,” and formal ties, which are constituted by shared membership in a producers organization.⁵⁸ It further demonstrates that the manner in which producers are embedded in each of those kinds of networks affects their capacity to obtain the

⁵⁷ There is an apparent divide between the work of economists, who tend to assume that information flows freely within clusters, and recent economic geographers, who question the manner in which intra-cluster networks and relationships shape the movement of information within clusters.

⁵⁸ In ceramics clusters there are no real equivalent of business networks as Giuliani defines them; trade between workshops is uncommon, given that most workshops complete all of the productive steps necessary within their own workshops. Where it does occur, it involves the selling of raw pots to workshops that concentrate on painting and glazing.

information necessary to adopt the lead-free technology, a concrete vindication of Guiliani's (2007) argument that the nature of networks matter.

This chapter pushes these arguments about local networks on step further by examining what underlies those networks. In other words, it does not assume that they are naturally occurring. As the previous sections argued, local social networks between producers may be shaped – at least in part – by the intervention of the state. The formal networks that Fonart has sought out to use as points of articulation and technology dissemination are the products of encouragement and selective benefits that come from the government, even if these formal networks are in part a codification of existing informal networks.

Conclusions

In brief, this chapter has made a two part argument: first, although the formal producers networks in the ceramics producing clusters are undergirded by pre-existing informal relations, they have not formed organically; second, that access to information within their cluster depends on distinct networks that are not necessarily fixed. The analysis here underlines the extent to which home workshops should be thought of as hybrid organizations, neither fully firm nor fully family. Chapter 2 underscores internal elements of this hybridity: vertical training and learning, parallel workshop/home authority structures, blended home-business finances. In that vein, this chapter demonstrates more outward elements of their hybrid status: the coincidence between informal relationships and ties through formal producers groups.

There are a variety of implications of these findings: most obviously, if the formal organizations in industries like traditional ceramics are what are “visible” to the state and,

consequently, what state agents have the capacity to engage, then understanding what underlies those formal relationships takes on additional importance. Literature on the economics, geography, politics, and internal dynamics of clusters have focused primarily on the producers in those clusters as firms; while this makes sense for larger firms with more “rational” business designs, at least for clusters of more traditional, lower-tech workshops, many family-based, it overlooks the degree to which those formal arrangements may overlap with (or be based upon) social relations. In this situation, the isolation of workshops is more than exclusion from formal organization but can be symptomatic of broader social isolation, a lack of the kind of personal ties that might allow a workshop head eventual entrée into a formal producers organization.

As the previous chapter made clear, the existence of formal organizations has been a critical factor for the capacity of the Mexican state to coordinate information diffusion with the communities. The very clear downside is the limited extent to which the workshops in the clusters are encompassed by these organizations. As this chapter has argued, insofar as the formal organizations themselves are largely a consequence of top-down organizing and government-sponsored selective benefits (historical or recent), those limits are a partial consequence of what was provided by the state. As Shadlen (2002, 2004) argues more broadly, the natural state of these workshops tends to be as unorganized organizations. In a similar vein, this chapter suggests that increased state efforts to encourage and sponsor formal networks are likely to have the beneficial effect of broadening producers groups within the clusters. The apparent pressures for restricted group membership stem from the limited nature of the primary selective benefits available to group members. Although deepening formal membership may not be so

simple – especially given the importance of informal ties and the producers who may hold out because they are suspicious of formal groups (Borgoneo 2012) – the percentage of workshops belonging to formal groups could likely be raised significantly. The consequence of this would be expanding the reach of technical information disseminated by the government through these organizations.

This is not to minimize the importance of local expertise (here, useful social ties between workshops) nor to suggest that a state-led process of establishing or expanding producers groups is a simple solution to the insider/outsider dynamic that limits the diffusion of productive information.⁵⁹ Consistent with previous work that considers the role of public and private contributions in development projects in the public domain (especially Tandler 1997; Ostrom 1996; Evans 1996), this chapter suggests a kind of harnessing of local capacity. The state itself may be able to enhance workshops' relationships to one another in a manner that makes the private sector contribution to the co-produced diffusion of innovation more effective.

Finally, this chapter is consistent with Chapter 4 in arguing that within clusters, one cannot assume that different kinds of relationships act the same as conduits. This is in keeping with Giuliani's (2007) demonstration of the distinction between business and knowledge networks. This undercuts the notion that information for innovations circulates more or less uniformly within clusters, an explicit or implicit assumption made by many previous studies on development and innovation in clusters, from Marshall (1920) to the present. Instead – and perhaps especially in clusters of low-tech family

⁵⁹ Schneider (2004) discusses the formation of very different business groups – large national organizations – in Latin America in the 20th Century. Without pushing the comparison too far, although his subjects are a different kind of organization, Schneider also finds that the state played an important role in encouraging their formation.

workshops – differentiated social ties and the manner in which workshops are embedded in those ties strong affect the kind and the extent to which they are capable of receiving the information necessary to innovate.

Chapter 6:
Seeing Like a Weak State:
Rural Resistance to Regulation

“An illegible society... is a hindrance to any effective intervention by the state, whether the purpose of that intervention is plunder or social welfare.” James Scott (1998; 78)

As shown in the previous chapter, networks within ceramics clusters in Mexico are highly heterogeneous. Formal organizations create the possibility of relatively uniform flows of information between members by having established meetings and modes of communication. Informal networks are far patchier, linking producers together into smaller, less uniform sub-networks. Neither encompasses all producers in a cluster. Moving beyond the nature of intra-cluster networks, this chapter looks at the uneven distribution of reliable public-private ties between the state agencies at the federal level and the workshops in the 76 ceramics clusters located in Mexico. In its analysis of the public-private dynamics of technology diffusion, Chapter 4 makes the case that without an effective public-private tie (i.e. a tie to embedded actors in the communities) the efforts of the state agents at the diffusion of know-how would be nearly impossible, based on the sheer number, dispersion, and informality of the workshops. This chapter asks what would prevent state agencies from being able to form effective public-private ties with target communities.

The chapter argues that the primary problems with establishing this public-private relationship stem from the geographic and cultural isolation that are characteristic of many of the ceramics clusters. Although adoption of the lead-free technology reduces negative health externalities and improves the prospects of exporting to more lucrative markets, these benefits are often not readily apparent to individual producers (and by

aggregation, to their communities); as a consequence, Fonart's efforts often appear to the producers to be strictly an imposition upon them. The unraveling of the corporatist arrangement between the PRI-led state and the rural population from the 1980s onward weakened the capacity of the state to coordinate the behaviors of populations that were party to that governance arrangement. The chapter draws on the notion that enforcing regulations – even through more tutorial means (Schrank and Piore 2007) – are part of what Scott (1998) calls “state simplifications” or means of homogenizing productive activity. But while Scott (1998) illustrates failures of strictly state-led development projects as a result of overreaching, the narrative here emphasizes the partial failure by “underreaching,” an outcome predicated on the weakness of the state (partly because of its regulatory approach, partly because of loosened control over rural and indigenous populations) relative to the producers.

The chapter first offers a brief review of Scott's notion of the propensity of states to homogenize the societies that they dominate. The following section briefly outlines the changing balance of state-society relations in Mexico since the dissolution of the PRI's corporatist program, especially among rural and indigenous populations where ceramics clusters are frequently located. It then brings these points together in a discussion of Fonart's efforts to build ties between the agency and formal producers groups, focusing on the illustrative case of Zautla, Puebla. The narrative traces the changes in the inter-workshop and public-private ties in this community as they shifted over a relatively short period of time. Although concentrating primarily on this single case over time, it also provides brief comparison to other ceramics producing communities.

Social Legibility and Regulation

In his study of ill-balanced state-society relations, Scott (1998) indicts strong “High Modernist” states for their failed efforts to reshape civil society without regard to the locally constituted practices and forms. He argues that states have an inherent inclination to make their societies “legible.” The machinery of the state (agents, bureaucracies, etc.) have standardized means of engaging with society (norms, regulations); elements of society that fall outside those standardized means are vexing and state agents tend to push for those elements to be homogenized or simplified. Processes developed at local levels encompassed by the state very frequently run counter to this and are “illegible” to the state. Scott argues that these local differences are both productive processes (what he calls “practical knowledge” or “metis”) and social processes. This tension is inherent in state-society relations; the problems that Scott focuses are when strong states (ideologically committed to scientific principles) attempt to restructure society in radical ways without attention to locally developed productive and social processes. In the example of the villagization (and attempted modernization) of people and agricultural production (“Ujamaa”) by President Julius Nyerere, the effort failed in part because the scientific agricultural principles upon which the program was built (based in part on the Tennessee Valley Authority) failed to take into account local soil conditions and erosion control in sandy soil. It also failed to acknowledge the social structures that had developed in conjunction with traditional production practices and sought to completely overwrite what Nyerere’s plan called “the destructive conservatism of the people.” The effort unraveled both because of the continued adherence to customary social organization and the resistance to what were indeed inappropriate farming methods for local conditions.

Regarding the development of the ceramics sector, more important than the failure of big state-led projects to reshape society is what Scott identifies as an inherent tension between diverse social groups and the state that seeks to simplify them into homogenous “legible” forms. One valuable insight that stems from this discussion is that many state-imposed regulations, too, are forms of “simplification” (9): state-led efforts to impose rational standards and reduce local variation. In scale, labor regulation and environmental regulation fall well short of the Soviet collectivization of agricultural production or compulsory villagization in Tanzania. In scale, regulation of production is more akin perhaps to the standardization of measurement in Europe. Scott identifies the monitoring and control of artisanal industries and small producers as particularly irksome for states because of the dispersion of industry and the numerous opportunities for “evasion and resistance” (1998; 338). While there is a significant difference in the magnitude (i.e. degree) of these projects – regulation of production is a relatively minor intervention compared to the resettlement of millions of people and the reorganization of society – the dynamic (i.e. type) is very much the same.

To draw this back to the case the ceramics sector in Mexico, the regulation of production in the form of the exclusion of lead-oxide is a top-down project initiated by the state. The regulation seeks to standardize the production of ceramics, to eliminate a technology that, while similar in most communities, is deeply rooted in local productive practices, passed down generationally in workshops. Regardless of the fact that the regulations are “beneficial” (Streek 1997) or “rewarding” (Schrank, n.d.), many workshops fail to immediately see the potential health and economic benefits and interpret the lead-free program simply as a state imposition with no clear logic and that

misunderstands the process by which ceramics have been produced in their communities for decades. This is not to suggest that the traditional practice of glazing with lead-oxide should be maintained or to vilify the efforts of the Mexican government to eliminate it. To the contrary, it is meant only to specify the nature of the tension between state and society that is of interest, a manifestation of the broader tension that Scott (1998) sees between states interested in homogenization and diverse societies.

Stronger Society, Weaker State

Scott's cautionary tales stem from the overzealous efforts of strong states to re-shape (and improve) weak civil societies with "rationally designed" (4) plans that ignore the local particularities of the populations they seek to alter. Many of these projects fail because of the state's capacity to "run roughshod" over weak popular opposition (5). He makes a case for what he calls "metis-friendly institutions" (352), by which he means state institutions that are flexible enough to take into consideration local customs, knowledge, ideas, and needs. Harking back to the discussion of Evans (1995) in Chapter Four, one imagines that the kind of embedded yet autonomous bureaucracies described are not far from what Scott imagines: state agencies with defined developmental goals, but who pursue those goals not with a fixedness and certainty that excludes the particular knowledge and expertise of society (i.e. firms and business groups); instead, through ties of embeddedness, they are able to adapt goals, policies, and procedures to the needs of civil society. The nature of this negotiation is likely to depend on the strength of the state relative to the civil society: relatively stronger civil society groups are likely to have more bargaining power and be able resist the efforts of state agencies to shape them (Migdal 1988; Atkinson and Coleman 1989). Strong and resistant civil societies facing the

regulatory goals of weak state agencies may be able to resist the formation of the public-private ties used for effective coordination. Turning back to the empirical question of what would cause the failure of Fonart to generate ties of embeddedness to formal ceramics producers groups in some communities, the causal factor seems to be the desire and capacity of civil groups to resist the incursion of the relatively weak state agency.

By most accounts, the strength of the Mexican state vis-à-vis autonomous civil has eroded markedly over the past several decades, gradually shifting away from one in which the Mexican state had “near-total control over the channels that linked it to civil society” (Fox and Hernández 1992, 167). This trend toward the rebalancing of state-society relations in Mexico is especially true with rural populations. The very vast majority of ceramics producers are located in rural villages. Traditionally, the producers also dedicated themselves to small (mostly subsistence) agricultural production, and were therefore considered by the post-Revolutionary state to be peasants (*campesinos*).⁶⁰ In the PRI’s corporatist structure, rural and indigenous communities were compelled to participate in the Confederación Nacional de Campesinos (CNC), the official peasants union. Early in its existence, the CNC helped raise the status of rural populations by helping secure the redistribution of some 75 million acres of land into peasant-controlled *ejidos* by 1940 (Edmonds-Poli and Shirk 2009). The continued promise of land distribution, as well as the provision of fertilizer and other agricultural implements, remained the primary benefits promised to *campesinos* in exchange for their nominal

⁶⁰ This is also true of many other artisanal producers. Working the land was considered to be their primary economic occupation, with artisanal production being considered something like a pastime (Covarrubias 2012b). Among the unintended side effects of this classification is that until very recently INEGI has never allowed census respondents to indicate artisanal production as their primary economic activity, which has made these producers essentially invisible (and complicated the task of data-seeking graduate students). Fonart is currently working with INEGI to correct this (Covarrubias 2012b).

political support and quiescence; resistance to this arrangement was a cause for state violence and coercion (Fox and Hernández 1992). These ties between the state and organized peasantry remained relatively unchanged into the 1970s, with the *campesinos* in a position of relative weakness (Overmyer-Velázquez 2010).⁶¹

Although cultural distinct from *mestizo* peasants, under the PRI's corporatist rule, indigenous groups were treated much the same and were compelled into participation in the CNC (Eisenstadt 2011). After the Revolution, the position consistently taken by the Mexican government was to recognize the existence and historical importance of indigenous groups but also to insist upon their integration into the workings of the modern Mexican state; the goal was the "Mexicanization" of indigenous people, never an measure of ethnically-identified autonomy (Muñoz 2010; O'Toole 2010, 68). Eisenstadt (2011; 8, 132) argues that this strategy of channeling the interests of all rural citizens through the CNC was relatively successful in shaping indigenous communities' own perception of themselves as *campesinos* – a class based identification – rather than as indigenous – an ethno-linguistic identification. In spite of this broad subservience of rural populations generated by the corporatist system, the state's efforts failed to eliminate "regionally defined identities which usually focused on the village" (Haake 2007, 104). In other words, while there was no regional or national indigenous movement *per se*, village-based identities remained important.

⁶¹ Rubin (1996; 86) reasonably resists the notion that the Mexican state's control over civil society was homogenous: "What has been viewed as the triumph of state building under President Lázaro Cardenas in the 1930s was actually a simultaneous forging of multiple regional arrangements – each a distinct combination of bargaining, coercion, and alliances – that together reinforced the power of the center in broadly similar ways." My contention is not that all regional arrangements were completely homogenous, but simply that they were coercive in much the same way, a condition that generally changed over time; the unraveling of the corporatist authoritarianism, however, was a process that proceeded at different rates, in fits and starts (Fox 1995)

In the 1970s and 1980s, cracks began to emerge in the corporatist arrangement that ensured the state's dominance over civil society in the countryside. This began in the 1970s, when the Mexican government halted any further land distribution, one of the chief benefits the state could promise to rural populations (both indigenous and *mestizo*) in return for continued cooperation (Overmyer-Velázquez 2010, 56). Harvey (1990, 183-184) argues that around this time there was an increase in grassroots efforts to organize independent peasant unions to compensate for the perceived stagnation of the CNC, which began to “render ineffective the continued use of clientelistic and corporatist forms of representation” in states like Michoacán, Guerrero, Oaxaca, and Chiapas.”⁶² The CNC's dominance in the countryside further eroded through the 1980s, as national agrarian policy was liberalized in response to the debt crisis: policies increasingly promoted large agricultural production, international trade in agricultural staples like corn was opened, and community-held land in *ejidos* was privatized (Edmonds-Poli and Shirk 2009).

At the same time that the arranged dominance of state interests over rural civil society was being rebalanced by a rising interest in independent organizing (or at least an aversion to corporatist organization), democratization was unraveling the single-party state's capacity to coerce compliance by presenting electoral alternatives to the PRI, which had been essentially indistinguishable from the state. Although the PRI did not lose control of the national executive until the 2000 election, its dominance had begun to erode much earlier at the state level and in the congressional bodies. Institutional reforms

⁶² Recall from Chapter 5 that the UNEAMICH was formed in this context in the 1970s. It is possible that this was an effort at the state-level to shore up support for the PRI among rural communities that also had artisanal producers. Again, though, this arrangement unraveled as alliances to the PRI and to Cuauhtémoc Cardenas divided the Union.

put in place during the Lopez Portillo *sexenio* (1976-1982) led to the first non-PRI members being elected to congress in the late 1970s. Doubts about the PRI's stewardship of the economy had lent growing support to the conservative PAN beginning in the mid-1970s, especially in the Northern and Western states. To the ideological left of the PRI, the PRD developed out of the failed presidential run of Cuauhtémoc Cardenas and gained a foothold in many central and Southern states. Essentially, the rising presence of competing parties at the state level in the 1990s "destroyed the elements ensuring institutional subordination" to the PRI (Hernandez-Rodriguez 2003, 108).

In short, by the 1990s, both increasing electoral alternatives to the PRI and the rising importance of alternative forms of rural organization had upset the "skillful combination of 'carrots and sticks'" that had allowed the state to dominate that relationship (Fox and Hernández 1992,167). The organizations that rural residents in the countryside participated in may not have gained in absolute size, strength, or coverage; quite to the contrary, obligatory membership in the CNC ended and many rural residents ceased participating in any organization at all. The formal organizations that did exist, however, had become more independent and the erstwhile PRI-state lost its coercive capacity over them (Teichman 1997). Civil society groups, in other words, had increased their bargaining power relative to the state. It was in this context that state agents in Fonart and Cofepris began the effort to train and regulate away the use of lead-oxide in ceramics workshops, and it has been the relatively strong capacity to resist state encroachment that has challenged Fonart in its efforts to form working public-private ties to formal civil society groups in some ceramics producing communities.

Building Ties in Zautla, Puebla

The experience of Zautla, Puebla offers an illustrative example of the Lead-Free Program's efforts to form ties to civil society groups and the capacity and potential inclination of these groups and their leaders to resist the efforts of the state. The case is particularly telling because in a relatively condensed period of time, the community went from rejecting ties with Fonart's Lead Substitution Program to agreeing to a cooperative relationship with it. The shifting relations between other communities and the Lead Substitution Program could similarly be traced and the conclusions drawn would be the same; however, the change over time in other clusters is less tidy and less stark. The clear progression over time of the formation of informational ties in Zautla makes it particularly amenable to short narrative. In the context of the weakened central state, the transition was a consequence not of increased effort, an altered approach, or coercive behavior by the state agency, but was a consequence of decisions at the community level to allow for public-private ties to be formed. The history of community organization in the municipality breaks down into three periods.

The first period corresponds to the years before 2008, when traditional ceramics producers in the municipality were largely unorganized, at least in a manner meant to advance their specific goals as small producers of ceramics. The CNC had traditionally been an organizing force in rural areas of the state, but there had been no strong organization dedicated to family workshops that produced ceramics. Puebla was traditionally a bastion of support for the ruling PRI, remaining under a PRI governor from the founding of the party through the 2011 electoral cycle. The municipal leadership of Zautla was similarly controlled by the PRI until recent elections. As Fox (1994) argues, there was a great deal of variation in the rate and success of independent

“pluralistic” social organization by location.⁶³ It is probable that the strength of the PRI in the state of Puebla and the consequent organizational strength of the official clientelistic channels allowed for these institutional structures to remain in place longer than in other areas that more rapidly embraced the leadership of competing political parties. In other areas in the remote Sierra Norte of Puebla, the occasional independent artisan cooperative had formed in order to overcome the unfavorable market conditions (i.e. oligopoly) faced by producers but apparently had little staying power. There is no evidence that there was any such organization in the municipality of Zautla. In short, as the importance of the CNC as a corporatist link between rural communities and the central state waned nationally, the municipality of Zautla seems to have seen little independent organizing develop in its place, at least among artisanal producers. In terms of the kinds of organizational ties that have been discussed in previous chapters – formal ties between producers in particular clusters and public-private ties between those clusters and Fonart’s Lead Substitution Program – neither existed in this period. In the two-by-two table in Figure 6.1, this period corresponds to the upper-left quadrant.

The second period began with the election of Enrique Iglesias Contreras, the first non-PRI municipal president (represented in lower-left quadrant of Figure 6.1). One of Iglesias’s goals as an administrator was the improvement of the standard of living of the many ceramics producers who live in the municipality. As discussed in Chapter Five, producers were encouraged to organize in small groups largely for the purpose of obtaining resources from federal agencies, such as the CDI, which has programs such as PROCAPI that provide assistance to indigenous producers. As a consequence of the

⁶³ Although heavily indigenous in some areas, especially the Sierra Norte, Puebla is not one of the states that Fox (1994) identifies as developing a higher degree of independent indigenous organization.

municipal government's efforts, some 80 small ceramics producers groups were legally constituted in the municipality, representing some 1,100 people and many were assisted by the municipality with their applications for assistance and received equipment for their workshops.

Figure 6.1: Progression of Public-Private Linkages in Zautla, Puebla

		Public-Private link to Lead Substitution Program	
		No	Yes
Local Producers Groups	No	Pre-2008: before organization led by municipal president	
	Yes	2008-2011: groups organized, resist tie to Fonart Program	2011-present: groups ties to Fonart Program established

During this period, agents in Fonart's National Lead-Free program became aware of the presence of these legally constituted formal groups of producers and that they had solicited assistance for ceramics production from the CDI. Fonart agents approached the municipal administration and requested that the administration facilitate their interaction with the producers groups, in order to diffuse information about the Lead Substitution Program, the dangers of lead, and the available lead-free technology, and to coordinate training session for the groups, as they had been doing in Capula, Michoacán. According to Contreras (2012b), Iglesias Contreras, who had experience in the production and marketing of traditional ceramics, was resistant to the program. He shared with many other ceramics producers a lack of concern with the use of lead-oxide, doubted the

functionality of the improved glazes and the marketability of products not glazed in the traditional fashion, and, consequently, felt that the lead-free regulation would simply “make life harder for his constituents” (Contreras 2012b). Consequently, he refused to cooperate with the Lead Substitution Program.

The assistance from the CDI had required legal organization, proposals, and budgets, but it apparently bore with it no other major stipulations; moreover, the benefits (mills, clay mixers) were concrete and had immediate, tangible, and marked benefits for workshops.⁶⁴ Those granted clay mixers, for example, were relieved of the necessity of reconstituting clay powder and kneading it by hand, a time-consuming and physically demanding step. By contrast, Fonart offered to provide training in lead-free glazes, along with assistance for the purchase of primary materials, pigments, glaze, and the like, but these came with the stipulation that the consequent production be undertaken without the use of lead. Because this stipulation was perceived by community authorities, particularly the municipal president, as unfavorable for the producers groups, and presented to the groups in that light, the relationship proposed by the Fonart’s lead-free agents was rejected. While the objection to working with Fonart’s Lead Substitution program was driven in part by the calculation that the costs of lead-free compliance outweighed the benefits the program would provide, in a more general sense it seems that have stemmed from both the sense that the regulation was inappropriate for local means of production.

This situation changed when the municipal government changed in early 2011 (moving to the lower-right quadrant in Figure 6.1). Agents from Fonart’s Lead Substitution Program approached the new municipal president, Victor Manuel Iglecias

⁶⁴ Recalling Rogers’ (1983) five innovation decision points, it is clear why these simple machines are adopted more rapidly than lead-free glaze: the advantages are clear, immediately visible, and simple to produce in the context of the workshop.

Parra, in hopes that in contrast to his predecessor, he would provide access and act as a link between Fonart and the small groups. There was no change in the constitution of the small ceramics producers groups with the change in administration: they continued to operate normally. The incoming municipal president was trained in rural development (*ingeniería rural*) and reportedly had a broader view of economic development and the status of the home workshops in the ceramics sector. Convinced of the potential benefits of producers converting to lead-free production and that the training and assistance provided by Fonart would be sufficient to make that transition possible, Iglesias agreed to cooperate with the agency.

In practice, this cooperation amounted to both institutional support and leadership in convincing producer groups to work with the Lead Substitution Program. Institutionally, the municipal president has charged the Rural Development office with liaising between the producer's groups and Fonart's Lead Substitution agents (particularly the Náhuatl-speaking resident of the municipality Fonart recruited to assist with their training efforts). This shift in a key figure in the municipal administration, then, has provided Fonart with a point of contact that is well embedded in the community and has access to each of the producers groups. In terms of leadership, Iglecias has been vocally supportive of the program, promoting the idea of replacing lead-oxide glaze and encouraging producers to become trained in the new technology. In these efforts, he has gone so far as to have a test kiln installed in a public building that can be used for public training sessions. This leadership in the community has played no small part in assisting the groups to overcome their reticence about the regulations and new technology (Borgoneo 2012).

In Zautla, for the time being, informational ties between Fonart and the groups of producers in the community function well, much as described in Capula in Chapter Four, and seven of the formal groups have reportedly made progress toward lead-free production with assistance from the Lead Substitution Program since early 2011 (Covarrubias 2012). As the experience of Zautla and other communities have made clear, the outcomes of the efforts by those promoting lead-free glaze to generate ties to communities have not always been so successful. One Cofepris agent recalled being prevented from entering into a largely indigenous, ceramics producing community in Michoacán (Molina 2010). Community authorities knew that he was coming to speak to producers about lead-oxide and its health effects but had determined before his arrival that allowing him in was not in the community's interest. The agent and his team were unable to address the community and were forced to return to the capital. Although it apparently does occur, active resistance of this sort may not be necessary to prevent the formation of public-private linkages; as the case of Zautla makes clear, passive resistance is sufficient.

Failed Ties

The experience of Zautla provides several important insights into the formation of information brokering public-private ties that make possible the dissemination of information to ceramics workshops on a large scale. First, it reveals Fonart as a state agency that is both very centralized and relatively weak. Like many federal agencies in the still very centralized Mexican government, Fonart's operations are governed from

Mexico City.⁶⁵ Although the agency has limited branch offices in a few states (Michoacán, Oaxaca, Jalisco, San Luis Potosí) and has cultivated embedded local contacts in some of the ceramics producing communities, it is a strongly centralized agency. The ties that Fonart does have at the community level can provide community information to the agency, so their procedures may be altered to fit local conditions. These contacts, however, are not full-time employees and there is no ongoing presence of the agency in the communities, so the training session or visits by the federal agents seem sporadic or inconsistent to the ceramics producers. When agents from federal (and often even from the state) do come to these communities, their presence is frequently interpreted cynically as the agencies or individuals pursuing “their own publicity” and goals, not necessarily those of the community (Fuentes 2010a).

In short, from the perspective of many producers, there is a significant gap between the Lead Substitution Program as an institution that is distant both in terms of geography and goals from many of the communities.

Second, Fonart has very limited leverage over most communities, making it difficult to strongly press for cooperation with the agency. The primary source of leverage is the threat to withdraw financial or informational support from producers; essentially, this means to decline to purchase an artisan’s goods, withhold financial assistance like cheap credit, and to deny an artisan training. However, as discussed previously, obtaining financial support from Fonart is a minor part of producers’ business strategies and many have no dealings with the agency whatsoever. In Capula, Michoacán, for example, just over 10 percent of the workshops surveyed had received financial

⁶⁵ See Edmonds-Poli (2006) for discussion of the centralized nature of the Mexican state, in spite of years of incremental efforts to devolve some of the federal government’s fiscal and political authority to the states.

assistance from the agency, and Capula is a much less isolated community in a state where Fonart has a regional office. Some of Fonart's support (purchasing, for example) is already limited to those who produce with lead-free glaze. Given that selling to Fonart is a comparably minor part of most workshops' commercialization strategy, the limitation on purchasing only lead-free glaze provides little incentive.

Moreover, the Lead Substitution Program's primary *modus operandi* is training and support, and excludes the legal authority to punish workshops for failing to comply with the official regulations on lead use. Their approach to communities is roughly consistent with Schrank and Piore's (2007) notion of tutorial rather than punitive regulation providing a means by which government agency can work cooperatively rather than adversarially with producers. The clear difference is that Fonart has no regulatory "sticks" to apply, even in the case of continued noncompliance after training. Cofepris' position is that broad training should precede the use of fines, seizures, and other punitive enforcement measures (even those aimed at lead-oxide distributors and *acapardores*), leaving Fonart to solve the gaps in the training of communities. In the bygone era of corporatist control over communities in the countryside, the capacity to mandate training would have been much higher given the federal government's more direct access to ceramics-producing communities and its much greater coercive capacity (see Lopez, 2010; Ch. 9).⁶⁶ Currently, the solely voluntary nature of the training and the weakened position of Fonart as a state agency relative to civil society both mean that the agency has little means of pushing resistant communities toward compliance.

⁶⁶ Again, this is not to suggest that corporatist control was homogenous in form or equal in the degree to which rural civil society was subordinated to the state.

Perhaps most significantly, the experience of Zautla more broadly underlines both the importance of a community's openness to participate in public-private coordination as well as its capacity to ensure that their relations with Fonart are established in a manner that they believe to be advantageous. Essentially, Zautla's experience depicts a community's resistance to the state's efforts at shaping production and bringing workshops into regulatory compliance. Few conditions changed in the municipality of Zautla between 2010 and 2011, when the municipality's groups moved from resisting to cooperating. The change that did occur was the inclination of the municipal president, the latter of whom was open to the idea of eliminating lead-oxide use, able to use his position within the community to promote cooperation, and willing to act as an informational conduit between the Lead Substitution Program and the formal producers groups in the community. Without the help of the municipal leadership, there is little likelihood that the Fonart would have been able to build effective public-private ties with the numerous formal groups. Some communities have been naturally inclined to participate, while others remain resistant.

If the Fonart agents have had difficulty forming effective ties in some communities, the obvious question is what makes some communities more resistant than others? Anecdotally, resistance is a general function of the insularity of a community, the extent to which it is culturally or geographically isolated from the nation more broadly.⁶⁷

⁶⁷ When asked about this directly, the Director of the National Lead Substitution Program suggests that the agency can go to any ceramics-producing community and have a training session for workshop heads. While this may be true in the most literal sense, the contacts between the local groups and the agency are what allow the sessions to be scheduled, coordinated, and attended. The training sessions are not spontaneous or ad hoc and Fonart has no permanent staff presence or training facilities in the communities, so planning is necessary. Data that has not yet been made available by Fonart will allow for a quantitative test of this argument across the 76 municipalities that are classified as ceramics producing clusters.

Linguistic and cultural gaps and geographic isolation – factors that generally covary – frequently create problems for the Lead Substitution officials seeking to build working informational ties to dispersed communities (Contreras 2012a). Communities that are less isolated tend to be more open to adopting new productive practices (including new forms or styles that they observe) and to working with the Lead Substitution Program to improve their products. A very clear example of this comes from the communities within the municipality of Zautla (depicted partially in Figure 6.2). San Miguel Tenextatiloyan, which occupies the far eastern spur of the municipality, is the largest community (roughly 3,900 residents) and most “urbanized” by virtue of the highway that runs through town connecting the city of Puebla with the “Emerald Coast” of the state of Veracruz. In San Miguel Tenextatiloyan, 40 percent of the residents are identified by the government as ethnically Nahua, with 14 percent speaking Náhuatl (CDI 2012). Moving west from San Miguel, the municipality consists of a series of smaller communities located in a precipitously steep range of mountains. In contrast to San Miguel Tenextatiloyan stands the community of Emilio Carranza, the second most populous community in the municipality and only a few kilometers west of San Miguel Tenextatiloyan toward the mountains. Also traditionally a ceramics producing community, Emilio Carranza (Santa Cruz) is estimated to be 93 percent indigenous with 68 percent speaking Náhuatl (CDI 2012). The community lacks cell phone service, reliable access to other modes of communication, and many parts of the community are physically accessible only by unimproved roads. Of the groups that have been actively working with Fonart in the municipality, most are clustered in and around San Miguel Tenextatiloyan, the most

physically accessible and urbanized area, a pattern that has been observed more broadly (Contreras 2012a; Rodriguez 2010; Aguila 2009).

Factors contributing to the resistance against cooperation with the Lead Substitution Program are not only physical but cultural and linguistic as well. Many producers in the more isolated areas perceive the Fonart agents promoting lead-free production as outsiders who fail to understand their communities and their traditions as ceramists and who seek to tinker with their means of production (Contreras 2012a). These sentiments are consistent with the resistance of the Iglesias Contreras administration to cooperation with Fonart: local understanding of the process is necessary. Spoken language is a barrier to some communities, especially those such as



Source: INEGI
Emilio Carranza where Náhuatl is spoken among many of the residents. This is typically not a consequence of the inability to communicate verbally, as most who speak

indigenous languages also speak Spanish. As many scholars have pointed out, however, language is strongly tied to identity, is a marker between in-groups and out-groups, and a part of the relationship between dominant and subordinate groups (e.g. Fishman 1989; Schmid 2010). These issues are clearly played out in the efforts of Fonart to shape traditional productive practices in these ceramics clusters. Those communities that are more strongly indigenous and speak an indigenous language are significantly more difficult for the Lead Substitution Program to penetrate. A village near Capula offers a good example: in Santa Fe de la Laguna, Michoacán, only 20 kilometers west along the same highway between Morelia and Guadalajara, some 90 percent of residents speak Purépecha. While some progress has been made in the village to promote and train the ceramics producers in lead-free production, it is a much more closed community than Capula (which is predominantly *mestizo* and Spanish-speaking). While several important community members have been active in trying to educate others about lead, a large part of the community's reticence to fully engage with the Lead Free Substitution Program is a strong sense of culture and tradition, which distinguishes it from more mainstream Mexican society (Rodriguez 2010).⁶⁸ Strong local identity, bolstered by language, has made communities like Santa Fe de la Laguna and Emilio Carranza much more reticent to the formation of public-private ties with the Lead Substitution Program.

This is not to suggest that in resistant communities there is necessarily an overt identification with any ethnic group in these communities. In fact, as Eisenstadt (2011) notes, even indigenous groups that organize specifically along ethnic lines in Mexico

⁶⁸ Many workshops in Santa Fe de la Laguna glaze with a distinctive black glaze not used in the same manner in other locations, which heightens the sense among the community members that agents from a federal agency are going to have little to offer in the way of improvements to their production.

tend to identify themselves also as Mexicans, use symbols and figures that are drawn from popular culture (e.g. Emiliano Zapata), and are not broadly interested in autonomy from the Mexican state. Instead, the resistance seems based on a particularistic local identity that inheres at the community level (see also Overmyer-Velázquez 2010); this local identity is reinforced by both local cultural practices and often by language. No informants suggested a resistance to Fonart's Lead Substitution Program because the new technology is inconsistent with production by Nahua producers or Purépecha producers; resistance was most often expressed in terms of incompatibility with *local* practices. Production styles differ by community, rather than by region, further suggesting that resistance is tied to local, community-based identities.

In these more isolated ceramics-producing communities there is not blanket resistance to state agencies; rather there is a sense that local relations to those agencies should be – and perhaps more importantly *can* be – resisted if the terms of the relationship are not amenable to the community. The producers in Zautla saw organizing and becoming legally constituted groups as a reasonable trade-off for the mills, mixers, and potting wheels provided by the PROCAPI program run by CDI, which immediately alleviate much of the heavy physical labor involved in the traditional production of ceramics but otherwise not interfere in the functioning of workshops. On the other hand, Fonart's proposition was to provide support with the condition that production be made lead-free, an unreasonable trade-off from their perspective: neither the externalities associated with lead use nor the economic benefits of adopting the new technology were clear, but the immediate costs of trying to adopt were. In addition to financial costs of adoption, many producers in the more closed communities take umbrage at the

suggestion that bureaucrats from the capital know better how to make the goods that they have spent their lives producing (Fuentes 2010a).

Conclusions

If Chapter Four identified the need for public-private informational ties, this chapter has sought to understand what it is that makes those ties difficult to form. In the high era of PRI corporatism, rural communities were linked to the state through the official *campesino* union reliably, if not homogeneously, on the basis of an exchange of at least tacit political support for land, financial and agricultural assistance; when the exchange of carrots failed, the PRI would could and did resort to more overtly coercive methods. While the corporatist arrangement may have differed somewhat from community to community (Rubin 1996), there is broad agreement that rural society was subordinated to the state. Financial crisis and economic and political liberalization weakened this arrangement and by the 1990s, the relative strength of the state relative to rural society was much eroded.

It is in this context that the efforts of the regulatory state were pitched against local, generations-old productive practices. Although smaller in scope and lower in stakes, this scenario is very much like those described by Scott (1998): a central state agency seeking to alter and homogenize local modes of production. The key difference is in outcome: the partial failure of the project is not a consequence of the state's strength and capacity to willfully ignore of local knowledge and conditions, but is instead a consequence of a state agency too weak relative to civil society to ensure compliance. Fonart's Lead Substitution Program has sought to establish working contacts with local producers groups to promote compliance, while resistance to these efforts has stemmed

from isolation and strong community identification and a commitment to what are perceived as local (even familial) methods over the state-proffered alternative. While Fonart's approach has been even-handed, the stipulation that production be lead-free simply appears too burdensome or unnecessary to be acceptable to many of the more isolated communities.

Scott (1998) is broadly concerned with the balance of state and society and the extent to which the latter can or cannot be dominated by the former. He tells cautionary tales about the dangers of states that create humanitarian problems by dominating the civil societies they regulate, paying too little attention to the locally developed conditions and processes in their attempts to remake them. While the extreme cases of the Tanzanian Ujamaa and Soviet collectivization are well-taken, more nuanced cases of state control and regulation perhaps have as much say about state-society relations. The story here is of a state whose historical mode of dominating civil society is weakened, and is in this condition often unable even to generate the kinds of ties to society necessary to promote a "beneficial" regulation. This failure is multifaceted: the "illegibility" of the communities, and the consequent difficulty Lead Substitution Program has in making the connections; their sometimes active resistance to outside agents' interference in their production; and the difficulty for workshop heads to see the long-term benefits of upgraded production. The incapacity of the state to create well functioning ties with these isolated and insular communities has a ironic edge: in protecting their local processes from regulation, these communities make it impossible for the state to help protect them from the forces of the integrated globally economy. This returns to the notion of the family workshop as a hybrid organization – both firm and family – the effort to change and homogenize the

mode of production is not as simply an economic intervention but a cultural one as well. On an aggregate level, this is true of engaging clusters as well: the efforts to promote lead-free glaze are taken as an open criticism of the methods that their families and communities have used for decades.

Finally, the goal of the Lead Substitution Program is to be able to tutor workshops into compliance (Schrank and Piore 2007) with regulations that are beneficial to both labor standards and to their capacity to adapt to the forces of the global economy (Streek 1997, Schrank, n.d.). While the presumption might be that firms and productive clusters should inherently be more open to a tutorial approach to enforcement of labor standards (than a purely punitive one) and more open to rewarding regulations (than to simply restrictive ones), this assumption is complicated when producers do not recognize the various benefits that stem from compliance. In this case, workshops often individually fail to see that benefits (Chapter 2, Chapter 4) and communities resist because the efforts of the state are unwanted tinkering in local custom. It may be tempting to conclude simply that Fonart needs the capacity (or Cofepris the willingness) to also apply sanctions to workshops for repeated failure to comply with regulations. While this is no doubt true, it is far from clear that it would have the intended effect on geographically and culturally isolated villages and their small, informal workshops, a good portion of which the government has no record, and it might simply lead to greater efforts to evade and resist the state. In Charles Lindblom's (1978) memorable terms, what may prior to the state applying more "strong thumb" and less "clumsy finger" is for the state to actually know where to put its hand. Given what I have argued is the partial "illegibility" (Scott 1998) of these clusters based on their cultural character, the regulatory thumb of the state may

best be applied to other parts of traditional ceramics' very short value chain (processors of lead-oxide, bulk re-sellers of ceramics (*acaparadores*)), increasing the visible incentives for these communities to be trained into compliance by the state while minimizing the visibility of the regulatory intervention. Although this possibility has been recognized, Cofepris has stated an interest in having workshops more broadly trained prior to placing regulatory pressure on any portion of the value chain, ensuring that the pressure will be translated into rapid upgrading rather than a scramble by workshops to become trained after punitive steps have been initiated.

Chapter 7: Conclusions

A decade from now, all of Mexico's current traditional ceramics workshops may have fully embraced and successfully adopted lead-free glaze. Or the Lead Substitution Program may have generally failed to progress further, allowing the ceramics industry in Mexico slide further down the low road on its way to obsolescence, leaving behind even greater rural poverty. The more likely scenario is a mixed outcome: many workshops having been trained and able to upgrade, with others having been forced into different jobs, perhaps out of their communities. What this dissertation has made clear is that since the generation of an alternative lead-free glaze, the proportion of workshops that eventually upgrade is highly dependent upon the nature of workshop networks within the clusters and the extent to which agents of the Mexican state are able to construct information brokering ties to those networks. Progress to date has been slow and mixed, but the benefit of looking at the process *in medias res* is that both innovators and non-innovators are still present and are in the process of making the decisions to upgrade or to delay innovation.⁶⁹ In future years, a mix of downward economic pressure, state-led training, and (ideally) some degree of punitive enforcement will have homogenized the industry's use of lead-free glaze, making a study of both innovators and non-innovators very difficult, if not impossible.

What can the experience of this single, apparently idiosyncratic industry in Mexico reveal about innovation among small firms in the developing world? As a matter of comparison, conditions in the ceramics industry vis-à-vis innovation and globalization

⁶⁹ Hall (2005) points out that the decision firms make is not to innovate or not innovate, but instead to innovate now or to continue under the status quo with the choice to innovate later.

are common among other industries. Although the specifics of ceramics production and workshops themselves are unique, the same kinds of barriers to adoption of new technologies are characteristic of small firms in low-tech industries: low levels of human capital, insufficient financial means and personnel to conduct research and development, low margins of profit, isolation and lack of access to new productive ideas. It is these characteristics that have led scholars to consider these kinds of firms the bottom of the barrel in terms of innovativeness (von Tunzelman and Acha 2005). In a sense, although the ceramics sector is hobbled in ways that are shared by other low-tech sectors, it is one of the worst of the lot – characterized by traditional in-family training, geographic and often cultural isolation, very weak market position – and, consequently, is one of the sectors that is least likely to upgrade.

Although the overarching focus is on the single case of the Mexican ceramics sector, the dissertation gets more leverage on the question of public-private cooperation and technology diffusion by varying the units of analysis. Within a somewhat positive case (which would be expected to be wholly negative), there is variation by community (addressed in Chapters 5 and 6) and, within communities, variation by workshop (Chapter 4). By looking at these lower levels of analysis, the analysis sheds light on the behavior of the sector as a whole. This final chapter sums up thematically some of the major issues that through the previous chapters' treatments of the state, the private sector, and their points of convergence and attempts to draw out some of the lessons provided by the case.

Social Network Methods

This dissertation has attempted to approach innovation in the ceramics sector at several different levels of analysis: it has described the national program and its efforts to advance an innovation sectorally; on the cluster level, it has compared the construction of formal networks in three major communities; and it has looked on a micro-level at the workshops within a single cluster. This latter portion requires thinking about both workshops themselves and the network in which they are embedded (or subdivisions of the network (e.g., ego-networks, formal producers networks)) as important factors in their decision-making process. The workshops may be thought of as the unit of analysis, but as individual workshops, they cannot be neatly separated from their roles as receivers and senders of information. Again, once we do away with the notion that small, low-tech firms will generate innovations on their own, the critical issue is what kind of information they have and how they access it. While their capacity to absorb technologies may be a consequence of characteristics internal to the workshop, their access to information is a function of the structure of the network(s) and the position of workshops within that. Long important in sociology and increasingly used in political science, social networks analysis is an important means of overcoming – or at least balancing – the assumption of independence that underlies traditional quantitative modeling.

This is not to say that network analytic methods are free of critique. Of particular consequence here is the criticism that network analytic methods are poor at identifying causal relationships because of the tendency to confuse homophily (the propensity for units with similar characteristics or similar inclinations to naturally form ties) with causality (those ties as exogenous factors shaping the characteristics of the units).⁷⁰

⁷⁰ The discussion over the work of Christakis and Fowler is a testament to the ferocity with which the homophily versus causality has raged.

This study has made an effort to understand the causal role played by the cluster networks in which the producers are embedded. First, it used the simple applications of social network methods to identify the formal and informal ties between the workshops in the Capula cluster. Network visualization allows for these ties to be observed across the cluster along with the correlation between their position in the network and their likelihood of having received the information necessary for upgrading. In spite of the fact that many network studies exclude isolates from analysis (see Wasserman and Faust 1994), the visualizations here include them and make especially clear how important the structure of the networks are to the movement of information. The analysis further relies on measures from the whole network – network degree and betweenness – as well as from their “ego networks” – personal network exposure – as predictors in statistical models. This method, inherently mixed, is an effort to more carefully identify causality at the individual level while still taking into consideration each workshop’s position among their peers and within the cluster.

Finally, insofar as embeddedness (as used by Evans 1995) has been a contentious concept – unfalsifiably linked to positive developmental outcomes – the use of social network methods seems to offer a means for some resolution. As Chapter Four demonstrated, the nature of embeddedness and where it exists and where it does not is empirically assessable using these methods. The clear benefit of this is that rather than simply relying on qualitative assessments of relative embeddedness, which critics have tied to the concept’s use in unfalsifiable arguments, social network analysis can provide both visualization of embeddedness (or lack of) and quantitative measurements of

network characteristics such as density and individual characteristics such as degree and betweenness that can in theory affect developmental outcomes.

State as Innovator

Small, low-tech enterprises are the least likely firms to develop innovations to their productive processes (von Tunzelman and Acha 2005). This is a function of many of their inherent traits: little capacity to engage in research and development, low margins of profit, typically low levels of human capital, and frequent isolation. Again, in the ceramics sector, and other industries whose units of production are home workshops, non-innovativeness is exacerbated by craft learning, isolation, and incentives against reinvestment in the workshop. In fact, as suggested in Chapter 3, they may bear more resemblance to small family farms than they do to higher-tech firms in more organized sectors. In short, simply based on the kinds of organizations they are, these small producers are unlikely to indigenously generate the kinds of innovations that will allow them to upgrade and remain competitive, especially in a world of swiftly evolving market conditions. Moreover, as Lester and Piore (2004) argue, in tightening markets for many products, globalization has decreased the kind of margins necessary for even larger firms to create the right conditions for innovation.

It is clear that these industries face distinct conditions and in terms of development policy need to be treated differently from higher-tech industries and large firms, which can be responsive to less intrusive policy choices: intellectual property protections, research and development subsidies, export targets, and so forth. Effective policies develop and advance innovation in low-tech industries are likely to require two particular elements. First, the level of intervention necessary for the *generation of*

innovations for industries of this sort is likely to be very high, even though the technologies themselves are relatively basic and possibly already exist. Like small farms, which have typically required heavy intervention for new technologies to be diffused, the ceramics sectors and others will ultimately require direct state assistance. That said, for many low-tech industries useful innovations will not need to be generated from scratch as happened in the Mexican ceramics sector. As Romer (1993) points out, there are many, many simple, extant, and nonproprietary technologies that could be used to improve production in the low-tech industries of the developing world. In these cases only adaptation to local circumstances would be necessary, a simpler process in most cases than generation from scratch. This dissertation advances the notion that state agencies without particularly deep expertise may in fact be quite useful in this process of innovation generation or adaptation, contrary to the conventional wisdom that bureaucracies are poorly suited to innovation. State agencies may, in fact, have the coordinative capacity to catalyze innovation by bringing together experts to address the technology gap. The requirements of the agency are that it have the capacity to identify useful or necessary technological upgrades and to coordinate an “interpretive public space” where technical solutions may be generated. This last point entails an understanding of the industry in question, the technologies used in workshops or firms, and potential upgrades.

Second, state agents and policymakers must be attentive to the manner in which information flows among producers along with their capacities to absorb new technologies. Recognizing that producers will not generate innovations on their own, one of the key points become how they are able (or not) to receive information about new

technologies. The importance of informational flows is illustrated in Chapter 4 (along with studies such as Giuliani 2007). The assumption that information is equally accessible or moves homogeneously within clusters of producers is untenable. Fonart's Lead Substitution Program has partially capitalized on this by using formal organizations as tools for information diffusion, but it has failed to make any accommodation for the fact that many unaffiliated producers are blocked by structural holes in the network from receiving the same information. Without at least a schematic understanding of how firms relate to each other within low-tech clusters, government efforts to diffuse productive information are unlikely to be especially effective for certain subgroups within the cluster.

Why should state agencies be catalyzers of innovation and go through the trouble of assisting industries that are not themselves innovative instead of letting waves of Schumpeterian creative destruction lead the country toward more efficient economic outcomes? Although, this dissertation does not explicitly address this normative question, it does offer some insights into why state intervention might be preferable to requiring the ceramics sector find its own solution or perish. The primary reason is the issue of rural welfare. Perhaps the most problematic part of the creative destruction scenario is the theoretical (and optimistic) claim of efficient job replacement; even if new jobs do spring up in the country to replace those lost in the comparatively inefficient industry, there is little guarantee that this process will occur quickly enough to avoid the welfare losses inherent to job realignment. After all, workers in low-tech industries in the developing world are typically of meager economic means (just over 2 US Dollars a day for workers in ceramics workshops (Cuiriz 2011a)), making adjustment and re-training difficult, and

have low skill levels, disqualifying them from many higher value-added jobs. Moreover, for industries located in rural areas or areas with few other options for employment, displaced workers must migrate to urban areas or abroad to find other work. Finally, in many circumstances the upgraded technology benefits not only the firms involved but can amount to a public good as well, improving community health or environmental conditions. In short, for many developing countries, actively assisting in the development or adaptation and diffusion of innovations is a means of helping small employers adjust to the heightened competition and vicissitudes of the global market.

Producers of traditional Mexican ceramics have benefitted from the fact that artisanally produced ceramics are identified with Mexican cultural identity (Lopez 2010), and, along with other branches of artisanal production, have a state agency (Fonart) dedicated to their preservation and development. For other industries that do not have a dedicated state agency, a remaining question is which state agencies are best placed to carry out the kind of technology diffusion described here. The developing literature on tutoring firms into regulatory compliance and on “rewarding regulation” suggests that regulatory agencies or inspectorates may be the best placed agencies, as they presumably have some understanding of the firms and their shortcomings. In the case of the Mexican ceramics sector, the regulatory agency, knowing little about the sector, partnered with a agency that did have greater (although limited) contact with the workshops. The questions of what bureaucratic characteristics make them effective in this role and how bureaucratic capacity can be built are still relatively open (Pires 2009; Evans and Rauch 1999).

Co-production of Innovation

Co-production is a concept that has typically been applied in the provision of services and public goods to communities by the state: services such as policing (Whitaker 1980), schooling (Ostrom 1996), and public health (Tendler 1997). Insofar as the diffusion of simple, health- and environment-improving technologies into the private sector can be considered a public good and requires complementary public and private inputs, the concept of co-production is reasonably applied to it without “conceptual stretching.” As stressed throughout this dissertation, the primary inputs that low-tech firms are lacking is technological and market information and certainty about the manner in which new technologies can be adapted to their workshops. Fonart has offered some financial incentives to adopt the lead-free technology, but the primary contribution has been the diffusion of information and understanding of the new technology through hands-on experience with it. For regulatory agencies more broadly, the most basic input they are able to offer is information about how to upgrade or meet existing regulations: technology, training, or tutoring (see Schrank and Piore 2007). For the Mexican ceramics sector, the primary contribution has been inter-workshop ties – both formal and informal – along with feedback based on trainings and field trials done with adjusted versions of the lead-free glazes. Where diffusion of information has failed to occur (to some sections of clusters that consist of unaffiliated workshops and some communities that have resisted the Lead Substitution Program), these inputs have not been brought together.

This dissertation has argued that the critical function of inter-workshop ties and public-private sector ties is informational, departing from scholarly work on development that has taken a more expansive conception of the relations at both the level of the cluster and between public officials and firms. Some development scholars (e.g. Evans 1997)

have tended to frame a community's input as "social capital"; this dissertation has avoided using that term in order to maintain focus on the informational nature of the ties formed by workshops. Because of contention over how social capital is to be conceptualized and operationalized, invoking the contentious concept would do little to advance the understanding of the producing communities. Scholarship has seen the development of two competing views of social capital: 1) an aggregated view (e.g. Putnam 1993) that sees social capital as trust or civic engagement that accrues and is measurable at the community level (or a higher level of aggregation), and 2) an individual characteristic that stems from access to or control of information based on one's position within the network structure (e.g. Burt 1992, 2001; Portes 1996). The analysis in Chapter Four suggests that ties between workshops vary enough within clusters that talking about social capital as an aggregated characteristic of a cluster or producing community is not advisable. The analysis presumes that informal and formal ties between workshops (and with the state) are beneficial as they provide the means to gain information necessary for upgrading. While this is very much in line with the latter conceptualization of individual social capital, the benefit of the network ties is demonstrated and little is to be gained from invoking the metaphor of social capital. The benefit of approaching the social input from the perspective of identifiable social ties is that it provides a more rigorous and accurate (if work intensive) means of determining where the necessary networks exist and where they do not. Moreover, if (as discussed below) the state is able to play a role in the sponsorship and expansion of producer networks, it allows for the overlaying of formal on informal relationships to be observed along with the consequent effect on diffusion.

Returning to the logic of the co-production diagram in Figure 1.1, the dissertation has noted throughout that both Fonart and ceramics producers have tight budget constraints. As discussed below, what the agency lacks in direct resources, it is able to make up in coordinative capacity and the ability to use its position as part of the Mexican state to draw on the informational resources of other agencies (Secretary of Health, INEGI, CDI). In this case, it is probably safe to say that the state's burden was greater as both the generator and active diffuser of the lead-free technology; the state's burden is likely to be similar in other low-tech sectors where non-trivial barriers to innovation exist. Where greater sectoral organization and cooperation are the rule and where firms or workshops face fewer informational hurdles and are better equipped to upgrade, the state's contribution can be lower.

NGOs and the State

Scholarship on the activity of NGOs has suggested the nongovernmental promotion of labor and product standards may provide an alternate route to improved labor conditions. Gereffi et al. (2001), for example, argue that the establishment of private product certifications can affect labor conditions in developing countries by putting pressure from final consumers on producers farther down the supply chain and also by acting as a supplement to insufficient legal protections. The nature of ceramics production and import controls in developed countries makes this an unlikely scenario in this case. The labor standard is inherently linked to product quality, which is legally controlled by the destination countries such as the US that have relatively strong enforcement. A pair of shoes produced under horrendous labor conditions may be indistinguishable from one produced under excellent ones; this is not true of Mexican

ceramics, where the easily detectable presence of soluble lead (Fonart 2010) is an unavoidable indication of the fact that the pieces were produced by workers who were exposed to lead-oxide. In short, import restrictions are sufficient to affect what consumers buy in developed countries, because only lead-free pieces are allowed entry into the market, and a private certification would be a weaker restriction and simply redundant.⁷¹ As such, the state-led approach to upgrading the sector is seemingly the appropriate means.

As mentioned in the brief discussion in Chapter Four, a non-governmental organization did make an effort parallel to the Mexican state to diffuse the use of lead-free glaze; its approach favored depth of treatment over breadth and ultimately was unsustainable. Fonart's less intensive approach is likely to be a function of the fact that Fonart's responsibility is *sectoral* and has a responsibility to producers all over Mexico. Workshop by workshop, those BSP trained and worked with are more likely to have adopted lead-free glaze but the absolute number that they worked with was far smaller than those trained by Fonart's Lead Substitution Program. Much as advocating for a private standard against lead-oxide glaze in developed countries would miss an important dynamic in the market structure of the sector, BSP's approach seemed to miss a critical social structure: that little productive information is passed explicitly from workshop to workshop. As argued to in Chapter Four, some monitoring is possible among informal contacts, but very little actual technical information is passed between them. Fonart's

⁷¹ An NGO-promoted certification for Mexican consumers of ceramics could theoretically supplement the legal restrictions on the use of lead by putting pressure on producers from domestic consumers. Among the problems with this scenario is that – as discussed in previous chapters – much of the market for ceramics in Mexico is informal. Given the state itself is unaware of where many producers work and sell their goods, it is very highly unlikely that a credible certification could be developed and implemented.

(admittedly imperfect) approach has been to use existing networks to coordinate group trainings and garner feedback; BSP's reliance on single family training meant that each workshop would have to be treated individually, an impossible task for the NGO.

Finally, as documented in Chapter Six, the Lead Substitution Program has not always been successful at creating ties to communities; nevertheless, it has been able to draw on the resources of other state agencies such as CDI, Cofepris, Secretary of Health (and INEGI in the future) to identify both ceramics producing workshops and groups within clusters that they can attempt to coordinate with. Moreover, while Fonart may currently have little leverage over producers (see Chapter Six), Cofepris plans to begin phasing in more punitive measures to ensure compliance as training becomes more ubiquitous (Herrera 2012), which will provide increased leverage over producers. With no official role in economic or health policy, BSP had even less capacity to approach clusters. Moreover, in the event that Cofepris' more punitive regulatory measures are aimed at re-sellers of products made with lead, this kind of activity is well beyond the scope of what an NGO devoted to working in workshops themselves could do.

In short, although NGOs and their utility as international actors (or parts of "transnational advocacy networks") are often highlighted, their impact in this case seems to have been relatively minor. More broadly, it seems that the kind of private regulatory activities advocated by Gereffi et al. (2001) and others may not be effective depending on the structure of the industry and market.

Vestigial Corporatism and New Organization

Shadlen (2002, 2004) argues that the democratization of Mexico and the unraveling of the corporatist bargain between the PRI-state and civil society left the

difficult-to-organize small businesses with little means of advocating their positions to the government. This loss of representation was an unintended negative consequence of democratization. This analysis of the ceramics sector shows the opposing side of this problem: the same unraveling has left the state weakened in its capacity to shape the behavior of civil society. This may be seen as a positive development given the coercive and authoritarian nature of the Mexican state over the course of the 20th Century. It is sadly ironic, however, that when the state seeks to promote beneficial regulations and help upgrade production in a troubled rural sector, the state's weakened ties to these communities is a complicating factor. This is not to advocate for a return to a corporatist Mexico, but only to point out (much like Shadlen 2002, 2004) that this changed relationship has involved trade-offs for both small firms and the state.

As Chapter Four and Five show, the vestiges corporatism – formal organizations – have actually played an important part in the diffusion of innovations by providing an organizational structure to which the state agents can establish informational linkages. The UNEAMICH, formed in an effort to tighten PRI control over rural communities in the state of Michoacán, for example, has found a new role as the point of contact for the National Lead Substitution Program and a critical part of the diffusion and aggregation of information. That said, more recently formed producers groups are able to serve the same purpose, as the new producers groups in Zautla, Puebla illustrate. The organizational characteristics (i.e. regularized forms of communication, meetings) and their visibility to the state are what make them – like the vestigial union groups – functional points of articulation. As Chapter Five argues, this is cause for hope, since the provision of selective benefits for organization seems capable of harnessing some parts of the “sea of

informal ties” (Powell et al. 1996) into visible, legally constituted producers groups. In other words, sponsoring the formation of producers groups by providing some selective benefit may be a useful step toward getting producers to participate in a program or adhere to regulation that is less obviously beneficial for them.

That said, sponsorship of producers groups is unlikely to be a panacea for informational gaps in the sector. Workshops that are socially isolated within their clusters are not necessarily going to easily be incorporated into producers groups. In the absence of informal ties, the establishment of formal ties (as seen in Chapter Five) will not occur in many cases, as seen in the communities where group formation seems to have been based largely on informal networks. Moreover, even where there are producers groups, there is no guarantee that the communities will not be resistant to the state agencies seeking to shape their productive behavior. In short, state-assisted formal organizations may have potential for programs to diffuse technologies, but those same organizations are capable of resisting relatively weak state agencies when it comes to implementation of regulations.

Benefits of Regulation

This study of the ceramics sector also provides insights into recent efforts to understand the dynamics by which governments can create and enforce regulations that improve both the competitiveness of firms as well as the conditions under which their workers labor (Schrank n.d.). The notion that regulation can be “rewarding” runs counter the general presumption that limits imposed on products or production are distortions of the market that generate losses for firms, and that, therefore, regulation may protect laborers or communities but only at the expense of firms. This line of research has sought

to dispel the notion that regulation is zero-sum and promote the idea that positive sum outcomes can result when dangerous, inefficient, environmentally damaging processes cut into the profitability of the firm – a situation that is not at all uncommon. The rewarding nature of the lead restrictions is straightforward: it reduces exposure to lead among ceramics workers, their families, their consumers, and those affected by environmental contamination as well as re-opening the possibility of accessing foreign markets. The costs of inputs are essentially unchanged by adoption; the benefits include the elimination of negative health and environmental externalities and the potential to enter more lucrative markets.

This study has in part revealed the importance of information in promoting these kinds of regulation. For small firms, stasis is the norm in the face of informational gaps. First, they may not understand either the long-term benefits of adopting new technologies or meeting beneficial regulations or the costs that are built into current practices. Ceramics producers are probably an extreme in this sense, as they generally do not understand the toxicity of lead (though they do grasp the economic effects of being barred from an export market). Second, even where they do understand the costs of stasis, they face a variety of potential uncertainties ranging from not knowing how the front-loaded costs of upgrading will be amortized over a future period to a lack of access to information about how to upgrade or meet regulations. In its most basic form, then, tutoring firms into compliance in order for them to meet regulations that are ultimately beneficial is an informational task: assisting in the provision of more complete market information and increasing access to flows of information.

This case, however, underlines an additional point: close contact with the sector in question is probably a necessity for the formation of regulations that are feasibly met by the sector. The Mexican Secretary of Health (and Cofepris) and formulated an outright ban on the use of lead-oxide in low-temperature ceramics workshops before it understood that no alternative glaze existed. Although an alternative glaze was generated, the risks inherent to this are obvious: firms are regulated out of business (undermining the economy), regulations are not enforced (undermining the regulatory agency and allowing firms to continue unsafe practices), or a potentially inefficient scramble ensues to assist the firms in meeting the regulations. Amengual (2011) provides a similar example of the Argentine environmental regulators adopting international environmental standards, without realizing that meeting those regulations was well beyond the capacities of local citrus producers. Harking back to the broader literature on development, this is one of the points of bureaucratic embeddedness: to understand the conditions in the private sector and generate benchmarks that push but are within the range of possibility for firms to meet (possibly with assistance) (Evans 1995). In short, putting rewarding regulations into place will require both bureaucratic understanding of what those regulations can and should be, along with (at least) the capacity to improve informational flows.

Industrial Policy for Laggard Firms?

Rather than a call for a return to old models of state-led development, the conclusions drawn here are part of a reinvigorated interest in industrial policy in the more integrated global economy. The record of states like Mexico (many in Latin America) that thoroughly embraced market liberalization with aplomb has been spotty at best: sluggish average rates of overall growth, stagnating incomes, and rising inequality.

Meanwhile, while countries like China and Vietnam in the same period have turned in extraordinary rates of growth with very active state development policy, although under authoritarian regimes. Brazil, often taken to be Latin America's success case, is under close examination for the state's capacity to operate a relatively successful development model under conditions of political and economic liberalization. Yet even the future of Brazil's economic boom seems uncertain in the face of structural problems.

This project fits into the general tenor of this new interest in industrial policy, but it aims not at fast growth in big firms and advanced sectors but rather at small, low-tech industries. These kinds of industry play a critical role in the welfare of wide swaths of the populations of developing countries, especially in rural areas. If the developing world's experiment with liberalization taught any lesson well, it was that the assumptions about the efficiencies of markets held by mainstream economists (among others: job replacement, the fluid movement of information) did not hold up to empirical scrutiny. Small, low-tech firms and farms and family businesses have been perhaps the least likely to survive the competition that has accompanied the integration of global markets. This is not to argue that all aspects of globalization are negative: it generates market opportunities and can generate pressures for the domestic improvement of standards for labor (e.g. NAFTA's labor standards), environment protections, and product quality (e.g. eliminating lead-oxide glaze). The experience of the Mexican ceramics sector makes a case for a more hands-on, state-led and yet flexible approach to ensuring that these labor-intensive industries are able to take advantage of the benefits of integrated economies and not abandoned to find the high road on the merits of their own workshops. Most simply will not. The welfare costs of the low road in these sectors – increased informality,

downward pressure on wages, unemployment, continued use of outdated technologies – are high and worth the effort to address.

Bibliography

- Aghion, P., & Harris, C. V. (2001). Competition, Imitation, and Growth with Step-by-Step Innovation. *Review of Economic Studies*, 68, 467-492.
- Ahuja, G. (2000). Collaboration Networks, Structural Holes, and Innovation: A Longitudinal Study. *Administrative Science Quarterly*, 45, 425-455.
- Amengual, Matthew. (2011). *Enforcement without Autonomy: The Politics of Labor and Environmental Regulation in Argentina*. PhD Dissertation, Massachusetts Institute of Technology.
- Amsden, A. (1989). *Asia's Next Giant: South Korea and Late Industrialization*. New York: Oxford University Press.
- _____. (2001). *The Rise of "The Rest": Challenges to the West from Late-Industrializing Economies*. Oxford: Oxford University Press.
- Anderson, J. R., & Feder, G. (2004). Agricultural Extension: Good Intentions and Hard Realities. *World Bank Research Observer*, 19 (1), 41-60.
- Arrow, K. J. (1983). *Collected Papers of Kenneth Arrow, Volume 2: General Equilibrium*. Cambridge, MA: Harvard University Press.
- Atkinson, M. M., & Coleman, W. D. (1989). Strong States and Weak States: Sectoral Policy Networks in Advanced Capitalist Economies. *British Journal of Political Science*, 19 (1), 47-67.
- Baum, J. A., Calabrese, T., & Silverman, B. S. (2000). Don't Go it Alone: Alliance Network Composition and Startups' Performance in Canadian Biotechnology. *Strategic Management Journal*, 21, 267-294.
- Birkhaeuser, D., Evenson, R. E., & Feder, G. (1991). The Economic Impact of Agricultural Extension: A Review. *Economic Development and Cultural Change*, 39 (3), 607-650.
- Burt, R. S. (1992). *Structural Holes*. Cambridge, MA: Harvard University Press.
- _____. (2002). The Social Capital of Structural Holes. In M. F. Guillén, R. Collins, P. England, & M. Meyer (Eds.), *The New Economic Sociology: Developments in an Emerging Field*. New York: Russell Sage Foundation.

- Cash, D. W. (2001). "In Order to Aid in Diffusing Useful and Practical Information": Agricultural Extension and Boundary Organizations. *Science, Technology, and Human Values*, 26 (4), 431-453.
- Coleman, J., Katz, E., & Menzel, H. (1957). The Diffusion of an Innovation Among Physicians. *Sociometry*, 20 (4), 253-270.
- Comisión Nacional para el Desarrollo de los Pueblos Indígenas (CDI). (various). *Localidades Indígenas 2005*. Retrieved October 2011 from <http://www.cdi.gob.mx/localidades2005/estatal.htm>
- Connors McQuade, M. *Loza Poblana: The Emergence of a Mexican Ceramic Tradition*. Doctoral Dissertation: City University of New York.
- Cornelius, W. A., Craig, A. L., & Fox, J. (Eds.). (1994). *Transforming State-Society Relations in Mexico*. San Diego, CA: Center for US-Mexican Studies.
- Coslovsky, S., Pires, R., & Silbey, S. (2011). The Politics of Regulatory Enforcement. In D. Levi-Faur (Ed.), *Handbook on the Politics of Regulation*. London: Edward Elgar Publishers.
- Debreu, G. (1972). *Theory of Value: An Axiomatic Analysis of Economic Equilibrium*. New Haven, CT: Yale University Press.
- Diehl, M., & Stroebe, W. (1987). Productivity Loss in Brainstorming Groups: Toward the Solution of a Riddle. *Journal of Personality and Social Psychology*, 53, 497-509.
- Dietz, G., Garbers, F., Höllmann, G., & Stolley de Gámez, K. (1991). *Las Artesanías en la Cuenca del Lago de Patzcuaro: El Caso del Tallado de Madera y la Alfarería*. Hamburg: University of Hamburg.
- Donaldson, J. (2011). *Small Works: Poverty and Economic Development in Southwestern China*. Ithaca: Cornell University Press.
- Dussel Peters, E., Ruiz Durán, C., & Piore, M. J. (2002). Learning and the Limits of Foreign Partners as Teachers. In G. Gereffi, D. Spener, & J. Bair (Eds.), *Free Trade and Uneven Development: The North American Apparel Industry after NAFTA* (pp. 224-245). Philadelphia, PA: Temple University Press.

- Eckstein, H. (1975). Case Study and Theory in Political Science. In F. Greenstein, & N. Polsby (Eds.), *The Handbook of Political Science* (Vol. 7). Reading, MA: Addison-Wesley.
- Edmonds-Poli, E. (2006). Decentralization under the Fox Administration: Progress or Stagnation? *Mexican Studies*, 22 (2), 387-416.
- Edmonds-Poli, E., & Shirk, D. A. (2009). *Contemporary Mexican Politics*. New York: Rowman and Littlefield.
- Eisenstadt, T. (2011). *Politics, Identity, and Mexico's Indigenous Rights Movements*. New York: Cambridge University Press.
- Estrada, S., & Heijs, J. (2006). Technological Behaviours and Export Probability in Developing Countries: The Case of Mexico. *Science, Technology, and Society*, 11 (2), 271-317.
- Evans, P. (1995). *Embedded Autonomy: States and Industrial Development*. Princeton, NJ: Princeton University Press.
- _____. (1996). Government Action, Social Capital, and Development: Reviewing the Evidence of Synergy. In P. Evans (Ed.), *State-Society Synergy: Government and Social Capital in Development*. Berkeley, CA: University of California Press.
- _____. (Ed.). (1997). *State-Society Synergy: State and Social Capital in Development* (Research Series #94 ed.). Berkeley, CA: University of California International and Area Studies Collection.
- _____. (2005). The Challenges of the Institutional Turn: New Interdisciplinary Opportunities in Development Theory. In V. Nee, & V. Swedberg (Eds.), *The Economic Sociology of Capitalist Institutions*. Princeton, NJ: Princeton University Press.
- Evans, P., & Rauch, J. E. (1999). Bureaucracy and Growth: A Cross-National Analysis of the Effects of Weberian State Structures on Economic Growth. *American Sociological Review*, 64 (5), 748-765.
- Evans, P., Rueschemeyer, D., & Stephens, E. H. (Eds.). (1985). *States versus Markets in the World-System*. London: Sage Publications.

- Falleti, T. G., & Lynch, J. F. (2009). Context and Causal Mechanisms in Political Analysis: Potentialities and Pitfalls. *Comparative Political Studies*, 42 (9), pp. 1143-1166.
- Figueiredo, P. N., Vedovello, C., & Martelotte, M. C. (2007). Firms and Innovation System Supporting Organisations: A Brief Empirical Scrutiny of their Knowledge-centred Links in a Developing Area in Brazil. *Science, Technology, and Society*, 12 (1), 73-112.
- Filon, F. L., Boeniger, M., Maina, G., Adami, G., Spinelli, P., & Damian, A. (2006). Skin Absorption of Inorganic Lead (PbO) and the Effect of Skin Cleansers. *Journal of Occupational and Environmental Medicine*, 48 (7), 692-699.
- Fine, B. (1999). The Developmental State is Dead - Long Live Social Capital? *Development and Change*, 30 (1), 1-19.
- Fishman, J. (1989). *Language and Identity in Minority Sociolinguistic Perspective*. Clevedon, England : Multilingual Matter.
- Fondo Nacional para el Fomento de las Artesanías (Fonart). (2009). *Como detectar la presencia de plomo en cazuelas, ollas, platos, y jarros de barro esmaltado?* Mexico City: Fonart.
- Fondo Nacional para el Fomento de las Artesanías (Fonart). (2010). *Informe 2000: Uso de Plomo en la Alfarería en México*. Mexico City: Fonart.
- Foster, G. M. (1967). *Tzintzuntzan: Mexican Peasants in a Changing World*. Boston: Little, Brown and Co.
- Fox, J. (1997). How Does Civil Society Thicken? The Political Construction of Social Capital in Rural Mexico. In P. Evans (Ed.), *State-Society Synergy: Government and Social Capital in Development* (pp. 119-149). Berkeley, CA: University of California International and Area Studies Collections.
- _____. (1994). The Difficult Transition from Clientelism to Citizenship: Lessons from Mexico. *World Politics*, 46 (2), 151-184.
- _____. (1992). *The Politics of Food in Mexico: State Power and Social Mobilization*. Ithaca, NY: Cornell University Press.

- Fox, J., & Hernández, L. (1992). Mexico's Difficult Democracy: Grassroots Movements, NGOs, and Local Government. *Alternatives: Global, Local, Political*, 17 (2), 165-208.
- Freeman, C. (1987). *Technology Policy and Economic Performance: Evidence from Japan*. London: Pinter.
- Frickel, S., & Moore, K. (2005). *The New Political Sociology of Science: Institutions, Networks, and Power*. Madison: University of Wisconsin Press.
- Geddes, Barbara. (1990). Building "State" Capacity in Brazil, 1930 – 1964. *Comparative Politics*, 22 (2), 217-235.
- George, A., & Bennett, A. (2005). *Case Studies and Theory Development in the Social Sciences*. Cambridge, MA: MIT Press.
- Gereffi, G., Garcia-Johnson, R., & Sasser, E. (2001). The NGO-Industrial Complex. *Foreign Affairs*, 125, 56-65.
- Gereffi, G., Spener, D., & Bair, J. (Eds.). (2002). *Free Trade and Uneven Development: The North American Apparel Industry after NAFTA*. Philadelphia, PA: Temple University Press.
- Gerschenkron, A. (1962). Economic Backwardness in Historical Perspective. In A. Gerschenkron, *Economic Backwardness in Historical Perspective: A Book of Essays* (pp. 5-30). Cambridge, MA: Harvard University Press.
- Granovetter, M. (2002). A Theoretical Agenda for Economic Sociology. In M. F. Guillén, R. Collins, P. England, & M. Meyer (Eds.), *The New Economic Sociology: Developments in an Emerging Field*. New York: Russell Sage Foundation.
- _____. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91, pp. 481-510.
- Guiliani, E. (2007). The Selective Nature of Knowledge Networks in Cluster: Evidence from the Wine Industry. *Journal of Economic Geography*, 7, 139-168.
- Guillén, M. F., Collins, R., England, P., & Meyer, M. (Eds.). (2002). *The New Economic Sociology: Developments in an Emerging Field*. New York: Russell Sage Foundation.

- Haake, C. (2007). *The State, Removal and the Indigenous Peoples in the United States and Mexico, 1620-2000*. New York: Routledge.
- Haber, S., Klein, H. S., Maurer, N., & Middlebrook, K. J. (2008). *Mexico Since 1980*. Cambridge: Cambridge University Press.
- Hall, B. H. (2005). Innovation and Diffusion. In J. Fagerman, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.
- Harriss, J. (2006). Social Capital. In K. Jomo, & B. Fine (Eds.), *The New Development Economics: After the Washington Consensus*. New York: Zed Books.
- Harvey, N. (1990). Peasant Strategies and Corporatism in Chiapas. In J. Foweraker, & A. Craig (Eds.), *Popular Movements, NGOs, and Local Government*. Boulder: Lynn Rienner.
- Heaney, M. T., & McClurg, S. D. (2009). Social Networks and American Politics. *American Politics Research*, 37 (5), pp. 727-741.
- Helpman, E. (2004). *The Mystery of Economic Growth*. Cambridge, MA: Harvard University Press.
- Hernández-Rodríguez, R. (2003). The Renovation of Old Institutions: State Governors and the Political Transition in Mexico. *Latin American Politics and Society*, 45 (4), 97-127.
- Hirschman, A. O. (1977). *The Passion and the Interests: Political Arguments for Capitalism Before its Triumph*. Princeton: Princeton University Press.
- Hlavacek, J. D., & Thompson, V. A. (1973). Bureaucracy and New Product Innovation. *The Academy of Management Journal*, 16 (3), 361-372.
- Johnson, C. (1982). *MITI and the Japanese Miracle*. Stanford: Stanford University Press.
- Kohli, A. (2004). *State-Directed Development: Political Power and Industrialization in the Periphery*. Cambridge: Cambridge University Press.
- Koput, K., & Powell, W. W. (2000). Not Your Stepping Stone: Collaboration and the Dynamics of Industry Evolution in Biotechnology. Denver, CO: Organization Science Winter Conference.

- Kuznetsov, Y., Piore, M. J., Ruiz Dúran, C., & Sabel, C. (2001). *Think Globally, Act Locally: Decentralized Incentive Framework for Mexico's Private Sector Development*. Washington, D.C.: The World Bank.
- Lamphear, B. P., Dietrich, K., Auinger, P., & Cox, C. (2000). Cognitive Deficits Associated with Blood Lead Concentrations <10 ug/dL in US Children and Adolescents. *Public Health Report, 115*, 521-529.
- Landrigan, P. T. (1990). Current Issues in the Epidemiology and Toxicology of Occupational Exposure to Lead. *Environmental Health Perspectives, 89*, 61-66.
- Landrigan, P. T., Todd, A. C., & Wedeen, R. P. (1996). Lead Poisoning. *Mount Sinai Journal of Medicine, 62* (5), 360-364.
- Lester, R., & Piore, M. (2004). *Innovation: The Missing Dimension*. Cambridge, MA: Harvard University Press.
- Lindblom, C. (1978). *States and Markets*. New York: Basic Books.
- Lorentzen, J. (2009). Learning and Innovation: What's Different in the (Sub)Tropics and How Do We Explain it? *Science, Technology, and Society, 14* (1), 177-205.
- Lucas, R. E. (1988). On the Mechanics of Economic Development. *Journal of Monetary Economics, 22*, 3-42.
- López, R. A. (2010). *Crafting Mexico: Intellectuals, Artisans, and the State after the Revolution*. Durham: Duke University Press.
- Malerba, F. (2005). Sectoral Systems: How and Why Innovation Differs Across Sectors. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.
- McCann, M. (1996). Hazards in Cottage Industries in Developing Countries. *American Journal of Industrial Medicine, 30* (2), 125-129.
- McEvily, B., & Zaheer, A. (1999). Bridging Ties: A Source of Firm Heterogeneity in Competitive Capabilities. *Strategic Management Journal, 20*, 1133-1156.
- McQuade, M. C. (2005). *Loza Poblana: The Emergence of a Mexican Ceramic Tradition*. PhD Dissertation, City University of New York.
- Migdal, J. S. (1988). *Strong Societies and Weak States: State-Society Relations and State Capabilities in the Third World*. Princeton, NJ: Princeton University Press.

- Migdal, J. S., Kohli, A., & Shue, V. (Eds.). (1994). *State Power and Social Forces: Domination and Transformation in the Third World*. Cambridge: Cambridge University Press.
- Mill, J. S. (2004 [1848]). *Principles of Political Economy with Some of their Applications to Social Philosophy*. Indianapolis, IN: Hackett Publishing Co.
- Mullen, B., Johnson, C., & Salas, E. (1991). Productivity Loss in Brainstorming Groups: A Meta-analytic Integration. *Basic and Applied Social Psychology*, 12, 3-24.
- Muñoz, M. (2010). Forging Destiny: Populism, Indigenismo, and Indigenous Mobilization in Echeverría's Mexico. In A. Kiddle, & M. Muñoz (Eds.), *Populism in 20th Century Mexico: The Presidencies of Lázaro Cárdenas and Luis Echeverría*. Tucson: University of Arizona Press.
- Nelson, R. (1993). *National Innovation Systems: A Comparative Study*. Oxford: Oxford University Press.
- Nijstad, B. A., Stroebe, W., & Lodewijkx, H. F. (2006). The Illusion of Group Productivity: A Reduction of Failures Explanation. *European Journal of Social Psychology*, 36, 31-48.
- Ó Riain, S. (2004). *The Politics of High Tech Growth: Developmental Network States in the Global Economy*. New York: Cambridge University Press.
- Oliveira, J. A. (2008). *Upgrading Clusters and Small Enterprises: Environmental, Labor, Innovation, and Social Issues*. London: Ashgate.
- Osborn, A. F. (1953). *Applied Imagination: Principles and Procedures of Creative Problem Solving*. New York: Charles Scribner's Sons.
- Ostrom, E. (1997). Crossing the Great Divide: Coproduction, Synergy, and Development. In P. Evans (Ed.), *State-Society Synergy: State and Social Capital in Development* (pp. 85-118). Berkeley, CA: University of California International and Area Studies Collection.
- _____. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.
- O'Toole, G. (2010). *The Reinvention of Mexico: National Ideology in and Neoliberal Era*. Liverpool: University of Liverpool Press.

- Overmyer-Velázquez, R. (2010). *Folkloric Poverty: Neoliberal Multiculturalism in Mexico*. University Park: Pennsylvania State University Press.
- Owen-Smith, J., & Powell, W. W. (2004). Knowledge Networks and Channels and Conduits. *Organizational Sciences*, 15 (1), 5-21.
- Peréz-Lizaur, M. (1997). The Mexican Family Enterprise Faces the Open Market. *Organization*, 4 (4), 535-551.
- Piore, M. J. (2002). Rethinking International Labor Standards. *Presented at Conference on Labor and the Globalization of Production*. Center for Economic Policy Analysis, New School University.
- Pires, R. R. (2009). *Flexible Bureaucracies : Discretion, Creativity, and Accountability in Labor Market Regulation and Public Sector Management*. PhD Dissertation, Massachusetts Institute of Technology.
- Podolny, J. M. (2001). Networks as the Pipes and Prisms of the Market. *American Journal of Sociology*, 107 (1), 33-60.
- Polanyi, K. (1944). *The Great Transformation*. New York: Rinehart & Company.
- Portes, A. (1996). Review: Embedded Autonomy: States and Industrial Transformation. *Contemporary Sociology*, 25 (2), 175-176.
- Powell, W. W., & Grodal, S. (2005). Networks of Innovators. In J. Fagerberg, D. C. Mowery, & R. C. Nelson (Eds.), *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.
- Remmer, K. (1997). Theoretical Decay and Theoretical Development: The Resurgence of Institutional Analysis. *World Politics*, 50 (1), 34-61.
- Rodríguez Gómez, G. (2000). A Matter of Quality: Power and Change among Dairy Farmers in Los Altos de Jalisco. In G. Rodríguez Gómez, & R. Snyder (Eds.), *Resource Management, Production, and Marketing in Rural Mexico* (pp. 31-50). La Jolla, CA: Center for US-Mexico Studies, University of California, San Diego.
- Rodríguez Gómez, G., & Snyder, R. (Eds.). (2000). *Strategies for Resource Management, Production, and Marketing*. La Jolla, CA: Center for US-Mexican Studies, University of California, San Diego.
- Rodrik, D. (2004). *Industrial Policy for the 21st Century*. Kennedy School of Government, Harvard University.

- Romer, P. (1990). Endogenous Technological Change. *Journal of Political Economy*, 94, S71-S102.
- _____. (1986). Increasing Returns and Long Run Growth. *Journal of Political Economy*, 94 (5), 1002-1037.
- _____. (1993). Two Strategies of Economic Development: Producing Ideas and Using Ideas. In L. Summers, & S. Shah (Eds.), *Proceedings of the 1992 Annual World Bank Conference on Development Economics*. Washington, DC: World Bank.
- Rosenberg, N. (2006). *Innovation and Economic Growth*. Retrieved 2012 йил 13-March from Organization for Economic Cooperation and Development: <http://www.oecd.org/dataoecd/55/49/34267902.pdf>
- Rubin, J. W. (1996). Decentering the Regime: Cultural and Regional Politics in Mexico. *Latin American Research Review*, 31 (3), 85-126.
- Ruiz Sandoval, G. (1878). Envenenamiento lento por plomo en los habitantes de Oaxaca. *Gaceta Médica de México*, 13 (21), 394-403.
- Sabel, C. (1995). Bootstrapping Reform: Rebuilding Firms, the Welfare State, and Unions. *Politics and Society*, 23 (1), 5-48.
- Sabel, C. (n.d.). Bootstrapping Development: Rethinking the Role of Public Intervention in Promoting Growth. *Manuscript*.
- Samford, S. (2010). Averting "Disruption and Reversal": Reassessing the Logic of Rapid Trade Reform in Latin America. *Politics and Society*, 38 (3), 373-407.
- Schmid, C. L. (2001). *The Politics of Language: Conflict, Identity, and Cultural Pluralism in Comparative Perspective*. Oxford: Oxford University Press.
- Schneider, B. R. (1998). Elusive Synergy: Business-Government Relations and Development. *Comparative Politics*, 31 (1), 101-122.
- _____. (1999). The Desarrollista State in Brazil and Mexico. In M. Woo-Cummings (Ed.), *The Developmental State* (pp. 276-305). Ithaca NY: Cornell University Press.
- _____. (2004). *Business Politics and the State in Twentieth-Century Latin America*. New York: Cambridge University Press.
- Schrank, A., & Piore, M. (2007). Norms, Regulations, and Labor Standards in Central America. *CEPAL: Serie Estudios y Perspectivas*, 77.

- Scott, J. C. (1998). *Seeing Like a State: How Certain Schemes to Improve the Human Condition have Failed*. New Haven, CT: Yale University Press.
- Secretaría de Economía. (n.d.). *Talleres Familiares*. Retrieved February 17, 2011, from <http://www.talleresfamiliares.gob.mx>
- Secretaría de Salud. (2003). *Protección Contra Riesgos Sanitarios: Sistema Federal de Protección*. Secretaría de Salud. Mexico, D. F.: Secretaría de Salud.
- Shadlen, K. C. (2004). *Democratization without Representation: The Politics of Small Industry in Mexico*. University Park, PA: Pennsylvania State University Press.
- _____. (2005). Exchanging Development for Market Access?: Deep Integration and Industrial Policy under Multilateral and Regional-Bilateral Trade Agreements. *Review of International Political Economy*, 12 (5), 750-775.
- _____. (2002). Orphaned by democracy: small industry in contemporary Mexico. *Comparative Politics*, 35 (1), 43-62.
- Sheets, R. (2000). Hazards from Lead in Ceramic Dinnerware: Antiquity to the Year 2000. *International Conference on Heavy Metals in the Environment*. Ann Arbor, MI.
- Silva, E. (1997). Business Elites, the State, and Economic Change in Chile. In S. Maxfield, & B. R. Schneider (Eds.), *Business and the State in Developing Countries*. Ithaca: Cornell University Press.
- Snyder, R. (Ed.). (1999). *Institutional Adaptation and Innovation in Rural Mexico*. La Jolla, CA: Center For US-Mexican Studies, University of California, San Diego.
- _____. (2001). *Politics after Neoliberalism: Reregulation in Mexico*. Cambridge: Cambridge University Press.
- _____. (1999). Reconstructing Institutions for Market Governance: Participatory Policy Regimes in Mexico's Coffee Sector. In R. Snyder (Ed.), *Institutional Adaptation and Innovation in Rural Mexico* (pp. 51-82). La Jolla, CA: Center for US-Mexican Studies, University of California, San Diego.
- Storper, M., Lavinás, L., & Mercado-Célis, A. (2007). Society, Community, and Development: A Tale of Two Regions. In K. Polenske (Ed.), *The Economic Geography of Innovation*. New York: Cambridge University Press.

- Streeck, W. (1997). Beneficial Constraints: On the Economic Limits of Rational Voluntarism. In R. Boyer, & J. R. Hollingsworth (Eds.), *Contemporary Capitalism: The Embeddedness of Institutions*. New York: Cambridge University Press.
- Stroebe, W., & Diehl, M. (1994). Why Groups are Less Effective than their Members: On Productivity Losses in Idea-generating Groups. *European Review of Social Psychology*, 5 (1), 271-303.
- Styhre, A. (2007). *The Innovative Bureaucracy: Bureaucracy in the Age of Fluidity*. New York: Routledge.
- Teichman, J. (1997). Neoliberalism and the Transformation of Mexicana Authoritarianism. *Mexican Studies/Estudios Mexicanos*, 13 (1), 121-147.
- Tendler, J. (1997). *Good Governance in the Tropics*. Baltimore, MD: The Johns Hopkins University Press.
- _____. (2002). Small Firms, the informal Sector, and the Devil's Deal. *Institute for Development Studies Bulletin*, 33 (3), 1-14.
- Thompson, V. A. (1965). Bureaucracy and Innovation. *Administrative Science Review*, 10 (1), 1-20.
- Umali-Deininger, D. (1997). Public or Private Agricultural Extension: Partners or Rivals? *World Bank Research Observer*, 12 (3), 203-224.
- Valente, T. (1995). *Network Models of the Diffusion of Innovations*. Cresskill, NJ: Hampton Press.
- von Hippel, E. (2005). *Democratizing Innovation*. Cambridge, MA: MIT Press.
- _____. (1988). *The Sources of Innovation*. Oxford: Oxford University Press.
- von Tunzelman, N., & Acha, V. (2005). Innovation in "Low-Tech" Industries. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.
- Wade, R. (1990). *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton, NJ: Princeton University Press.
- _____. (2004). On the Causes of Increasing World Poverty and Inequality, or Why the Matthew Effect Prevails. *New Political Economy*, 9 (2), 163-188.

- Wang, X. (1999). Review: Mutual Empowerment of State and Society: Its Nature, Conditions, Mechanisms, and Limits. *Comparative Politics*, 31 (2), 231-249.
- Warsh, D. (2006). *Knowledge and the Wealth of Nations*. New York, NY: W. W. Norton & Company.
- Wasserman, S., & Faust, K. (1994). *Social Network Analysis: Methods and Applications*. New York: Cambridge University Press.
- Weber, M. *Theory of Social and Economic Organization*. New York: Free Press.
- Weiss, L. (1998). *Myth of the Powerless State*. Ithaca: Cornell University Press.
- Whitaker, G. P. (1980). Co-Production: Citizen Participation in Service Delivery. *Public Administration Review*, 40 (3), 240-246.
- Whyte, M. K. (1996). The Chinese Family and Economic Development: Obstacle or Engine. *Economic Development and Cultural Change*, 44 (1), 1-30.
- Woolcock, M. (1998). Social Capital and Economic Development: Toward a Theoretical Synthesis and Policy Framework. *Theory and Society*, 27, 151-208.
- Woolcock, M., & Narayan, D. (2000). Social Capital: Implications for Development Theory, Research, and Policy. *World Bank Research Observer*, 15 (2), 225-249.
- World Bank. (2011). *Trade and Production Database*. Retrieved November 1, 2011 from Trade and Production Database: <http://go.worldbank.org/4AFUHVT590>
- Wright, E. O. (1996). Review: Embedded Autonomy: States and Industrial Transformation. *Contemporary Sociology*, 25 (2), 176-179.

Appendix 1: Common Abbreviations

Casart –	Casa de las Artesanías de Michoacán [Michoacán Center for Artisan Goods]
CDI –	Comisión Nacional para el Desarrollo de los Pueblos Indígenas [National Commission for the Development of Indigenous Peoples]
CNC –	Confederación Nacional Campesina [National Federation of Peasants]
Cofepris –	Comisión Federal para la Protección contra Riesgos Sanitarios [Federal Commission for the Protection against Health Risks]
Fonart –	Fondo Nacional Para El Fomento De Las Artesanías [National Fund for the Development of Artisan Goods]
INEGI –	Instituto Nacional de Estadística y Geografía [National Institute of Statistics and Geography]
PAN –	Partido Acción Nacional [National Action Party]
PRD –	Partido de la Revolución Democrática [Party of the Democratic Revolution]
PROCAPI -	Programa de Coordinación para el Apoyo a la Producción Indígena [Coordination Program for the Support of Indigenous Production]
PRI –	Partido Revolucionario Institucional [Institutional Revolutionary Party]
STYDE -	Oaxaca Secretaria de Turismo y Desarrollo Económico [Oaxaca State Secretary of Tourism and Economic Development]
UNEAMICH –	Unión Estatal de Artesanos de Michoacán [Michoacán State Artisans Union]

Appendix 2: Survey Instrument and Method

The workshop survey reported here was undertaken in the village of Capula, Michoacán over several months in the spring of 2011. The village, said to have over 200 workshops, was chosen as a cluster that would allow the most variation in the dependent variable (whether or not workshops had adopted the lead-free glaze) to be observed. According to interviews, Capula was advanced beyond most – perhaps all – other ceramics producing communities in this aspect, having a relatively high percentage of workshops that had upgraded (roughly 20 percent adoption). As a study that seeks in part to build theory about effective public-private relations, a relatively successful case was necessary to understand the dynamics occurring at the workshop and cluster levels.

Although a relatively modest survey, the process by which it was developed and applied involved a number of difficult choices. Because of the informal nature of many of the workshops, there was no means of acquiring an accurate list of the number or location of the workshops in the village. The exact population being unknown, surveying a randomized sample of the village was impossible. A portion of the survey is designed to capture the social contacts of the workshop heads for the purpose of analyzing the structure of the social networks within the village. Social network analytic methods most often are used with “whole networks” (i.e. all potential ties are identified and coded as either present or absent) (Wasserman and Faust 1994); however, without knowing the population of producers *a priori*, this method of data collection is as impossible as surveying a random sample. Rather than collecting “whole network” data, then, the survey collected “ego-network” data, or the names of “alters” nominated by the

respondent. For these methodological reasons, the survey was undertaken on a door-to-door basis, attempting to survey every workshop in the cluster.

On the door-to-door canvass, those answering the door were asked if ceramics were produced there and, if so, if the head of the workshop would be willing to answer some basic questions about the workshop. Of the 180 workshops with which I made contact, only three workshop heads refused outright to participate. The survey was conducted at the door of the home/workshop if no other location was offered, but very frequently (perhaps as much as half the time), I was asked inside to sit, to see the workshop, or to ask the survey questions as the workshop head continued to work. In these latter circumstances, I was also able to ask more open-ended interview questions upon the completion of the formal survey. An explanation of the study was provided and consent to participate taken orally before the survey was begun (in accordance with IRB requirements). In the interest of not missing any workshops, the canvass was typically undertaken between late morning and early afternoon (roughly 2:00), when work was being done and before lunch. Market days, holidays, and periods when major markets (*tianguis*) drew producers away from town were avoided. Streets were covered twice, in order for a second attempt to make contact at homes where no one answered on the first canvass.

Several notes on the construction of the survey are in order. First, regarding questions of income, those familiar with ceramics workshops warned against the inclusion of questions relating directly to the income of the workshops or the prices paid for their products. Because many operate informally, questions of this nature would be interpreted with suspicion and would not only result in unreliable income data but might

also prejudice the reliability of the survey more broadly. Alternate questions (number of workers and amount of clay (the primary input) consumed) were used to approximate the income generated by ceramics production. Second, the phrasing of the question requesting “alters” (i.e. names of contacts) was adjusted based on the responses from pilot surveys. The question originally requested names of workshop heads from whom they received advice and to whom they gave advice about production. The intent was to collect directional data about flows of information. The problem was that the workshop heads do not (without exception in the pilot surveys) perceive themselves as either giving or receiving advice about production. All answered that they neither gave nor received advice from other workshops and that workshops did not share information about production. While this is likely to be true on the most literal level, it was clear from more open-ended conversations that there was information moving between workshops. The question was rephrased asking more broadly who, of their friends, extended family, and neighbors who were also ceramics producers, did they have contact with.

Reproduced below are the survey instruments in Spanish and English.

Encuesta: Talleres Familiares – Capula, Michoacán

Tamaño de Taller:

- Numero de trabajadores que hacen tarea de algún tipo en la empresa (o la molienda de barro, moldura, pintura, o quema)? (# DE TRABAJADORES)
- Cual es la cantidad de arcilla utilizado en un mes promedio? (# KILOGRAMAS, # COSTALES)

Experiencia:

- Cuantos años ha trabajado en la alfarería el jefe/la jefa de la empresa? (# AÑOS)
- Hasta cuando estudió el jefe/la jefa? (# NIVEL)

Mercado:

- Cual porcentaje de las ventas son para cocinar o para servicio de mesa? Decorativo/ Adorno? (%COMIDA, % DECORATIVO)
- Cual porcentaje de las ventas compran: 1) Fonart, 2) Casa de Artesanías de

Michoacán, 3) Barro sin Plomo, 4) Encargados de compras/otra distribuidor? 5) Venta directa a la comunidad? (% FONART, % CASA DE ARTESANIAS, % BARRO SIN PLOMO/ECHERY, % DISTRUIBADORES, % VENTA DIRECTA)

Uso de Esmalte sin Plomo:

- Cual porcentaje de las piezas están producido con esmalte sin plomo y cual porcentaje con greta con plomo? (% SIN PLOMO/% CON PLOMO)
- Cuando empezó utilizar esmalte sin plomo? (MES/AÑO)
- Intentó utilizar esmalte sin plomo pero no podía/no quería? (SI/NO) Si sí, cuando intentó? (MES/AÑO)
- Regresó a utilizar greta con plomo después de usar esmalte sin plomo? (SI/NO) Si sí, cuanto tiempo utilizaba esmalte in plomo? (# MESES)
- Porque regresó a usar greta con plomo? (RESPUESTA ABIERTA)

Motivo:

- Cual fue el motivo primaria por adoptar esmalte sin plomo? (FINANCIAL/SALUD/OTRO)

Vínculos:

- Me puede dar nombres de tres talleres familiares de alfarería con quienes Ud. tiene contacto. Pueden ser familiares, amigos, o simplemente personas con quien habla (NOMBRE/NOMBRE/NOMBRE)
- El jefe pertenece la Unión de Alfareros de Capula? (SI/NO) Banco de materia prima apoyado por Fonart? (SI/NO) Marcas colectivas? (SI/NO) Otro grupo de alfareros en Capula? (SI/NO)

Apoyos:

- Ha asistido una capacitación de esmalte de 1) Fonart, 2) Casa de Artesanías de Michoacán, o 3) Barro sin Plomo/Echery Group? (SI/NO, SI/NO, SI/NO) Cuando? (MES/AÑO) Cuantas veces? (# TOTAL, #/AÑO)
- Ha tenido contacto personal con un representante de 1) Fonart, 2) Casa de Artesanías, o 3) Barro sin Plomo/Echery Group? (SI/NO, SI/NO, SI/NO) Cuando? (MES/AÑO) Cuantas veces? (# TOTAL, #/AÑO)
- Ha recibido asistencia o apoyo de 1) Fonart, 2) Casa de Artesanías, 3) Barro sin Plomo? (SI/NO, SI/NO, SI/NO) Cuando? (MES/AÑO) Que forma de apoyo? (ASSISTENCIA TECHNICAL/CREDITO O PRÉSTAMO/DONATIVO DE MATERIALES/OTRA)

Survey Instrument: Family Workshops – Capula, Michoacán

Size of workshop:

- Number of workers who participate in production in some respect (milling, molding, painting, firing)? (#EMPLOYEES)
- Amount of clay used in an average month? (# KILOGRAMS, # BAGS)

Experience:

- How long has head of operation been working in ceramics? (# YEARS)
- How much education does head of operation have? (# GRADE LEVEL)

Market:

- What percentage of products is for food service? What percentage decorative? (% FOOD, % DECORATIVE)
- What percentage of ceramics are sold to: 1) Fonart? 2) Casa de Artesanías? 3) BSP or other exporter? 4) local markets or distributors? 5) Direct sales to community (%FONART, %CA, %BARRO SIN PLOMO, %DISTRIBUTORS, %DIRECT SALES)

Use of Lead-Free Glaze:

- What percentage of products are produced with lead-free glaze and what percentage with lead-oxide glaze? (%LEAD-FREE, %WITH LEAD)
- When begin to use lead-free glaze? (MONTH, YEAR)
- Did you attempt to adopt lead-free and were not able? (YES/NO) If yes, when? (MONTH, YEAR)
- Did return to use of lead-based after using lead-free? (YES/NO) After using lead free for how long? (# MONTHS)
- Why did you return to use leaded glaze? (OPEN ENDED)

Motive

- Was primary motivation for using lead free glaze? (FINANCIAL/HEALTH/OTHER)

Professional and Social contacts

- Can you give me the names of three family workshops with whom you have contact. They can be extended family, friends, neighbors, or simply people with whom you talk. (NAME/NAME/NAME)
- Does head belong to Union of Alfareros? (YES/NO) Primary material bank supported by Fonart? (YES/NO) One of the collective brands? (YES/NO) Another group of ceramics producers in Capula? (YES/NO)

External Contacts:

- Have you attended training meetings held by 1) Fonart, 2) Casa de Artesanías, or 3) Barro sin Plomo? (YES/NO, YES/NO, YES/NO) When? (DATE) What frequency? (# TOTAL, #/YEAR)
- Have you had personal contact with representative from 1) Fonart, 2) Casa de Artesanías, or 3) Barro sin Plomo? When? (DATE) What frequency? (# TOTAL, #/YEAR)
- Have you received assistance or aid from 1) Fonart, 2) Casa de Artesanías, or 3) Barro sin Plomo? (YES/NO, YES/NO, YES/NO) When? (DATE) In what form? (CREDIT/TECHNICAL ASSISTANCE/GIFT OF EQUIPMENT, OTHER)

Appendix 3: Additional Information for Probit Regression (Table 4.3)

Variable	Definition	Coding	Descriptive Statistics
DV: Adopter	Workshop produces any glazed ceramics without lead-oxide glaze	0 = no 1 = yes	Min: 0 Max: 1 Mean: .18 Std. Dev: .38 N: 136
Training	Workshop has received external training in the use of lead-free glaze	0 = no 1 = yes	Min: 0 Max: 1 Mean: .19 Std. Dev: .39 N: 175
External Assistance	Workshop has received external financial assistance (credit, subsidized inputs, etc.)	0 = no 1 = yes	Min: 0 Max: 1 Mean: .18 Std. Dev: .39 N: 175
Number of Workers	Number of workers in the workshop	Number given	Min: 1 Max: 7 Mean: 2.34 Std. Dev: 1.14 N: 175
Size of Production	Number of bags of clay used in production on a monthly basis	Number given	Min: 1 Max: 120 Mean: 24.76 Std. Dev: 23.63 N: 172
Experience	Number of years of experience as ceramicist reported by workshop head	Number given	Min: 1 Max: 70 Mean: 33.20 Std. Dev: 14.04 N: 175
Education	Level of education achieved by workshop head	0 = None 1 = Primary 2 = Secondary 3 = > Secondary	Min: 0 Max: 3 Mean: 1.05 Std. Dev: .54 N: 175
Personal Network Exposure (PNE)	Ratio of other workshop heads in ego network that adopted lead-free glaze prior or in the same year as workshop head	0 - 1	Min: 0 Max: 1 Mean: .07 Std. Dev: .21 N: 175

Descriptive Statistics

	N	Mean	Std. Dev	Min	Max
Lead-free Production	136	.176	.383	0	1
Training	137	.226	.420	0	1
Financial Assistance	137	.219	.415	0	1
Member of Group	137	.328	.471	0	1
No. Workers	175	2.34	1.13	1	7
Years of Experience	174	33.20	14.04	1	70
Size of Production	172	24.76	23.63	1	120
Education	175	1.05	.555	0	3
PNE	174	.074	.208	0	1
PNE * Training	174	.041	.164	0	1

Bivariate Correlations of Variables

	Lead-free Production	Training	Financial Assistance	Member of Formal Group	No. Workers	Years of Experience	Size of Production	Education	PNE	Interaction: PNE * Training
Lead-free Production										
Training	.41*									
Financial Assistance	.32*	.68*								
Member of Group	.38*	.62*	.64*							
No. Workers	.09	.16	.14	.16						
Years of Experience	-.09	-.03	-.06	-.02	.09					
Size of Production	-.21*	-.04	-.17	-.02	.20*	.12				
Education	.16	.15	.28*	.17*	-.03	-.35*	-.05			
PNE	.55*	.34*	.36*	.37*	.19*	-.11	-.12	.10		
PNE * Training	.44*	.53*	.38*	.32*	.23*	.02	-.10	.05	.76*	
p < .05										

Additional Specifications of Statistical Model

	Coefficient (Std. Error)	Marginal Effects	Coefficient (Std. Error)	Marginal Effects
Training (bivariate)			3.56 ** (1.09)	.47**
External Financial Assistance (bivariate)	-.38 (.87)	-.02	-1.37 (.94)	-.05
Number of Workers	-.03 (.28)	-.002	.001 (.01)	.002
Amount of Production	-.05 * (.02)	-.004 *	-.07 * (.03)	-.004**
Years of Experience	-.006 (.02)	-.000	.008 (.02)	.000
Education Level	.62 (.60)	.05	.93 (.63)	.05
Personal Network Exposure	4.30 ** (1.26)	.34 *	7.47 ** (2.56)	.42*
PNE * Training			-5.10 (2.90)	-.28
Member of Formal Group	1.65 * (.84)	.17		
Constant	-2.17 (1.35)		-3.26 * (1.50)	
n	134		134	
LR χ^2	44.07 **		52.66 **	
Pseudo R ²	.35		.42	
** p <.01; * p<.05				

The two alternative specifications to the model presented in Chapter Four each include one additional variable. The first replaces training as a predictor with membership in a formal network. As noted in the chapter, membership in a formal network is very close to being a necessary condition for receiving training (although membership is clearly does not simply imply that one has been trained). The coefficient is significant at the .05 level, although it drops slightly below that threshold when marginal effects are calculated. For the most part, the apparent importance of group

membership is consistent with the argument made in the chapter. The second alternative model includes an interaction variable created from the personal network exposure and training variables. Based on the argument presented in the chapter – that both information moved through formal and through informal networks affects decisions to upgrade - the expectation would be that this interaction variable would be positively associated with the adoption of lead-free glaze. The fact that it is found to not be significantly associated may be a consequence of the very low mean of the interaction variable (.04). A further look at the structure of the variable reveals the preponderance of zeros in the observations, although the interaction term is associated with the outcome on a bivariate basis.

Interaction: PNE * Training	Not Lead Free User (0)	Lead Free User (1)	Total
0	107	15	122
.17	1	0	1
.2	1	1	2
.33	1	0	1
.5	1	2	3
.66	1	1	2
.75	0	2	2
1	0	2	2
Total	112	23	135

$\chi^2 = 30.13 **$

Appendix 4: Interviews Cited

Interviews listed here are limited to those whose role in the production of ceramics and the substitution of lead-free glaze is public: government officials and employees and affiliates of NGOs. Those not cited here are the many interviews conducted with ceramics producers themselves (some in conjunction with the workshop survey that was conducted in Capula, Michoacán); these latter interviews were conducted with the understanding that the responses would be anonymous.

Acosta, Maribel (Sub-Director, Casa de las Artesanías de Michoacán). Personal Interview, Morelia, Michoacán, México. December 13, 2010.

Acosta, Maribel (Sub-Director, Casa de las Artesanías de Michoacán). Personal Interview, Morelia, Michoacán, México. July 7, 2011

Aguila, Victor (Director, Barro sin Plomo (NGO) and Echery Pottery). Personal Interview, Santa Fe, New Mexico. July 15, 2009

Aguila, Victor (Director, Barro sin Plomo (NGO) and Echery Pottery). Personal Interview, Patzcuaro, Michoacán, México. January 14, 2010.

Aguila, Victor (Director, Barro sin Plomo (NGO) and Echery Pottery). Personal correspondence. May 5, 2010.

Borgoneo, María Rosa (Auxiliar, Zautla Department of Rural Development), Personal interview, Santiago Zautla, Puebla, México. February 15, 2012.

Contreras, Veronica (Ceramics Producer, Fonart Lead-Free Trainer). Personal communication, Zautla, Puebla, México. February 14, 2012.

Contreras, Veronica (Ceramics Producer, Fonart Lead-Free Trainer). Personal communication, Zautla, Puebla, México. February 15, 2012.

Covarrubias, Mario (Fonart, Director of National Program for the Adoption of Lead-Free Glazes). Personal Interview, México, DF, México. March 1, 2011.

Covarrubias, Mario (Fonart, Director of National Program for the Adoption of Lead-Free Glazes). Personal Interview, México, DF, México. July 5, 2011

Covarrubias, Mario (Fonart, Director of National Program for the Adoption of Lead-Free Glazes). Personal Interview, México, DF, México. February 13, 2012.

Cuiriz, Francisco. (Fonart, Federal Lead-Free Ceramics Trainer). Personal Interview, Tzintzuntzan, Michoacán, México. June 30, 2011.

Cuiriz, Francisco. (Fonart, Federal Lead-Free Ceramics Trainer). Personal communication, Morelia, Michoacán, México. July 8, 2011.

Enciso, Amelia (Fonart, Director of Operations in Michoacán). Personal Interview, Morelia, Michoacán, México. September 7, 2010.

Enciso, Amelia (Fonart, Director of Operations in Michoacán). Personal Interview, Capula, Michoacán, México. June 21, 2011.

Fuentes, Raul (President, Capula Artisans Union – State Union of Michoacán Artisans (UNEAMICH)). Personal Interview, Capula, Michoacán, México. October 25, 2010.

Fuentes, Raul (President, Capula Artisans Union – State Union of Michoacán Artisans (UNEAMICH)). Personal Interview, Capula, Michoacán, México. December 9, 2010.

Hernandez Jimenez, Miriam (Director, Zautla Department of Rural Development), Personal interview, Santiago Zautla, Puebla, México. February 15, 2012.

Herrera, Jose Antonio (Cofepris, National Director of the Project for Lead in Low-temperature Ceramics), personal correspondence. February 22 – March 15, 2012.

Herrera, Sergio (Director, Casa de las Artesanías de Michoacán). Personal communication, Morelia, Michoacán, Mexico. July 8, 2011.

Martinez, Laureano (Independent Ceramics Producer; Fonart Lead-Free Trainer). Capula, Michoacán, México. September 13, 2010.

Martinez, Rogelio (Independent Ceramics Producer; Head of a Fonart “Banco de Materia Prima”). Personal Interview, Capula, Michoacán, México. March 29, 2011.

Molina Garcia, Alejandro, Dr. (Sub-Director of Cofepris, Michoacán). Personal Interview, Morelia, Michoacán, México. December 14, 2010.

O’Leary, Anna (Affiliate, Barro sin Plomo (NGO)). Personal Interview, Telephone. May 29, 2009.

Rodriguez, Ricardo (Director of Training, Casa de las Artesanías de Michoacán). Personal Interview, Morelia, Michoacán, México. January 21, 2010.

Rodriguez, Ricardo (Director of Training, Casa de las Artesanías de Michoacán).
Personal Interview, Morelia, Michoacán, México. August 31, 2010.

Rodriguez, Ricardo (Director of Training, Casa de las Artesanías de Michoacán).
Personal Interview, Capula, Michoacán, México. October 11, 2010.